FINAL REPORT NUMBER 201UI-MGA-15-05

SAFETY COMPLIANCE TESTING FOR FMVSS 201
Occupant Protection In Interior Impact
Upper Interior Head Impact Protection

MAZDA MOTOR CORPORATION
2015 Mazda 3
NHTSA No. C20155401

MGA RESEARCH CORPORATION
446 Executive Drive
Troy, Michigan 48083

Test Dates: July 13-15, 2015
Report Date: July 20, 2015

FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Approval Date: _____

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: _____

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16. Abstract A compliance test series was conducted on the subject 2015 Mazda 3, NHTSA No. C20155401, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-201U-01. The testing was conducted at MGA Research Corporation in Troy, Michigan on July 13-15, 2015. Test failures identified were as follows: None			
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1.0 PURPOSE OF COMPLIANCE TEST

The FMVSS 201 upper interior compliance test sponsored by the National Highway Traffic Safety Administration (NHTSA) was conducted under Contract DTNH22-11-D-00246. The purpose of this test was to evaluate upper interior head impact protection performance of a 2015 Mazda 3.

Tests were conducted on July 13-15, 2015 on a 2015 Mazda 3, manufactured by Mazda Motor Corporation.

All tests were conducted in accordance with the U. S. Department of Transportation, National Highway Traffic Safety Administration's Laboratory Test Procedure TP-201U-01 dated April 3, 1998 and the corresponding MGA Research Corporation's FMVSS 201U procedure number MGATP201U_FRAME#2 dated May 8, 2012.

All tests were conducted at MGA Research Corporation in Troy, Michigan and were performed by MGA engineers and technicians. The FMVSS 201U impactor test machine was used to conduct the testing. Target locations were determined by using a Coordinate Measurement Machine in conjunction with the MGA EZ-Target™ program and MGA procedure MGATP201U_Test Series dated November 9, 2009.

2.0 COMPLIANCE TEST DATA SUMMARY

The 2015 Mazda 3 was equipped with A, B and rear pillars, an adjustable seat belt anchorage on each B-pillar, and grab handles located on the driver and passenger front side rails and rear side rails.

Upon completion of targeting the test vehicle, twelve (12) targets were chosen to be impacted based upon engineering judgment and certification test data provided by the manufacturer. The twelve (12) targets chosen were:

AP1	BP1	SR2B	UR3@BP
AP2	BP2	RH	UR4@SR3-1
AP3	RP2	UR1@SR1	UR11@SR3-2

The 2015 Mazda 3 tested appears to comply with the upper interior performance criteria for FMVSS 201. The HIC(d) measured using the Part 572L (Free Motion Headform) was below 1000 for each tested component.

TABLE 2-1

SUMMARY TABLE OF TEST RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2015 Mazda 3

VEH. NHTSA NO.: C20155401 VIN: JM1BM1T75F1262658

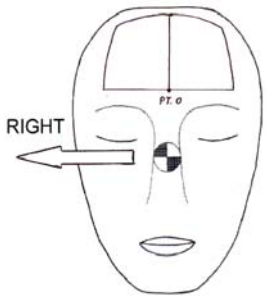
COLOR: Liquid Silver Metallic VEH. BUILD DATE: March, 2015

TEST DATES: July 13-15, 2015 TEST LABORATORY: MGA Research Corp.

OBSERVERS: Helen Kaleto, Sean Fortnam, David Burkett, Ryan Jones, Kurt Reichert

TARGET	VEHICLE SIDE	HORIZONTAL ANGLE (deg)	VERTICAL ANGLE (deg)	VELOCITY (kph)	HIC(d)	FMH HIC	IMPACT ON FMH (mm)	
							Above	Left/Right
AP1	Right	107	17	19.0	554	514	19	14 Right
AP2	Left	220	50	18.9	418	333	21	3 Right
AP3	Right	155	50	19.0	484	421	13	9 Left
BP1	Right	90	19	18.9	517	465	64	0
BP2	Right	90	0	24.1	613	591	17	4 Left
RP2	Right	40	-10	24.2	504	447	28	15 Left
SR2B	Right	90	40	18.9	389	296	12	1 Left
RH	Left	0	50	24.0	372	272	24	8 Right
UR1@SR1	Left	270	50	24.1	437	358	48	20 Right
UR3@BP	Left	270	50	24.2	649	639	40	2 Right
UR4@SR3-1	Left	270	50	23.9	526	477	36	6 Left
UR11@SR3-2	Right	90	50	23.9	540	495	51	5 Left

Above and left/right refers to the position relative to reference pt. 0 where the target made contact with the Free Motion Headform. See the diagram below for details.



POST TEST COMMENTS:

The following description lists any post-test damage or other test observations for each target.

AP2 Left: A-pillar dislodged.

BP1 Right: Headliner deformation.

RP2 Right: Pillar trim dislodged.

SR2B Right: Grab handle pushed in; headliner deformation.

RH Left: Headliner deformation.

UR1@SR1 Left: Grab handle pushed in; headliner deformation.

UR3@BP Left: Headliner deformation.

UR4@SR3-1 Left: Grab handle pushed in; headliner deformation.

UR11@SR3-2 Right: Grab handle pushed in; headliner deformation.

REMARKS:

The targets listed were impacted in the following order:

Left: AP2, UR1@SR1, UR3@BP, UR4@SR3-1, RH

Right: AP3, AP1, SR2B, BP2, BP1, UR11@SR3-2, RP2

The 150 mm rule was observed for targets horizontal to each other and the 200 mm rule was observed for vertical components.

Recorded By: _____ Approved By: _____

Date: July 15, 2015

TABLE 2-2

GENERAL TEST AND VEHICLE PARAMETER DATA

VEH. MOD YR/MAKE/MODEL/BODY: 2015 Mazda 3

VEH. NHTSA NO.: C20155401 VIN: JM1BM1T75F1262658

COLOR: Liquid Silver Metallic VEH. BUILD DATE: March, 2015

TEST DATES: July 13-15, 2015 TEST LABORATORY: MGA Research Corp.

OBSERVERS: Helen Kaleto, Sean Fortnam, David Burkett, Ryan Jones, Kurt Reichert

INTERIOR TRIM INFORMATION: A, B and rear pillars, an adjustable seat belt anchorage on each B-pillar, and grab handles located on the driver and passenger front side rails and rear side rails.

SUNROOF INFORMATION:

Installed: ___Yes _X_ No

Operation: ___Electric ____ Manual

SIDE RAIL CURTAIN AIRBAG INFORMATION:

Installed: _X_Yes ____ No

ROLL-BAR INFORMATION:

Installed: _____Yes _X_ No

Padded: _____Yes ____ No

Braces: _____Yes ____ No

GENERAL INFORMATION:

Date Received: June 23, 2015; Odometer Reading 20 miles

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured By: Mazda Motor Corporation

Date of Manufacture: March, 2015; VIN: JM1BM1T75F1262658

GVWR: 1815 kg; GAWR FRONT: 975 kg;

GAWR REAR: 848 kg;

DATA FROM TIRE PLACARD:

Tire Pressure with Maximum Capacity Vehicle Load:

FRONT: 250 kPa REAR: 250 kPa

Recommended Tire Size: P205/60R16

Recommended Cold Tire Pressure:

FRONT: 250 kPa REAR: 250 kPa

Size of Tire on Test Vehicle: P205/60R16

Type of Spare Tire: T125/70D16; Space Saver: X; Standard__

VEHICLE CAPACITY DATA:

Type of Front Seats: Bench__; Bucket X; Split Bench __

Number of Occupants: Front 2; Rear 3; TOTAL 5

VEHICLE CAPACITY WEIGHT:

Vehicle Capacity Weight (VCW) = 385 kg

No. of Occupants x 68 kg = 340 kg

Rated Cargo/Luggage Weight (RCLW) = 45 kg (difference)

WEIGHT OF TEST VEHICLE AS DELIVERED AT LABORATORY: (with maximum fluids)

Right Front =	387.0 kg	Right Rear =	247.0 kg
Left Front =	404.0 kg	Left Rear =	263.0 kg
TOTAL FRONT =	791.0 kg	TOTAL REAR =	510.0 kg
% Total Weight =	60.80 %	% Total Weight =	39.20 %

TOTAL DELIVERED WEIGHT = 1301.0 kg

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight = 1301.0 kg

Max. Test Cargo/Luggage Weight = 45.0 kg

Target Test Weight = 1346.0 kg

WEIGHT OF TEST VEHICLE FULLY LOADED:

Right Front =	388.5 kg	Right Rear =	270.0 kg
Left Front =	401.0 kg	Left Rear =	286.0 kg
TOTAL FRONT =	789.5 kg	TOTAL REAR =	556.0 kg
% Total Weight =	58.68 %	% Total Weight =	41.32 %

TOTAL TEST WEIGHT = 1345.5 kg

Weight of ballast secured in vehicle's cargo area = 44.5 kg

TEST VEHICLE ATTITUDE:

AS DELIVERED: Right Front 695 mm; Left Front 695 mm;
Right Rear 715 mm; Left Rear 715 mm;
Pitch Angle at Right Door Sill = 0.3 Rear is higher
Pitch Angle at Left Door Sill = 0.1 Rear is higher
Roll Angle at Front Bumper = 0.2 Left is higher
Roll Angle at Rear Bumper = 0.0

FULLY LOADED: Right Front 700 mm; Left Front 695 mm;
Right Rear 710 mm; Left Rear 705 mm;
Pitch Angle at Right Door Sill = 0.1 Rear is higher
Pitch Angle at Left Door Sill = 0.0
Roll Angle at Front Bumper = 0.4 Left is higher
Roll Angle at Rear Bumper = 0.2 Right is higher

AS TARGETED: Right Front 845 mm; Left Front 840 mm;
Right Rear 850 mm; Left Rear 850 mm;
Pitch Angle at Right Door Sill = 0.2 Rear is higher
Pitch Angle at Left Door Sill = 0.0
Roll Angle at Front Bumper = 0.3 Left is higher
Roll Angle at Rear Bumper = 0.1 Right is higher

AS TESTED ON RIGHT SIDE:

Pitch Angle at Right Door Sill =	0.1 Rear is higher
Pitch Angle at Left Door Sill =	0.0
Roll Angle at Front Bumper =	0.4 Left is higher
Roll Angle at Rear Bumper =	0.0

AS TESTED ON LEFT SIDE:

Pitch Angle at Right Door Sill =	0.2 Rear is higher
Pitch Angle at Left Door Sill =	0.0
Roll Angle at Front Bumper =	0.3 Left is higher
Roll Angle at Rear Bumper =	0.1 Right is higher

VEHICLE WHEELBASE = 2700 mm

REMARKS: The seat travel distance was measured to be 260 mm for the driver front seat and 260 mm for the passenger front seat.

Recorded By: _____ Approved By: _____

Date: July 15, 2015

TABLE 2-3

HORIZONTAL IMPACT ANGLE RANGE FOR A AND B PILLARS

VEH. MOD YR/MAKE/MODEL/BODY: 2015 Mazda 3

VEH. NHTSA NO.: C20155401 VIN: JM1BM1T75F1262658

COLOR: Liquid Silver Metallic VEH. BUILD DATE: March, 2015

TEST DATES: July 13-15, 2015 TEST LABORATORY: MGA Research Corp.

OBSERVERS: Helen Kaleto, Sean Fortnam, David Burkett, Ryan Jones, Kurt Reichert

HORIZONTAL IMPACT ANGLE RANGE FOR A AND B PILLARS

	HORIZONTAL ANGLE SPECIFIED RANGE	MINIMUM HORIZONTAL ANGLE	MAXIMUM HORIZONTAL ANGLE
A-PILLAR	L 195º-255º	L 205.4º	L 255.0º
	R 105º-165º	R 106.7º	R 155.7º
B-PILLAR	L 195º-345º	L 204.1º	L 284.4º
	R 15º-165º	R 77.5º	R 156.2º

AS DETERMINED USING THE PROCEDURES SPECIFIED IN S8.13.4.1

REMARKS:

Recorded By: Sean Fortnam Approved By: Helen A. Kaleto

Date: July 15, 2015

TABLE 2-4

VERTICAL IMPACT ANGLE RANGES

VEH. MOD YR/MAKE/MODEL/BODY: 2015 Mazda 3

VEH. NHTSA NO.: C20155401 VIN: JM1BM1T75F1262658

COLOR: Liquid Silver Metallic VEH. BUILD DATE: March, 2015

TEST DATES: July 13-15, 2015 TEST LABORATORY: MGA Research Corp.

OBSERVERS: Helen Kaleto, Sean Fortnam, David Burkett, Ryan Jones, Kurt Reichert

VERTICAL IMPACT ANGLE RANGES

		VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
FRONT HEADER	FH1	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
	FH2	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
SIDE RAIL	SR1	L 0º-50º	L 0º	L 40º
		R 0º-50º	R 0º	R 40º
	SR2A	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
	SR2B	L 0º-50º	L 0º	L 40º
		R 0º-50º	R 0º	R 40º
	SR3-1	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
	SR3-2	L 0º-50º	L 0º	L 45º
		R 0º-50º	R 0º	R 45º
REAR HEADER	RH	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º

		VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
A-PILLAR	AP1	L -5º-50º	L -5º	L 17º
		R -5º-50º	R -5º	R 17º
	AP2	L -5º-50º	L -5º	L 50º
		R -5º-50º	R -5º	R 50º
	AP3	L -5º-50º	L -5º	L 50º
		R -5º-50º	R -5º	R 50º
B-PILLAR	BP1	L -10º-50º	L -10º	L 19º
		R -10º-50º	R -10º	R 19º
	BP2*	L 0º-50º	L 0º	L 0º
		R 0º-50º	R 0º	R 0º
	BP3	L -10º-50º	L -10º	L 18º
		R -10º-50º	R -10º	R 18º
	BP4	L -10º-50º	L -10º	L -5º
		R -10º-50º	R -10º	R -5º
REAR PILLAR	RP1	L -10º-50º	L -10º	L 17º
		R -10º-50º	R -10º	R 17º
	RP2	L -10º-50º	L -10º	L -10º
		R -10º-50º	R -10º	R -10º
UPPER ROOF 1		0º-50º	0º	50º
UPPER ROOF 2		0º-50º	0º	50º
UPPER ROOF 3		0º-50º	0º	50º
UPPER ROOF 4		0º-50º	0º	50º
UPPER ROOF 5		0º-50º	0º	50º
UPPER ROOF 6		0º-50º	0º	50º
UPPER ROOF 7		0º-50º	0º	50º
UPPER ROOF 8		0º-50º	0º	50º
UPPER ROOF 9		0º-50º	0º	50º

	VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
UPPER ROOF 10	0º-50º	0º	50º
UPPER ROOF 11	0º-50º	0º	50º
UPPER ROOF 12	0º-50º	0º	50º

As determined using the Procedures specified in S8.13.4.2. *Target BP2 is a seat belt anchorage location.

Recorded By: _____ Approved By: _____

Date: July 15, 2015

TABLE 2-5

TARGET MEASUREMENTS

VEH. MOD YR/MAKE/MODEL/BODY: 2015 Mazda 3

VEH. NHTSA NO.: C20155401 VIN: JM1BM1T75F1262658

COLOR: Liquid Silver Metallic VEH. BUILD DATE: March, 2015

TEST DATES: July 13-15, 2015 TEST LABORATORY: MGA Research Corp.

OBSERVERS: Helen Kaleto, Sean Fortnam, David Burkett, Ryan Jones, Kurt Reichert

Measurement	Description	Left Side	Right Side
M	Seat Fore/Aft Travel (Front seats)	260 mm	260 mm
Tº	Horizontal < {CG-F1 (Left Seat) to (Right A-Pillar)}	105.0º	--
A1º	360º - Tº	255.0º	--
Wº	Horizontal < {CG-2 (Left Seat) to (Left A-Pillar)}	205.4º	--
A2º	A2º = Wº	205.4º	--
Uº	Horizontal < {CG-2 (Left Seat) to (Left B-Pillar)}	284.4º	--
B1º	B1º = Uº	284.4º	--
Vº	Horizontal < {CG-R (Left Seat) to (Left B-Pillar)}	204.1º	--
B2º	B2º = Vº	204.1º	--
Wº (right)	Horizontal < {CG-F2 (Right Seat) to (Right A-Pillar)}	--	155.7º
A1º (right)	A1º (right) = Wº (right)	--	155.7º
T º (right)	Horizontal < {CG-F1 (Right Seat) to (Left A-Pillar)}	--	253.3º
A2º (right)	360º-Tº (right)	--	106.7º
V º (right)	Horizontal < {CG-R (Right Seat) to (Right B-Pillar)}	--	156.2º
B1º (right)	B1º (right) = Vº (right)	--	156.2º
Uº (right)	Horizontal < {CG-F2 (Right Seat) to (Right B-Pillar)}	--	77.5º
B2º (right)	B2º (right) = Uº (right)	--	77.5º
J	A-Pillar {(Plane 3) – (Plane 5)}	296.1 mm	296.0 mm
J/2	J ÷ 2	148.1 mm	148.0 mm
D1	Upper Roof {(Plane A) – (Plane B)}	1509.4 mm	
D1/2	D1 ÷ 2	754.7 mm	
D2	Upper Roof {(Plane C) – (Plane D)}	1242.8 mm	

Measurement	Description	Left Side	Right Side
D2/2	D2 ÷ 2	621.4 mm	
.35D1	.35 x D1	528.3 mm	
.35D2	.35 x D2	435.0 mm	
N	B-Pillar {(BPR) – (lowest point on daylight opening forward of B-Pillar)}	376.4 mm	374.9 mm
N/2	B-Pillar {(BP3) – (lowest point on daylight opening forward of B-Pillar)}	188.2 mm	187.5 mm
N/4	B-Pillar {(BP4) – (lowest point on daylight opening forward of B-Pillar)}	94.1 mm	93.7 mm
D	R-Pillar (Point 7 – Point M)	690.0 mm	690.0 mm
3D/7	3 D / 7	295.7 mm	295.7 mm

As determined using the Procedures specified in S10.1-10.13.

SgRP Locations (world coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
Front	3133.0	-370.0	686.0	3133.0	370.0	671.0
Rear	3914.0	-345.0	696.0	3914.0	345.0	696.0

SgRP Locations (vehicle coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
Front	3133.0	-370.0	686.0	3133.0	370.0	671.0
Rear	3914.0	-345.0	696.0	3914.0	345.0	696.0

CG Locations (world coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
CGF1	3033.0	-370.0	1346.0	3033.0	370.0	1331.0
CGF2	3293.0	-370.0	1346.0	3293.0	370.0	1331.0
CGR	4074.0	-345.0	1356.0	4074.0	345.0	1356.0

REFERENCE FOR VEHICLE COORDINATE SYSTEM (measured in millimeters):

Front driver front outboard seat bolt hole (x, y, z) = 2778.0, -609.0, 473.0

Front passenger front outboard seat bolt hole (x, y, z) = 2778.0, 609.0, 473.0

Passenger sun visor screw (x, y, z) = 2889.0, 481.0, 1479.0

REMARKS:

Recorded By: _____ Approved By: _____

Date: July 15, 2015

TABLE 2-6

SUMMARY OF TARGETING RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2015 Mazda 3

VEH. NHTSA NO.: C20155401 VIN: JM1BM1T75F1262658

COLOR: Liquid Silver Metallic VEH. BUILD DATE: March, 2015

TEST DATES: July 13-15, 2015 TEST LABORATORY: MGA Research Corp.

OBSERVERS: Helen Kaleto, Sean Fortnam, David Burkett, Ryan Jones, Kurt Reichert

SUMMARY OF TARGETING RESULTS								
Target	**Location (mm)**			**Horizontal Angle (deg)**	**Vertical Angle (deg)**	**Relocation (Yes/No)**	**Extension (# of 25 mm Spheres)**	**Impact (Yes/No)**
	x	**y**	**z**					
A-Pillar Left Side								
AP1	2954.4	-564.8	1453.2	--	--	Yes	--	--
REL	2972.7	-569.1	1438.7	253	17	--	1	No
AP2	2829.0	-601.7	1365.8	220	50	No	--	Yes
AP3	2699.0	-619.2	1305.9	205	50	No	--	No
A-Pillar Right Side								
AP1	2955.1	561.6	1454.5	--	--	Yes	--	--
REL	2972.9	567.1	1438.1	107	17	--	1	Yes
AP2	2830.6	596.7	1367.5	140	50	No	--	No
AP3	2702.0	617.9	1307.5	155	50	No	--	Yes
B-Pillar Left Side								
BP1	3430.4	-496.3	1496.7	270	19	No	--	No
BP2	3397.8	-599.9	1295.2	270	0	No	--	No
BP3	3342.2	-626.6	1309.1	284	18	No	--	No
BP4	3444.8	-660.2	1214.7	205	-5	No	--	No
B-Pillar Right Side								
BP1	3428.8	494.5	1495.9	90	19	No	--	Yes
BP2	3397.4	597.2	1294.4	90	0	No	--	Yes
BP3	3342.8	623.1	1308.2	78	18	No	--	No
BP4	3444.0	658.2	1213.7	115	-5	No	--	No

SUMMARY OF TARGETING RESULTS								
Target	**Location (mm)**			**Horizontal Angle (deg)**	**Vertical Angle (deg)**	**Relocation (Yes/No)**	**Extension (# of 25 mm Spheres)**	**Impact (Yes/No)**
	x	**y**	**z**					
Rear Pillar Left Side								
RP1	4176.4	-518.1	1448.1	270	17	No	--	No
RP2	4269.5	-595.9	1298.2	320	-10	No	--	No
Rear Pillar Right Side								
RP1	4171.8	518.5	1447.8	90	17	No	--	No
RP2	4268.4	595.6	1298.2	40	-10	No	--	Yes
Front Header Left Side								
FH1	2878.7	-456.7	1482.4	--	--	Yes	--	--
REL	2877.9	-431.9	1480.3	180	50	--	1	No
FH2	2861.1	-307.4	1487.2	180	50	No	--	No
Front Header Right Side								
FH1	2879.7	457.4	1483.8	--	--	Yes	--	--
REL	2877.6	431.6	1480.0	180	50	--	1	No
FH2	2862.6	309.2	1487.1	180	50	No	--	No
Side Rail Left Side								
SR1	3103.9	-519.5	1480.8	270	40	No	--	No
SR2A	3254.6	-507.9	1494.6	270	50	No	--	No
SR2B	3130.2	-529.7	1508.1	--	--	Yes	--	--
REL	3171.1	-497.5	1505.0	270	40	--	2	No
SR3-1	3755.8	-506.7	1470.3	270	50	No	--	No
SR3-2	3928.9	-508.0	1458.6	270	45	No	--	No
Side Rail Right Side								
SR1	3104.5	519.3	1479.1	90	40	No	--	No
SR2A	3256.1	513.5	1487.5	90	50	No	--	No
SR2B	3128.4	530.8	1506.1	--	--	No	--	--
REL	3169.6	496.6	1502.0	90	40	--	2	Yes
SR3-1	3756.4	505.3	1471.0	90	50	No	--	No
SR3-2	3928.0	507.1	1459.2	90	45	No	--	No

SUMMARY OF TARGETING RESULTS								
Target	**Location (mm)**			**Horizontal Angle (deg)**	**Vertical Angle (deg)**	**Relocation (Yes/No)**	**Extension (# of 25 mm Spheres)**	**Impact (Yes/No)**
	x	**y**	**z**					
Rear Header Left Side								
RH	4162.9	-345.9	1517.8	0	50	No	--	Yes
Rear Header Right Side								
RH	4162.7	345.3	1518.5	0	50	No	--	No
Upper Roof Left Side								
UR1@SR1	3085.6	-383.1	1524.9	270	50	No	--	Yes
UR2@SR2A	3267.1	-371.5	1556.9	270	50	No	--	No
UR3@BP	3432.4	-410.6	1516.2	270	50	No	--	Yes
UR4@SR3-1	3782.2	-364.1	1547.1	270	50	No	--	Yes
UR5@SR3-2	3928.0	-351.9	1547.1	270	50	No	--	No
UR6@x=4041	4041.9	-404.4	1529.2	270	50	No	--	No
Upper Roof Right Side								
UR7@SR1	3085.6	382.6	1525.2	90	50	No	--	No
UR8@SR2A	3266.2	370.5	1557.2	90	50	No	--	No
UR9@BP	3432.4	410.4	1517.0	90	50	No	--	No
UR10@SR3-1	3782.6	363.1	1549.0	90	50	No	--	No
UR11@SR3-2	3928.2	3506.0	1548.8	90	50	No	--	Yes
UR12@x=4041	4041.2	405.8	1530.2	90	50	No	--	No

As determined using the Procedures specified in S10.1-10.13.

Recorded By: _____ Approved By: _____

Date: July 15, 2015

3.0 TEST DATA (Including Acceleration and Velocity Plots)

Test U15137 Data

mga research corporation

FMVSS 201U
Test No.: U15137 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/14/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 8 Time: 11:36am

Horizontal Approach Angle: 107 deg Temperature: 21.3 °C

Vertical Approach Angle: 17 deg Humidity: 51.7 %RH

Impact Form ID No.: 38 Impact Form Mass: 4.51 kg

Target Location: Right AP1

Additional Description:

Test Results

Impact Velocity: 18.99 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	513.49	87.5	91	3.5
HIC 15	513.49	87.5	91	3.5
HIC (d)	553.81	87.5	91	3.5

3 ms Clip = 83.86 G , Time 1 = 87.69 ms , Time 2 = 90.69 ms

Impact Location on FMH: 19 mm Above Pt. 0 , 14 Right mm Lateral of Pt. 0

Post-Test Comments: No visible damage.

Test Series Performed By: DB, KR

Page 1 of 3

Recorded By: _____ Approved By: _____

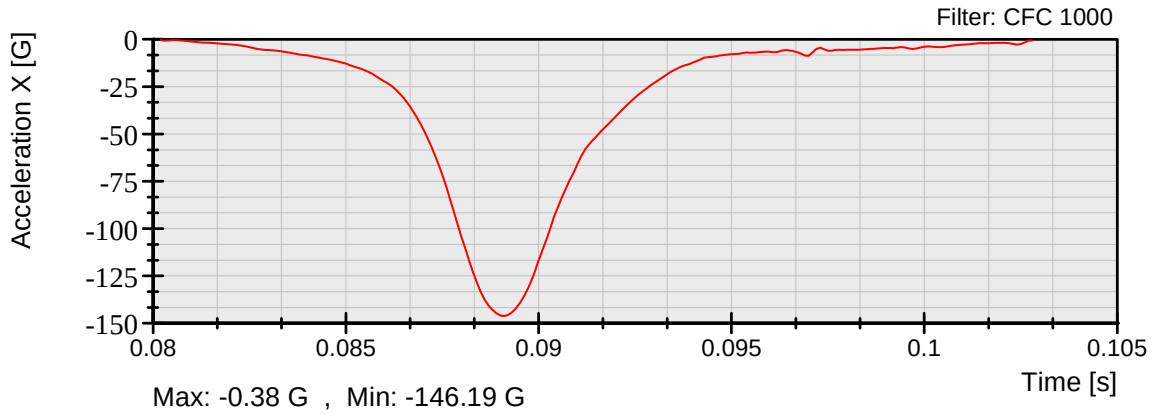
Date: July 14, 2015

mga research corporation

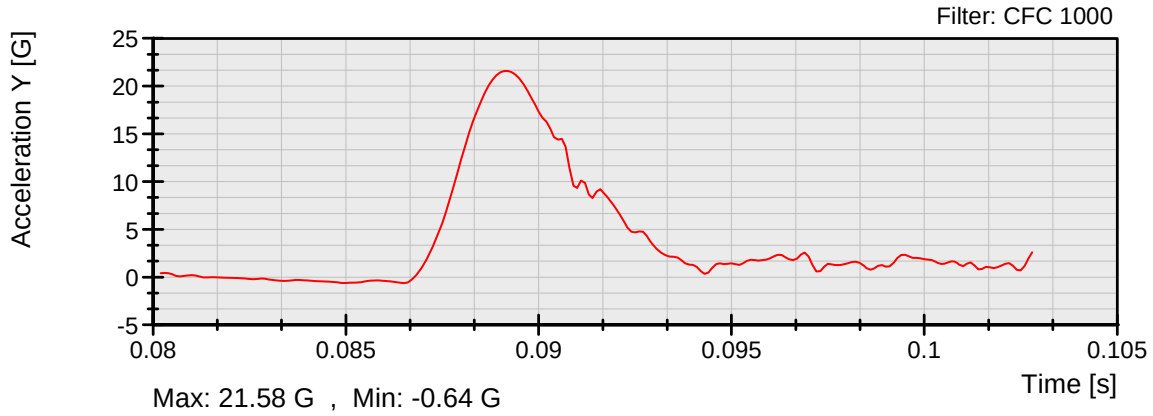
FMVSS 201U

Test No.: U15137 Report No.: G15I7-001.5

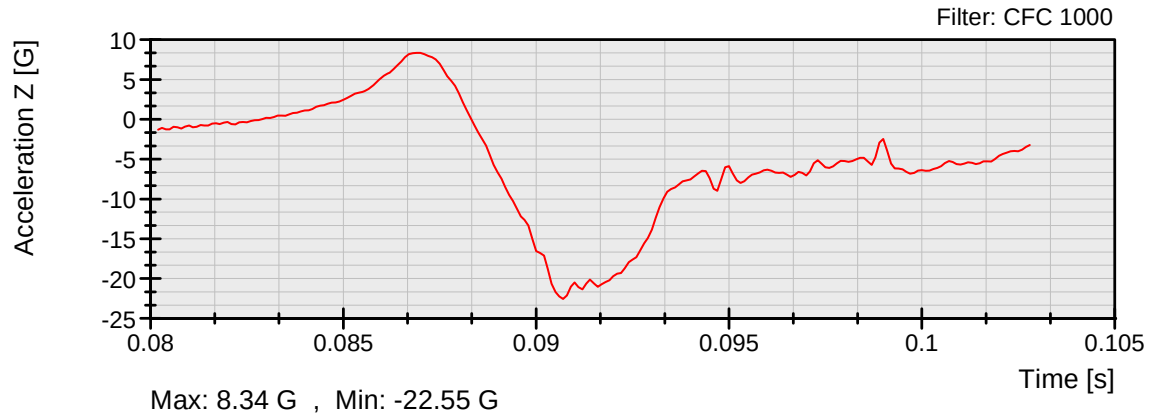
Customer: NHTSA Date: 07/14/2015



Max: -0.38 G , Min: -146.19 G



Max: 21.58 G , Min: -0.64 G



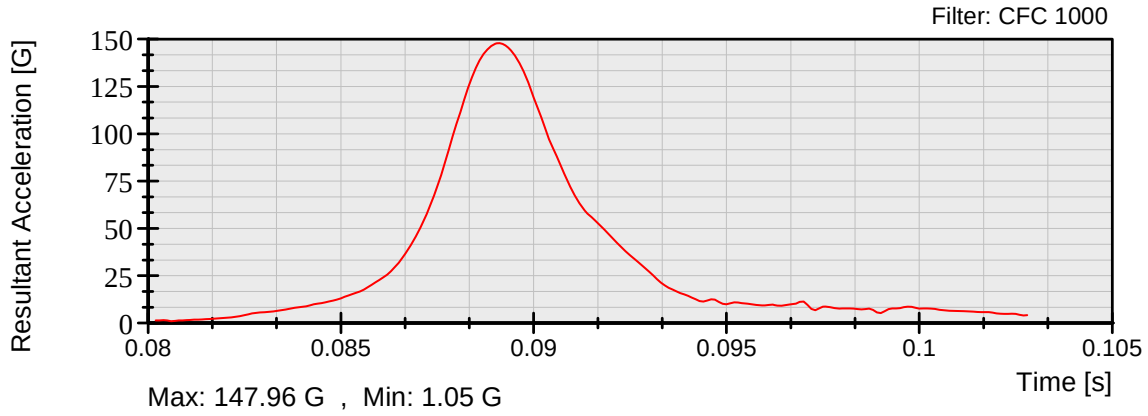
Max: 8.34 G , Min: -22.55 G

mga research corporation

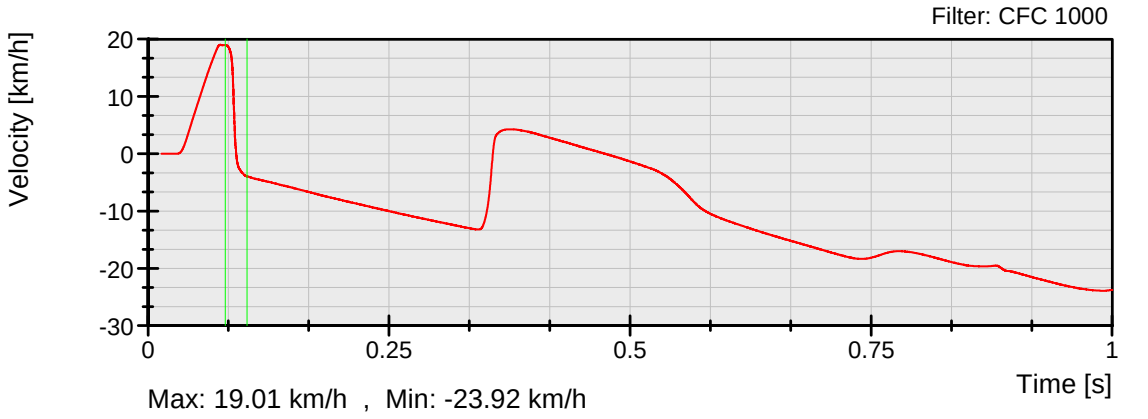
FMVSS 201U

Test No.: U15137 Report No.: G15I7-001.5

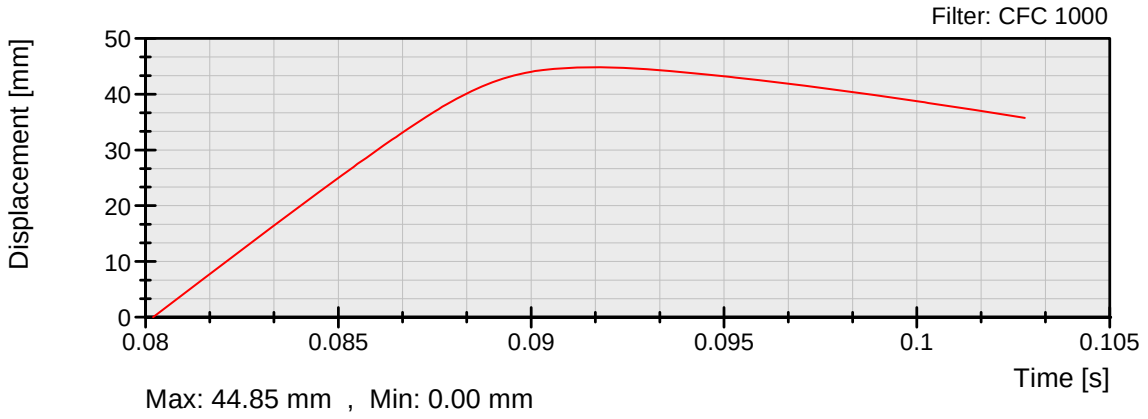
Customer: NHTSA Date: 07/14/2015



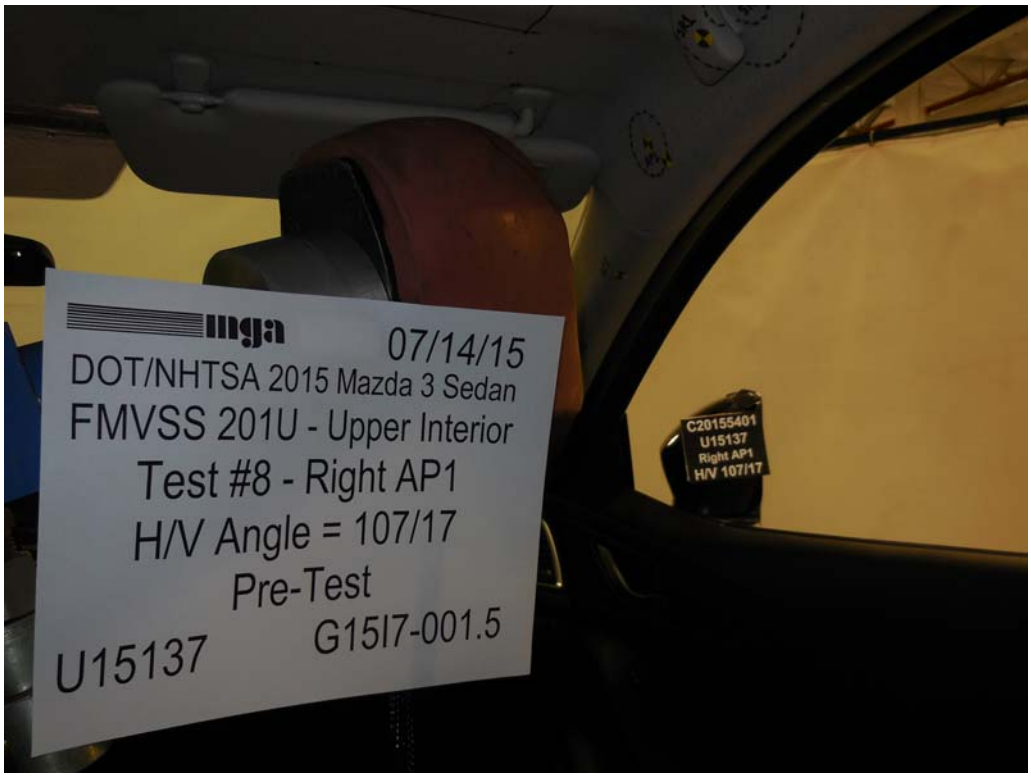
Max: 147.96 G , Min: 1.05 G



Max: 19.01 km/h , Min: -23.92 km/h



Max: 44.85 mm , Min: 0.00 mm


mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #8 - Right AP1
H/V Angle = 107/17
Pre-Test
U15137
G15I7-001.5
C20155401
U15137
Right AP1
H/V 107/17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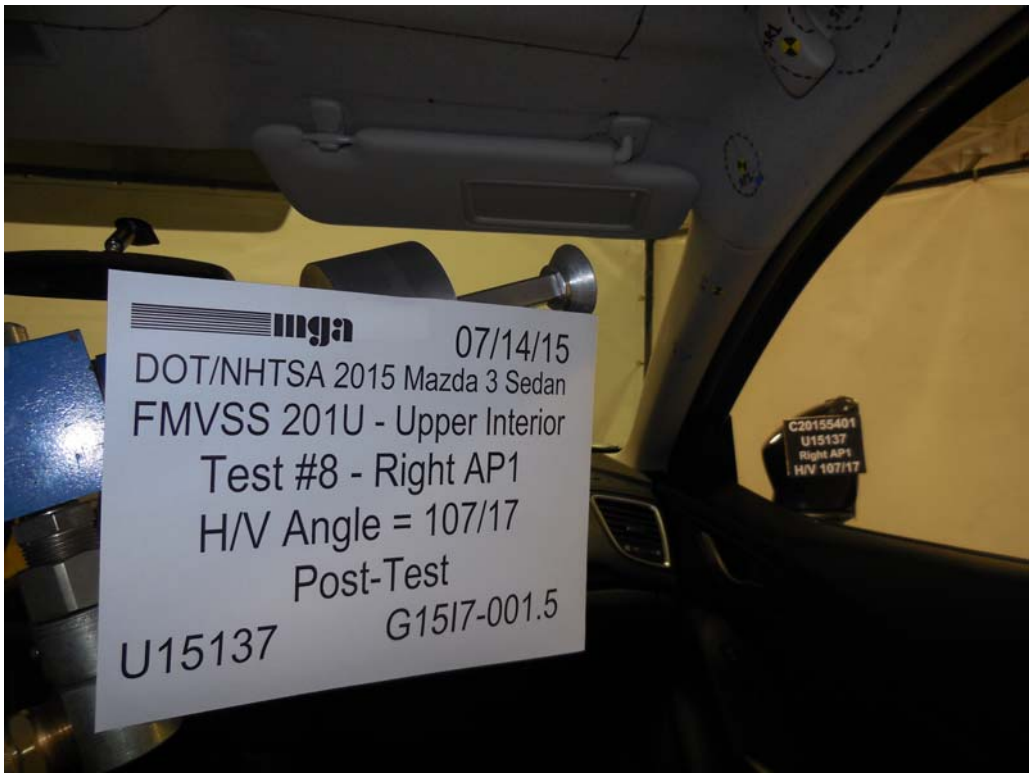
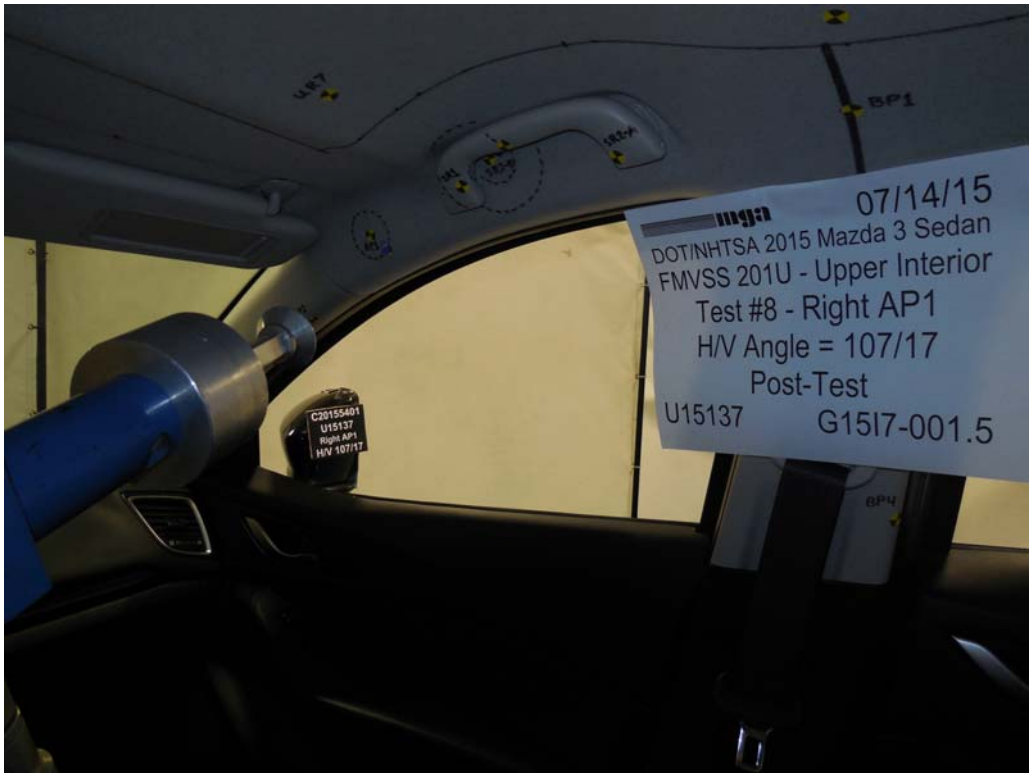
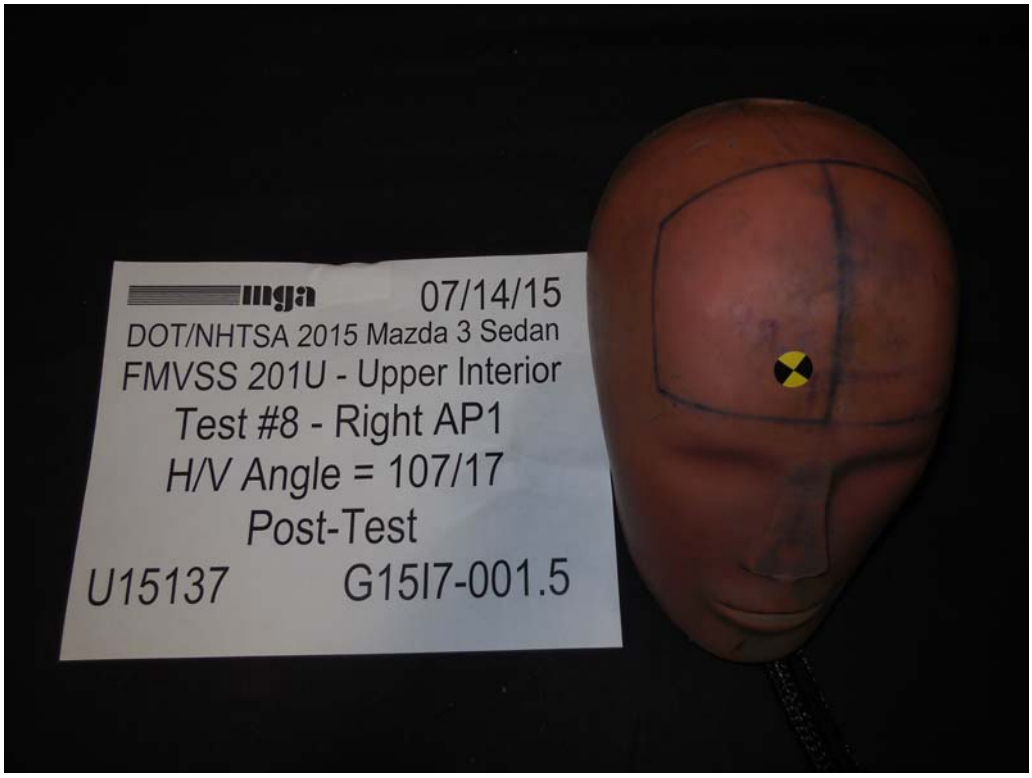
FMVSS 201U - Upper Interior
Test #8 - Right AP1
H/V Angle = 107/17
Pre-Test
U15137
G15I7-001.5
BP1


mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #8 - Right AP1
H/V Angle = 107/17
Post-Test
U15137
G15I7-001.5
C20155401
U15137
Right AP1
H/V 107/17


BP1
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #8 - Right AP1
H/V Angle = 107/17
Post-Test
U15137
G15I7-001.5
C20155401
U15137
Right AP1
H/V 107/17
BP4


AP1


07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #8 - Right AP1
H/V Angle = 107/17
Post-Test
U15137
G15I7-001.5

Test U15130 Data

mga research corporation

FMVSS 201U
Test No.: U15130 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/13/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 1 Time: 10:29am

Horizontal Approach Angle: 220 deg Temperature: 22.0 °C

Vertical Approach Angle: 50 deg Humidity: 47.9 %RH

Impact Form ID No.: 35 Impact Form Mass: 4.51 kg

Target Location: AP2 Left

Additional Description:

Test Results

Impact Velocity: 18.93 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	333.43	82	93.2	11.2
HIC 15	333.43	82	93.2	11.2
HIC (d)	417.96	82	93.2	11.2

3 ms Clip = 66.63 G , Time 1 = 82.76 ms , Time 2 = 86.07 ms

Impact Location on FMH: 21 mm Above Pt. 0 , 3 Right mm Lateral of Pt. 0

Post-Test Comments: A-Pillar Dislodged.

Test Series Performed By: DB, KR

Recorded By: Dan Brott Approved By: Helen A. Kaleto

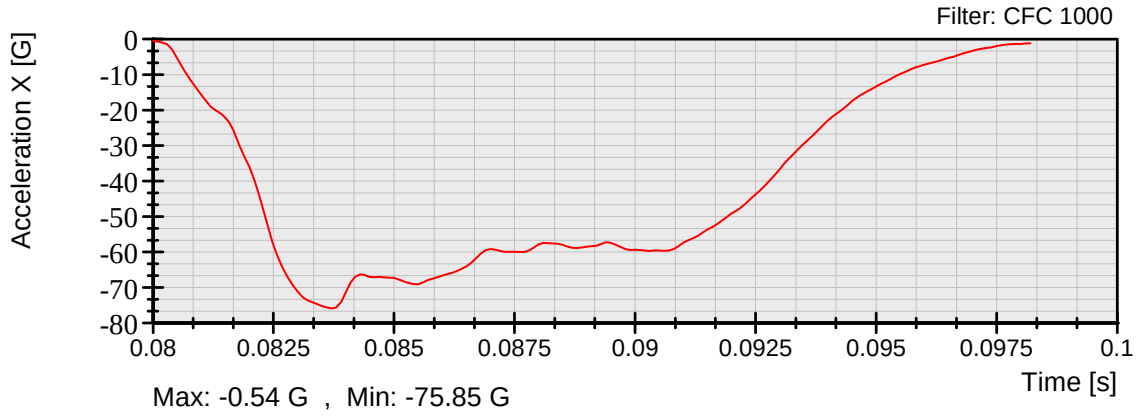
Date: July 13, 2015

mga research corporation

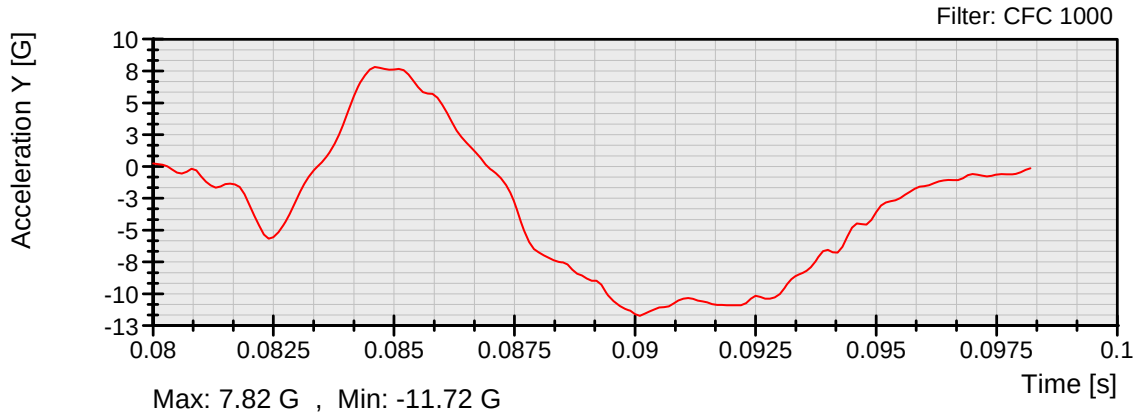
FMVSS 201U

Test No.: U15130 Report No.: G15I7-001.5

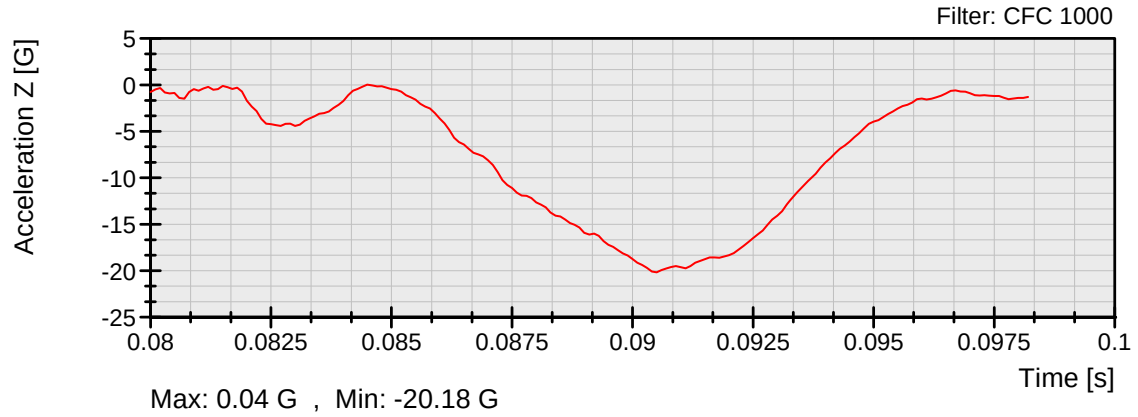
Customer: NHTSA Date: 07/13/2015



Max: -0.54 G , Min: -75.85 G



Max: 7.82 G , Min: -11.72 G



Max: 0.04 G , Min: -20.18 G

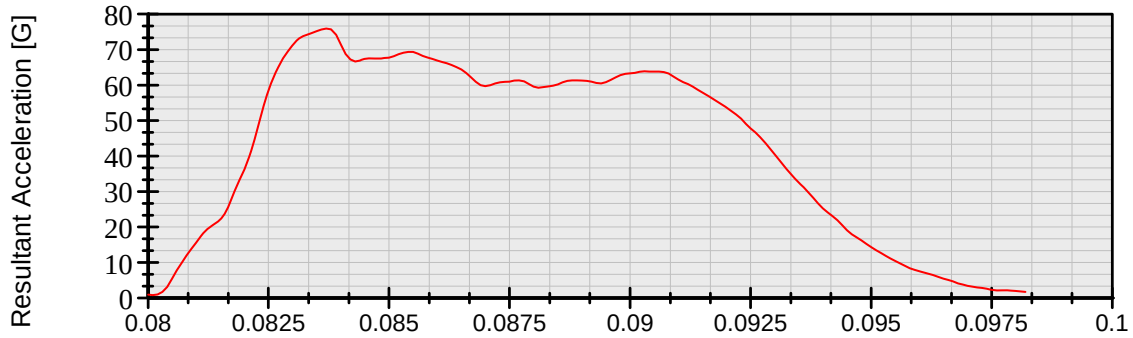
mga research corporation

FMVSS 201U

Test No.: U15130 Report No.: G15I7-001.5

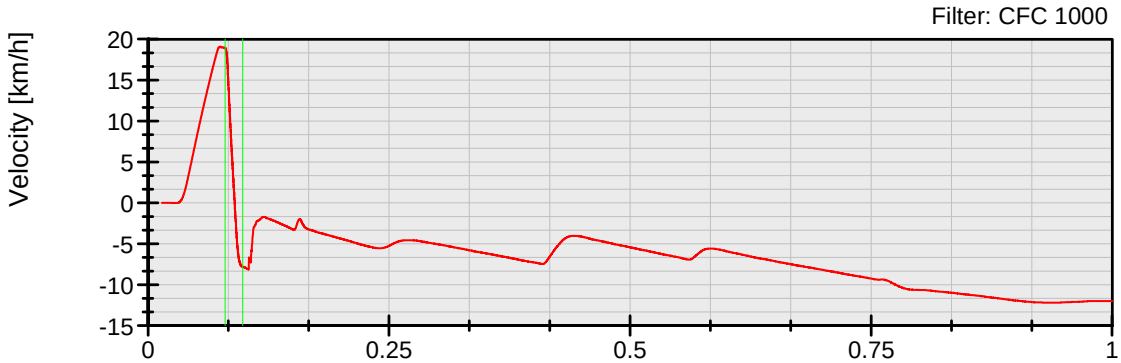
Customer: NHTSA Date: 07/13/2015

Filter: CFC 1000



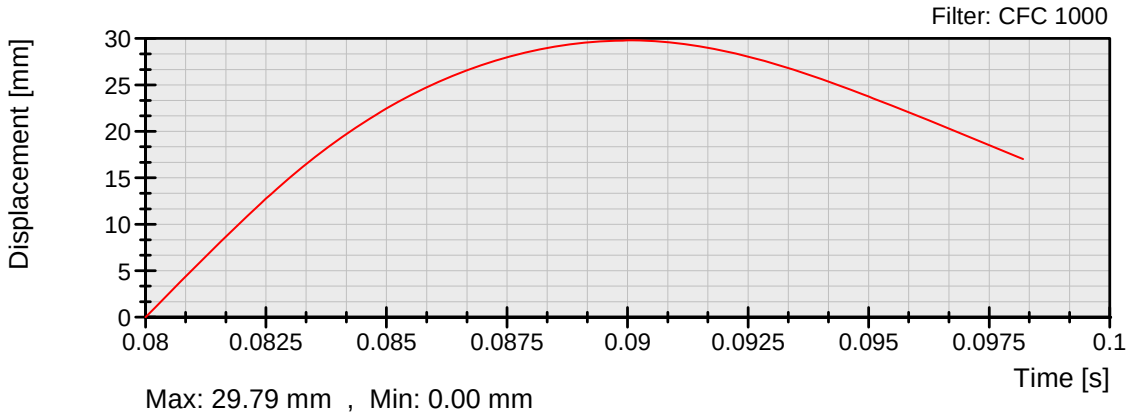
Max: 75.91 G , Min: 0.83 G

Filter: CFC 1000



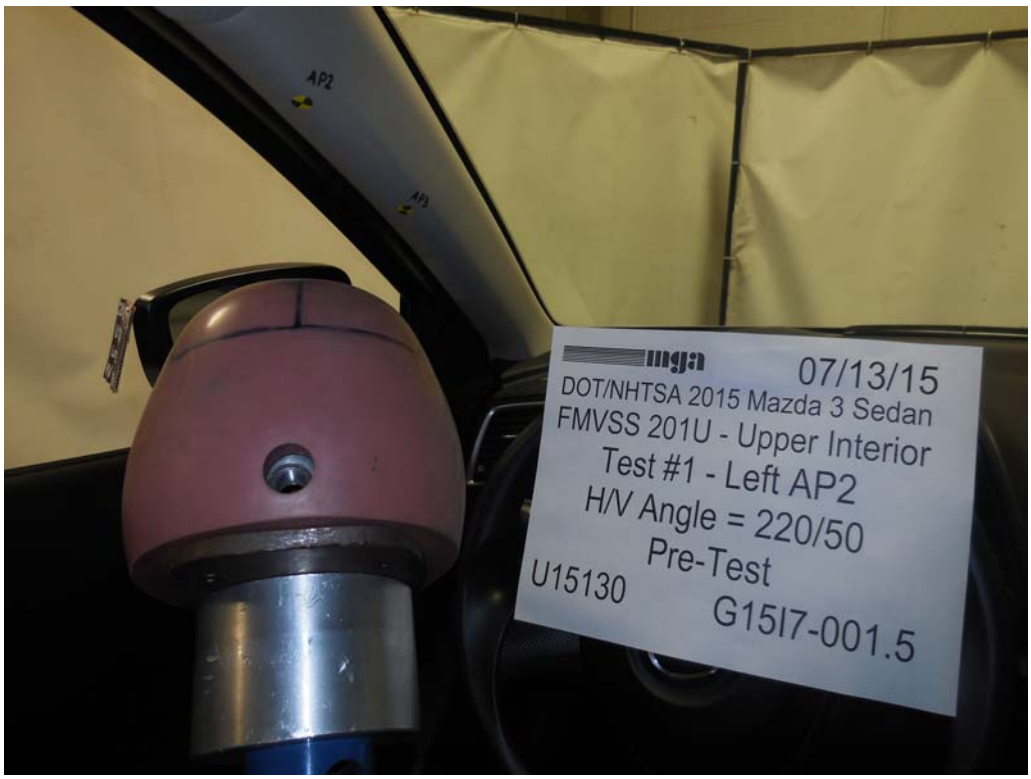
Max: 19.08 km/h , Min: -12.20 km/h

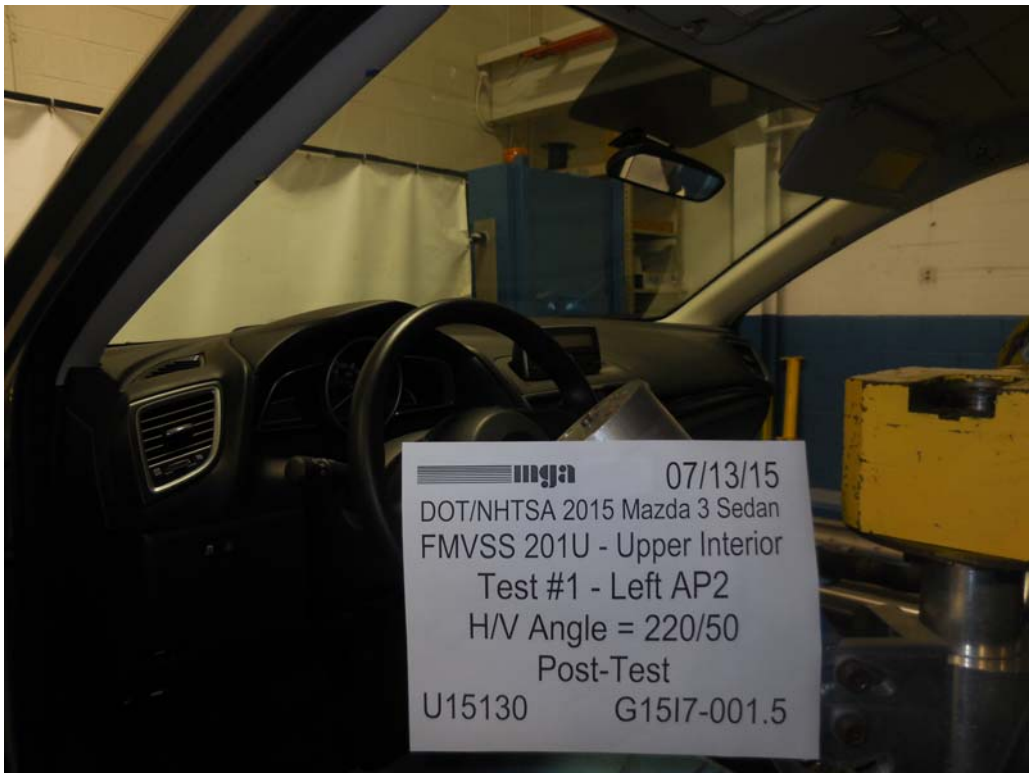
Filter: CFC 1000

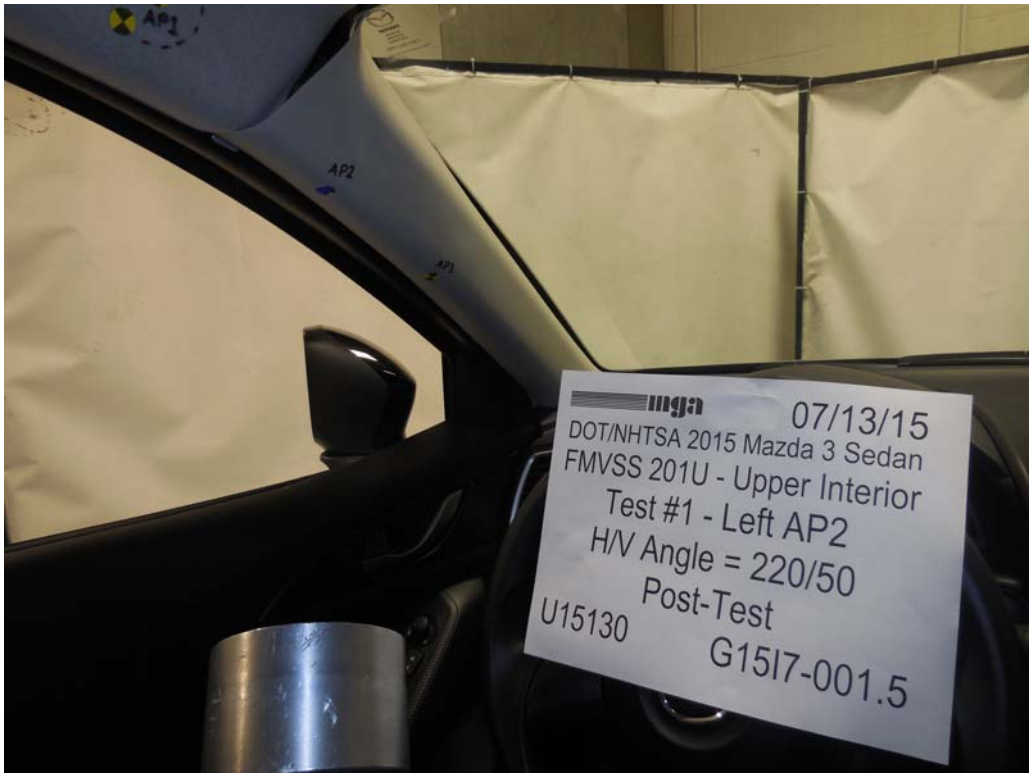


Max: 29.79 mm , Min: 0.00 mm


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #1 - Left AP2
H/V Angle = 220/50
Pre-Test
U15130
G15I7-001.5

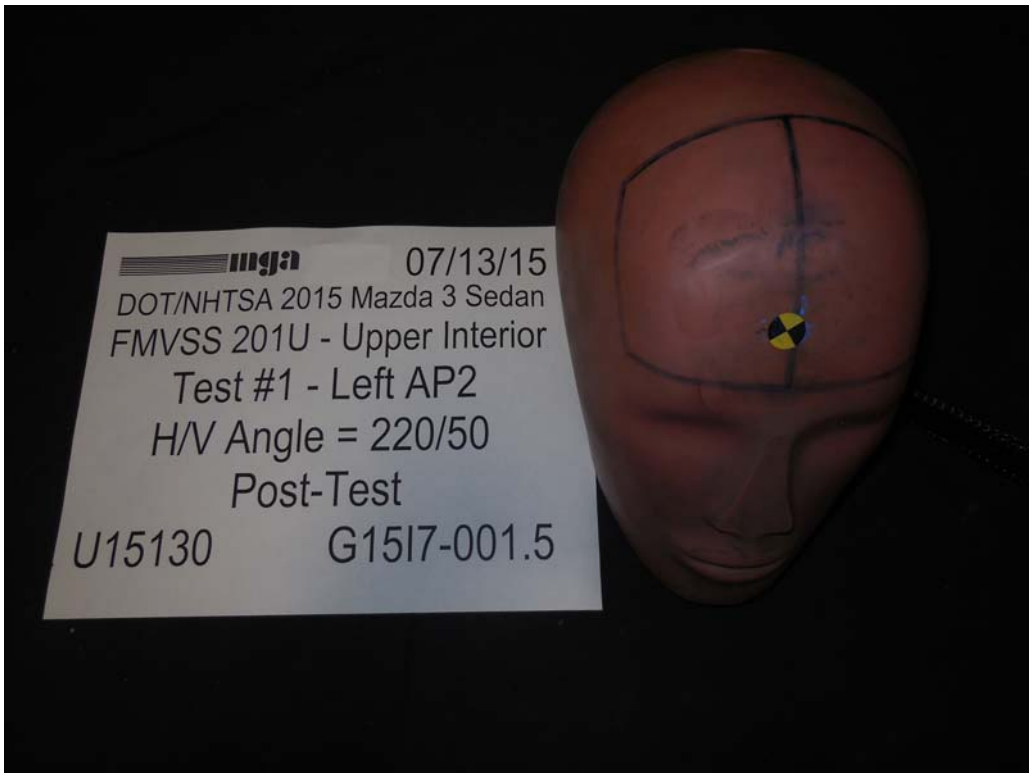

AP2
mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #1 - Left AP2
H/V Angle = 220/50
Pre-Test
U15130
G15I7-001.5


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #1 - Left AP2
H/V Angle = 220/50
Post-Test
U15130
G15I7-001.5


AP1
AP2
mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #1 - Left AP2
H/V Angle = 220/50
Post-Test
U15130
G15I7-001.5


AP2


P1
AP2


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #1 - Left AP2
H/V Angle = 220/50
Post-Test
U15130
G15I7-001.5

Test U15136 Data

mga research corporation

FMVSS 201U
Test No.: U15136 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/14/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 7 Time: 9:57am

Horizontal Approach Angle: 155 deg Temperature: 20.2 °C

Vertical Approach Angle: 50 deg Humidity: 50.2 %RH

Impact Form ID No.: 37 Impact Form Mass: 4.54 kg

Target Location: Right AP3

Additional Description:

Test Results

Impact Velocity: 18.97 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	420.68	84	92.4	8.4
HIC 15	420.68	84	92.4	8.4
HIC (d)	483.79	84	92.4	8.4

3 ms Clip = 85.13 G , Time 1 = 87.2 ms , Time 2 = 90.2 ms

Impact Location on FMH: 13 mm Above Pt. 0 , 9 Left mm Lateral of Pt. 0

Post-Test Comments: No visible damage.

Test Series Performed By: DB, KR

Recorded By: Dirk Brott Approved By: Helen A. Kalata

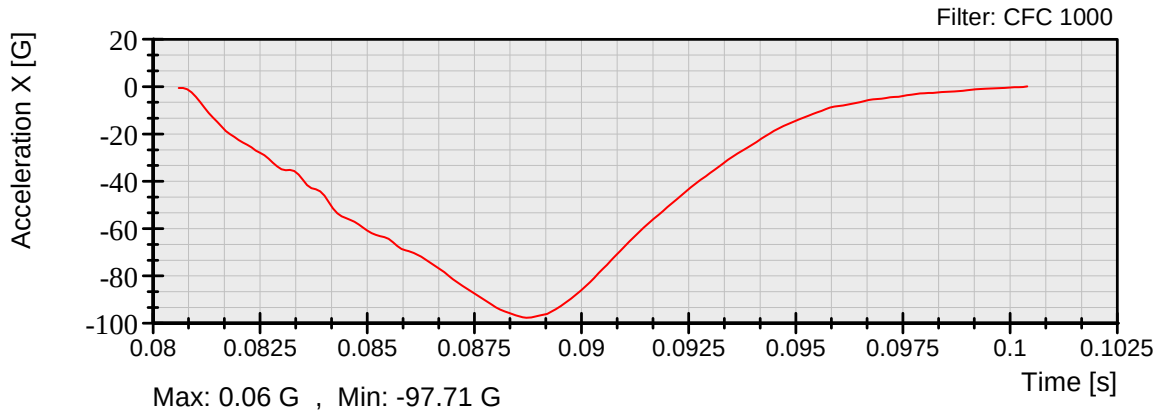
Date: July 14, 2015

mga research corporation

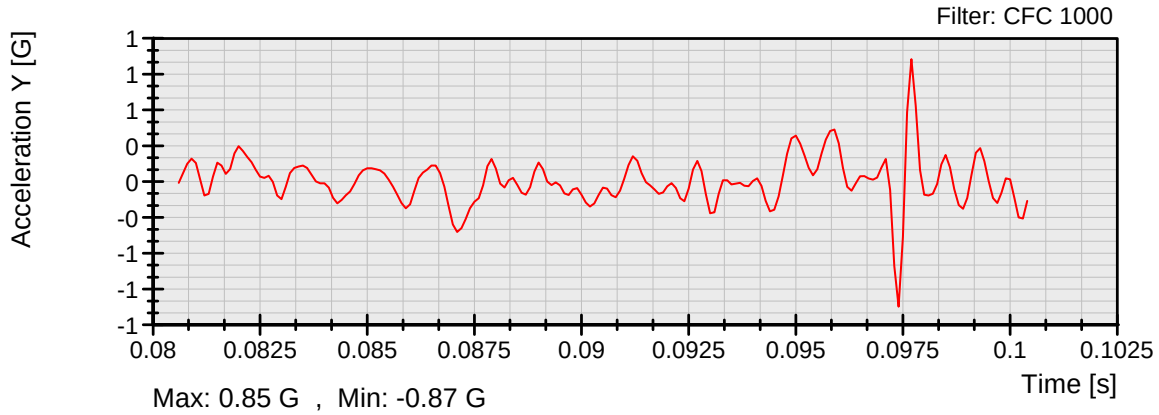
FMVSS 201U

Test No.: U15136 Report No.: G15I7-001.5

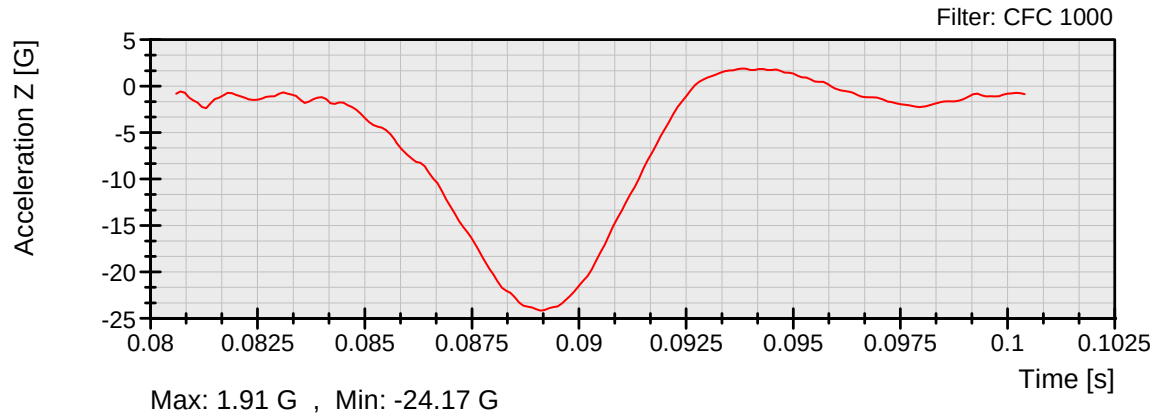
Customer: NHTSA Date: 07/14/2015



Max: 0.06 G , Min: -97.71 G



Max: 0.85 G , Min: -0.87 G



Max: 1.91 G , Min: -24.17 G

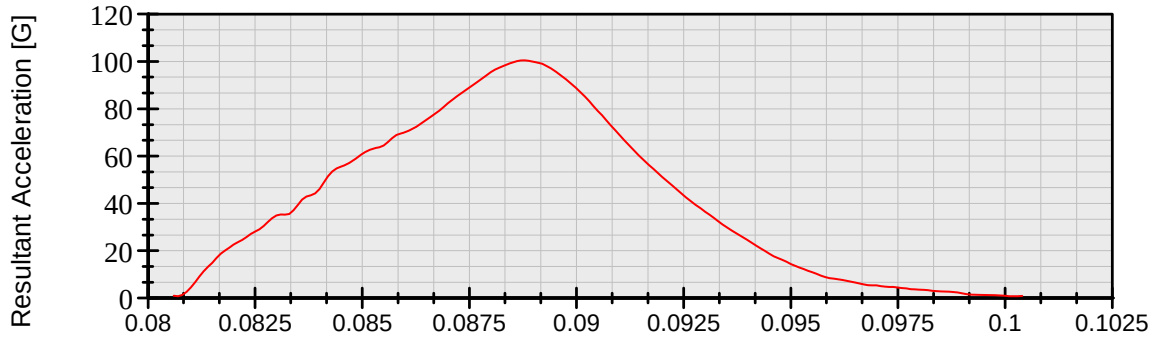
mga research corporation

FMVSS 201U

Test No.: U15136 Report No.: G15I7-001.5

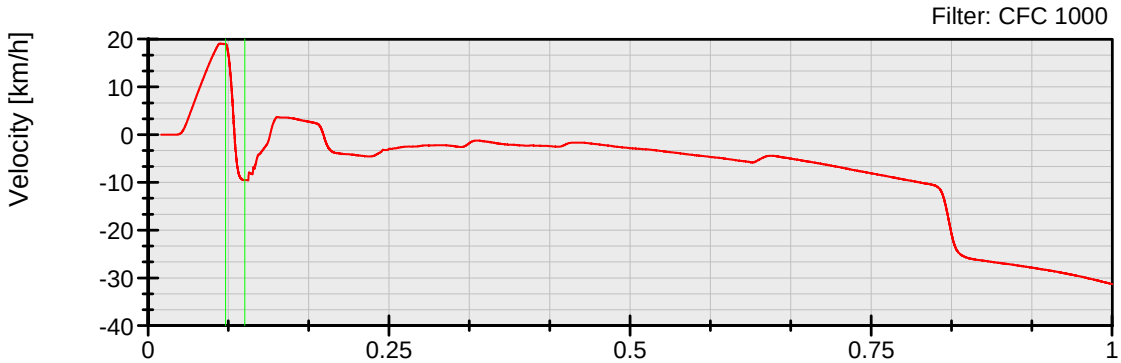
Customer: NHTSA Date: 07/14/2015

Filter: CFC 1000



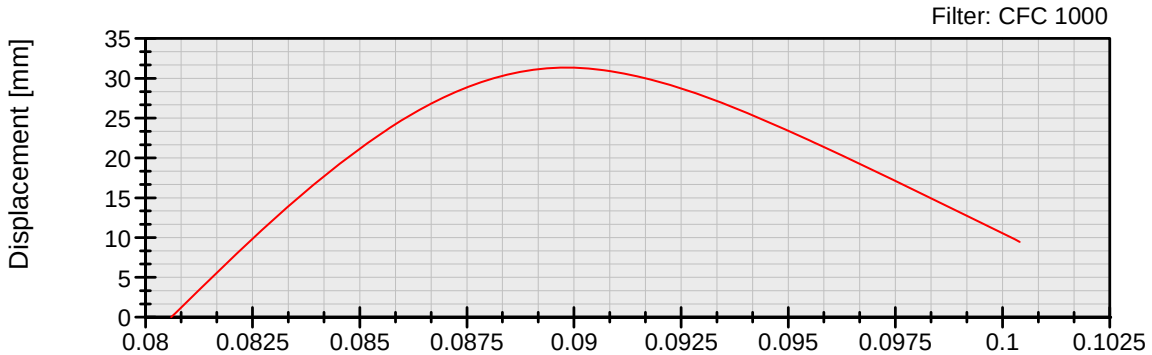
Max: 100.53 G , Min: 0.81 G

Filter: CFC 1000

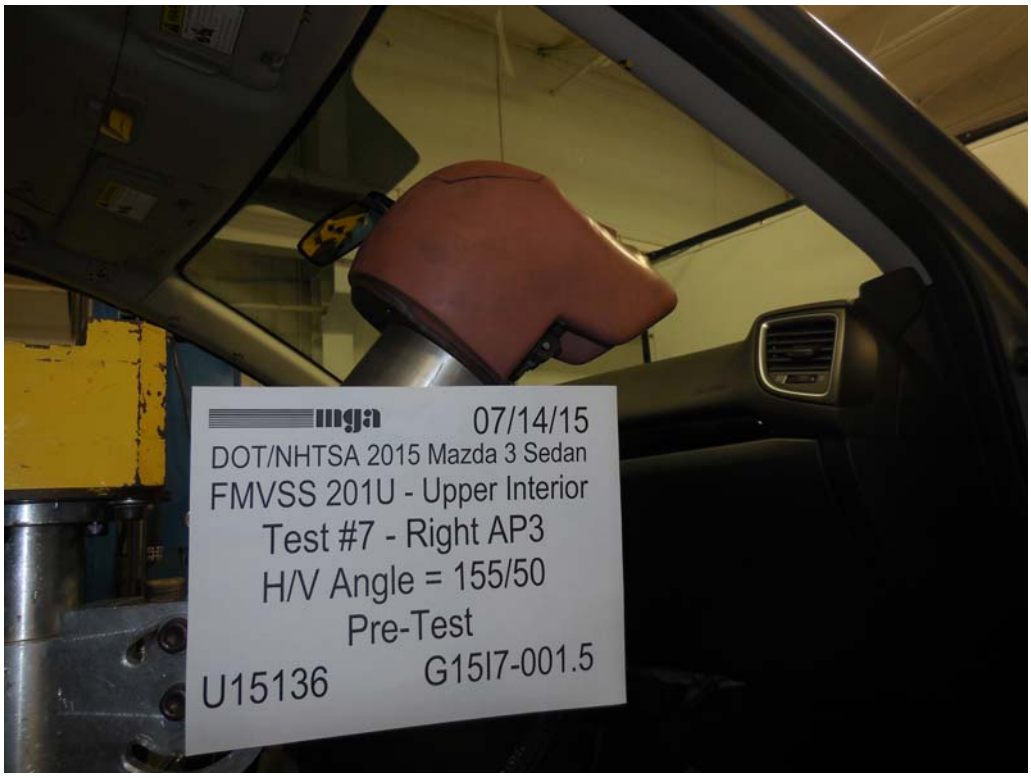


Max: 19.10 km/h , Min: -31.31 km/h

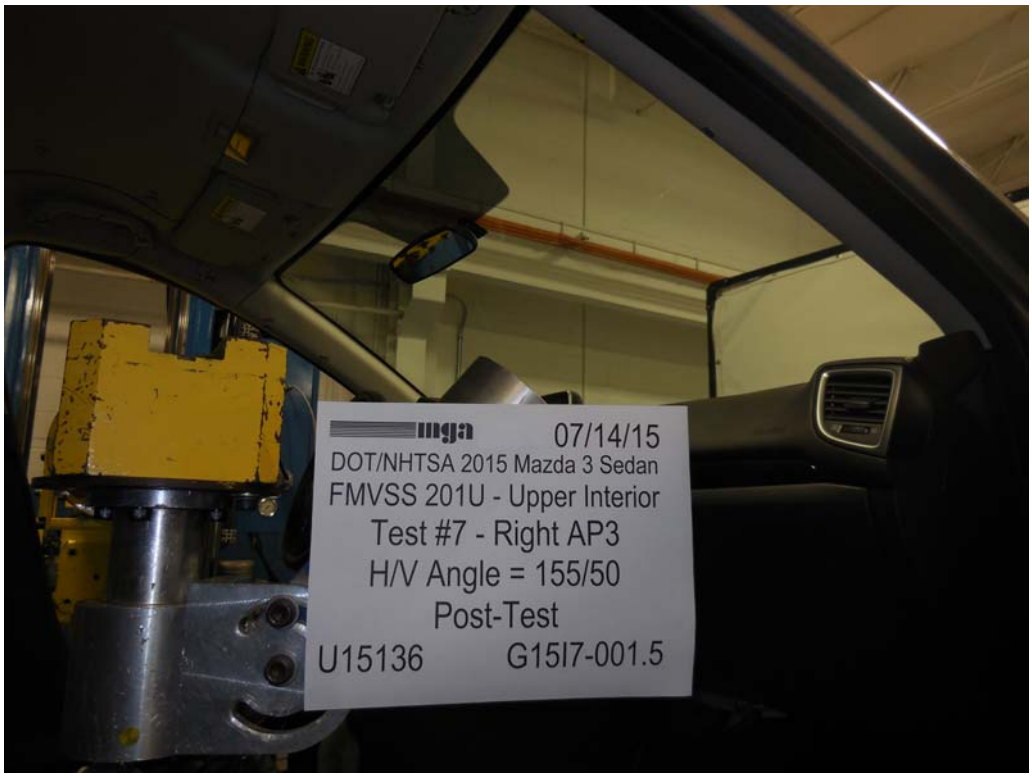
Filter: CFC 1000



Max: 31.33 mm , Min: 0.00 mm


mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #7 - Right AP3
H/V Angle = 155/50
Pre-Test
U15136
G15I7-001.5


mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #7 - Right AP3
H/V Angle = 155/50
Pre-Test
U15136
G15I7-001.5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07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #7 - Right AP3
H/V Angle = 155/50
Post-Test
U15136
G15I7-001.5


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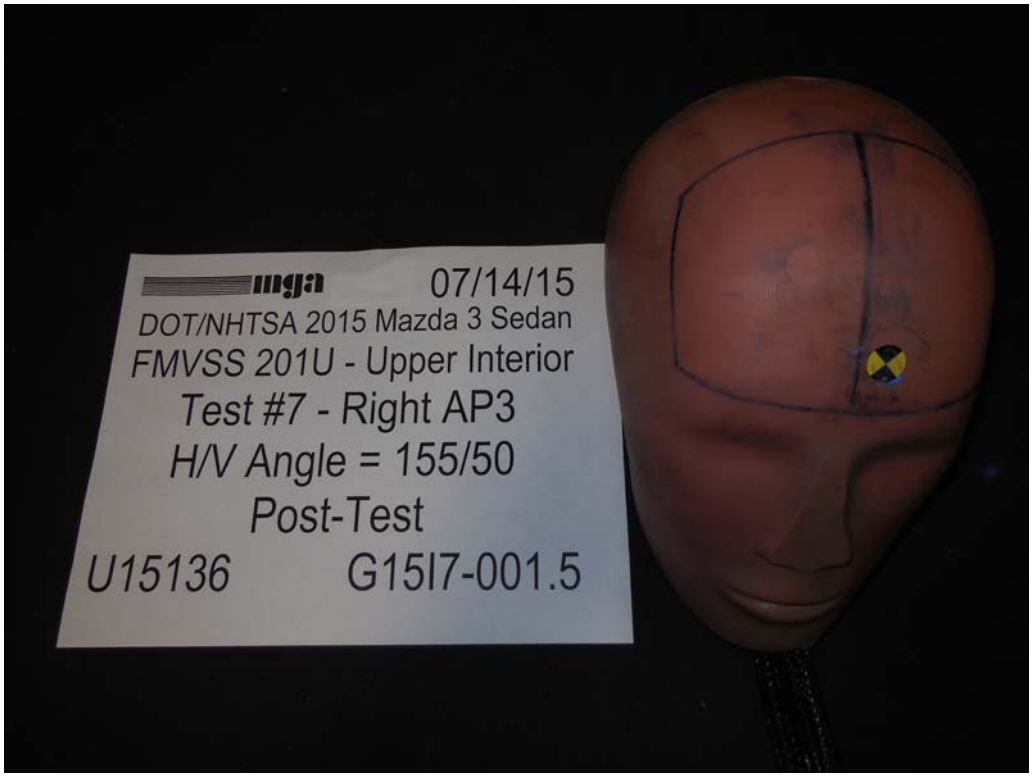
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #7 - Right AP3
H/V Angle = 155/50
Post-Test
U15136
G15I7-001.5


AP3


mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #7 - Right AP3
H/V Angle = 155/50
Post-Test
U15136
G15I7-001.5

Test U15140 Data

mga research corporation

FMVSS 201U
Test No.: U15140 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/14/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 11 Time: 3:05pm

Horizontal Approach Angle: 90 deg Temperature: 20.6 °C

Vertical Approach Angle: 19 deg Humidity: 48.4 %RH

Impact Form ID No.: 38 Impact Form Mass: 4.51 kg

Target Location: Right BP1

Additional Description:

Test Results

Impact Velocity: 18.94 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	465.12	88.6	95.3	6.7
HIC 15	465.12	88.6	95.3	6.7
HIC (d)	517.32	88.6	95.3	6.7

3 ms Clip = 90.08 G , Time 1 = 90.84 ms , Time 2 = 93.84 ms

Impact Location on FMH: 64 mm Above Pt. 0 , 0 mm Lateral of Pt. 0

Post-Test Comments: Headliner deformation.

Test Series Performed By: DB, KR

Recorded By: _____ Approved By: _____

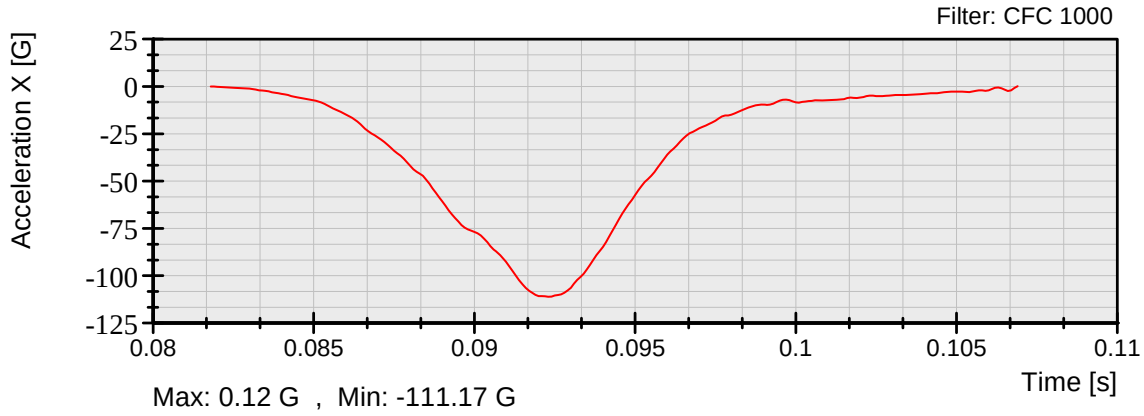
Date: July 14, 2015

mga research corporation

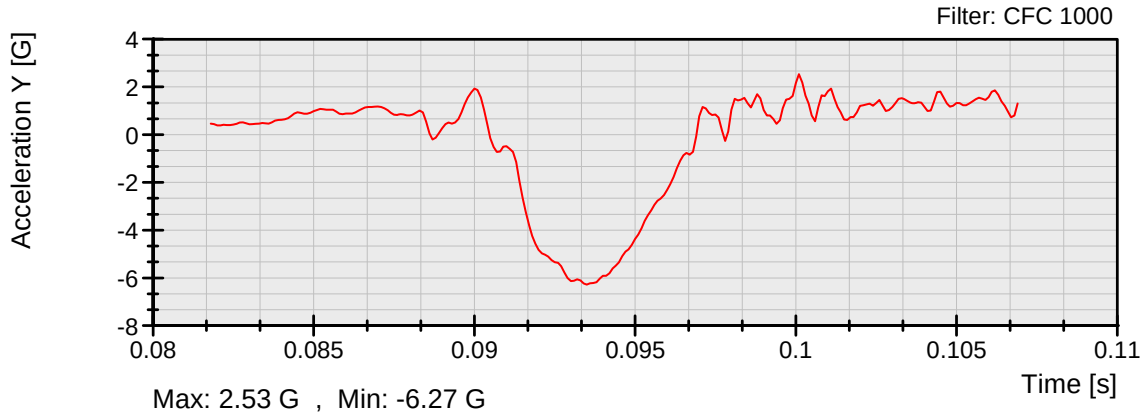
FMVSS 201U

Test No.: U15140 Report No.: G15I7-001.5

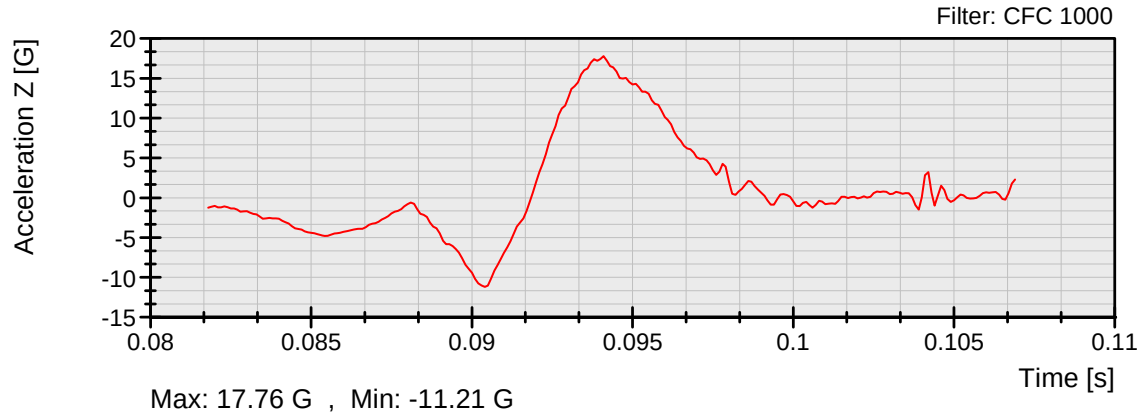
Customer: NHTSA Date: 07/14/2015



Max: 0.12 G , Min: -111.17 G



Max: 2.53 G , Min: -6.27 G



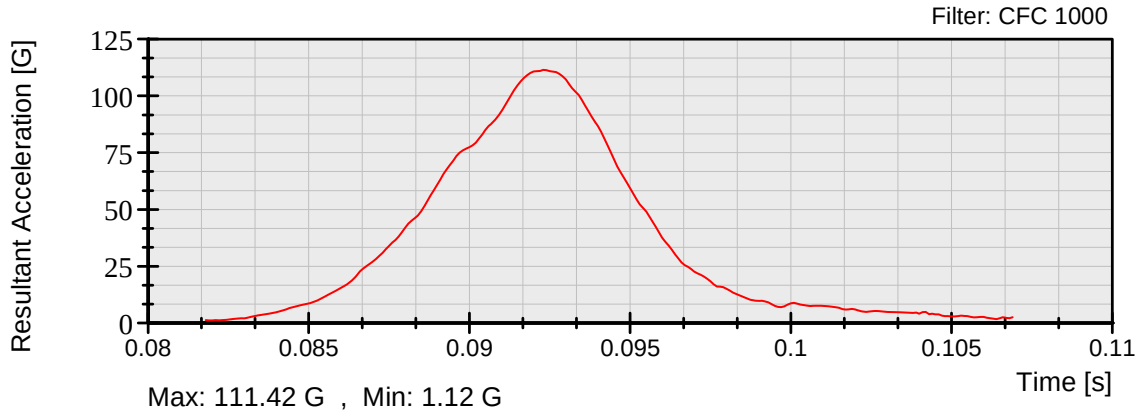
Max: 17.76 G , Min: -11.21 G

mga research corporation

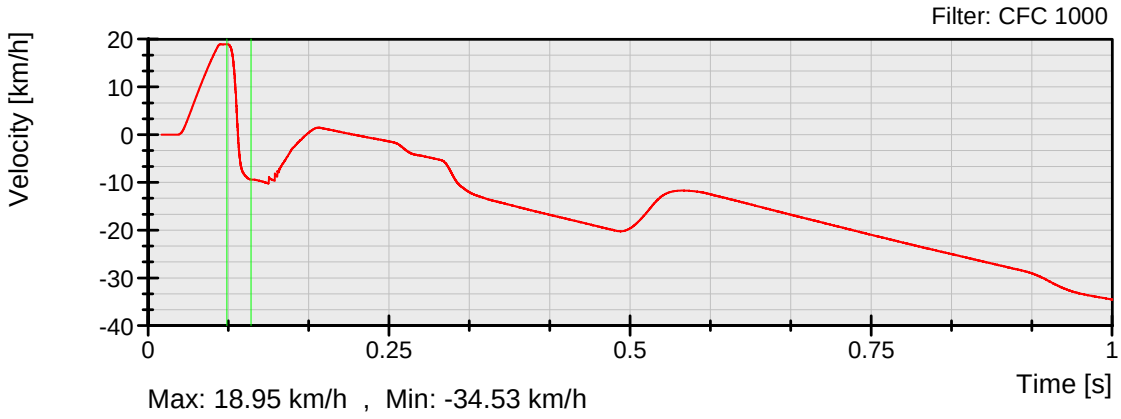
FMVSS 201U

Test No.: U15140 Report No.: G15I7-001.5

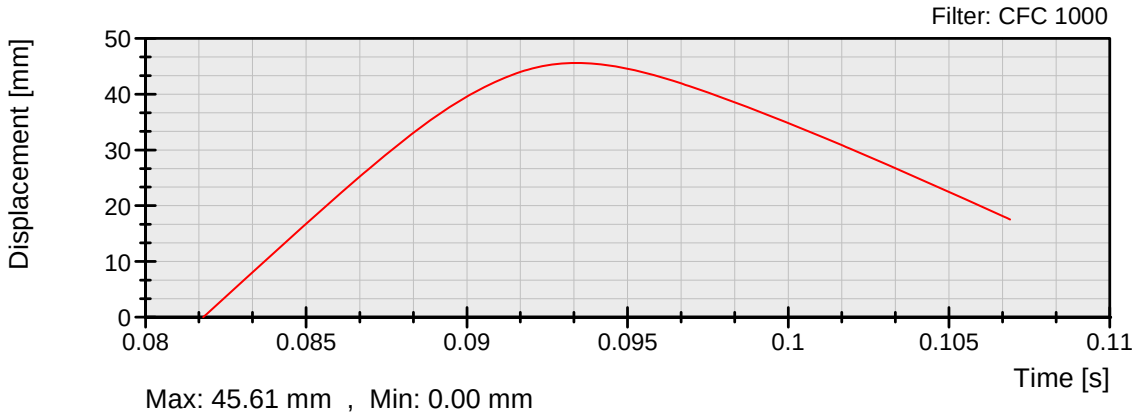
Customer: NHTSA Date: 07/14/2015



Max: 111.42 G , Min: 1.12 G



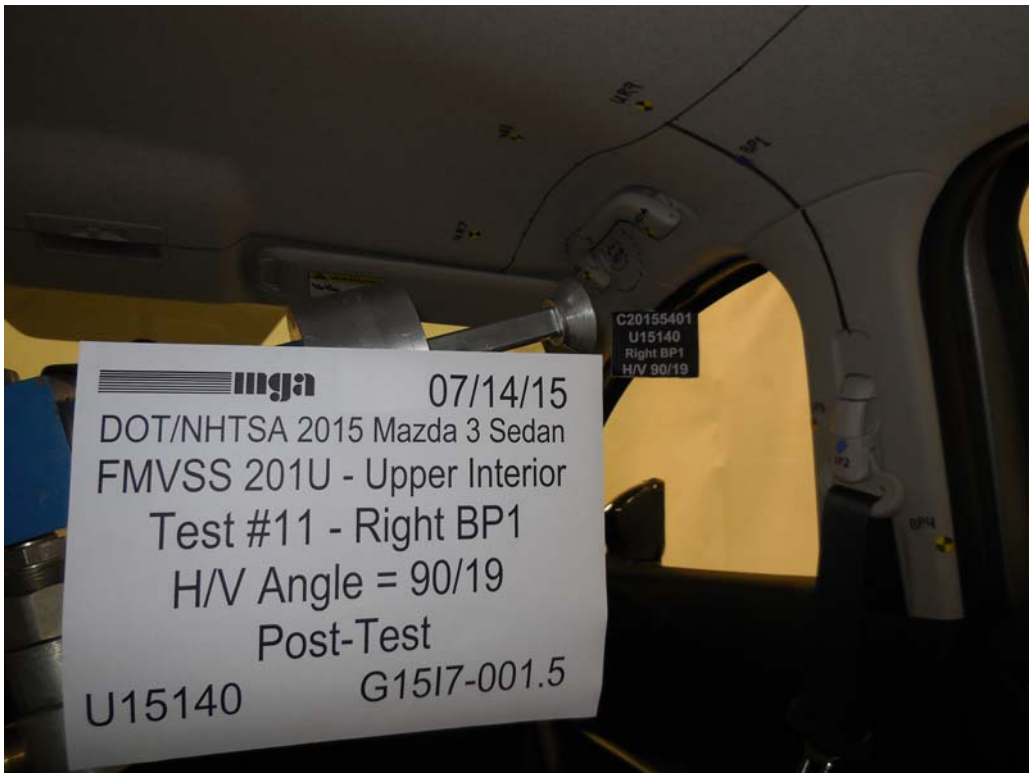
Max: 18.95 km/h , Min: -34.53 km/h



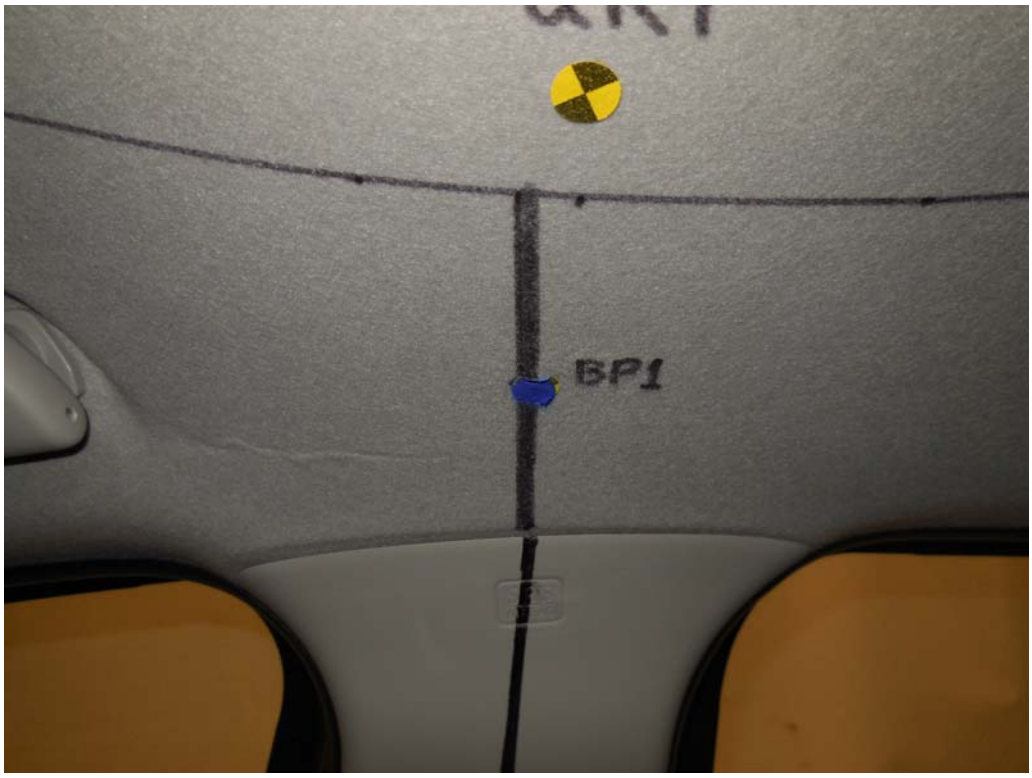
Max: 45.61 mm , Min: 0.00 mm

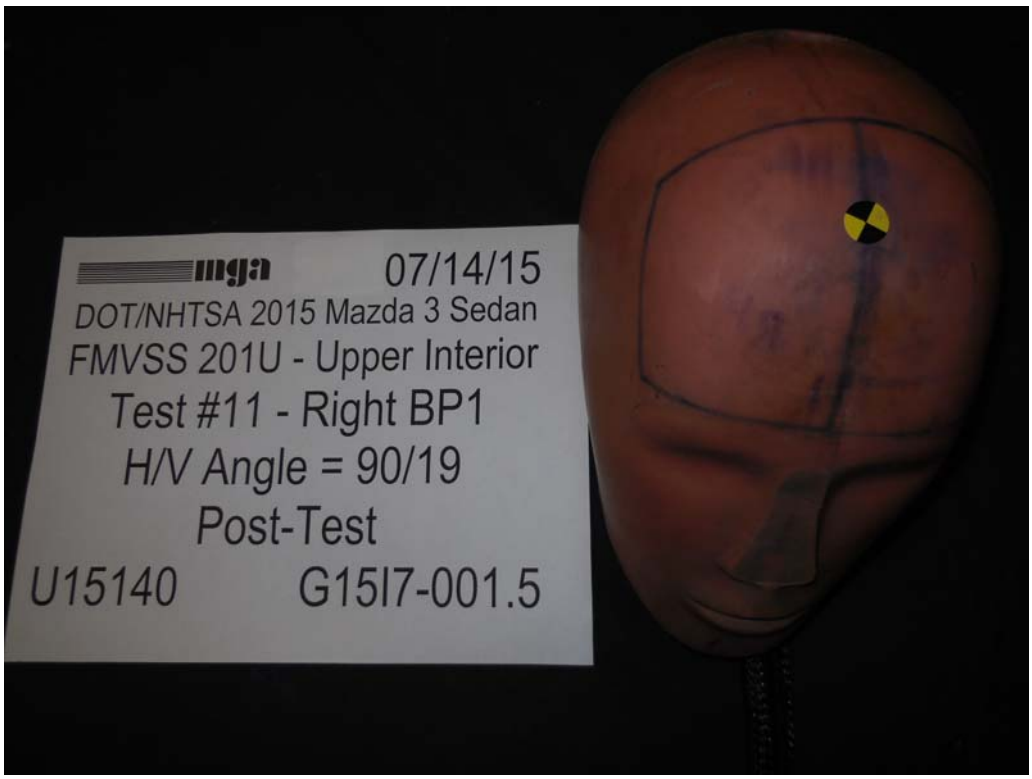

mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #11 - Right BP1
H/V Angle = 90/19
Pre-Test
U15140
G15I7-001.5


URIO
URR
BP1
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #11 - Right BP1
H/V Angle = 90/19
Pre-Test
U15140
G15I7-001.5


C20155401
U15140
Right BP1
H/V 90/19
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #11 - Right BP1
H/V Angle = 90/19
Post-Test
U15140
G15I7-001.5


C20155401
U15140
Right BP1
H/V 90/19
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #11 - Right BP1
H/V Angle = 90/19
Post-Test
U15140
G15I7-001.5


BP1


mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #11 - Right BP1
H/V Angle = 90/19
Post-Test
U15140
G15I7-001.5

Test U15139 Data

mga research corporation

FMVSS 201U
Test No.: U15139 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/14/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 10 Time: 2:16pm

Horizontal Approach Angle: 90 deg Temperature: 20.8 °C

Vertical Approach Angle: 0 deg Humidity: 49.7 %RH

Impact Form ID No.: 37 Impact Form Mass: 4.54 kg

Target Location: Right BP2

Additional Description:

Test Results

Impact Velocity: 24.1 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	591.3	73.5	83.3	9.8
HIC 15	591.3	73.5	83.3	9.8
HIC (d)	612.51	73.5	83.3	9.8

3 ms Clip = 89.96 G , Time 1 = 75.83 ms , Time 2 = 78.83 ms

Impact Location on FMH: 17 mm Above Pt. 0 , 4 Left mm Lateral of Pt. 0

Post-Test Comments: No visible damage.

Test Series Performed By: DB, KR

Recorded By: Dirk Brott Approved By: Helen A. Kalata

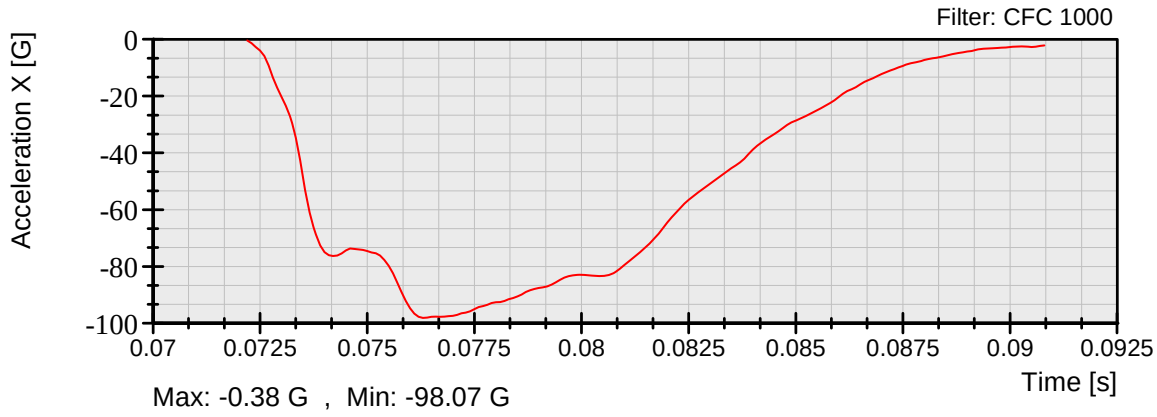
Date: July 14, 2015

mga research corporation

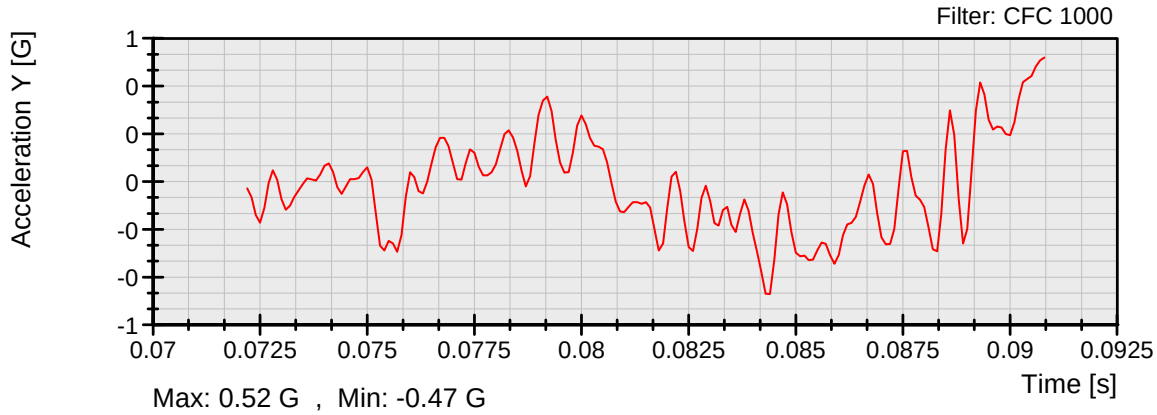
FMVSS 201U

Test No.: U15139 Report No.: G15I7-001.5

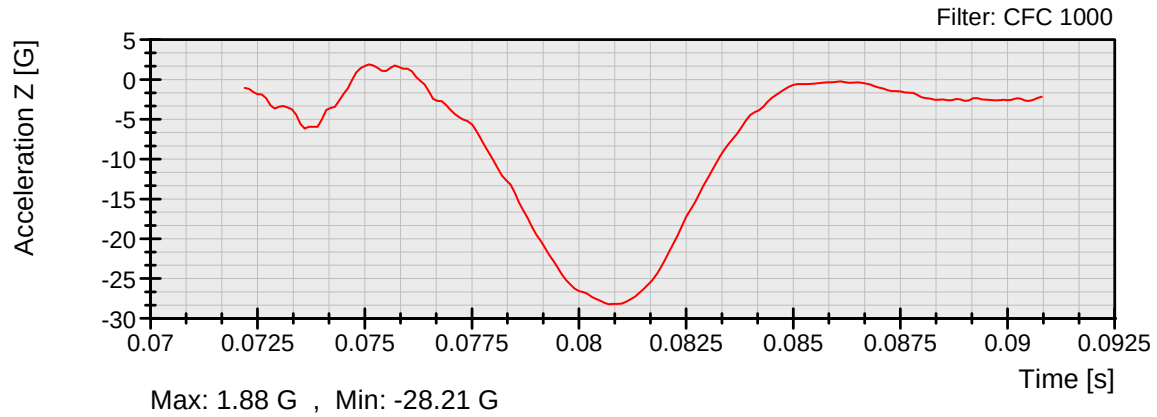
Customer: NHTSA Date: 07/14/2015



Max: -0.38 G , Min: -98.07 G



Max: 0.52 G , Min: -0.47 G



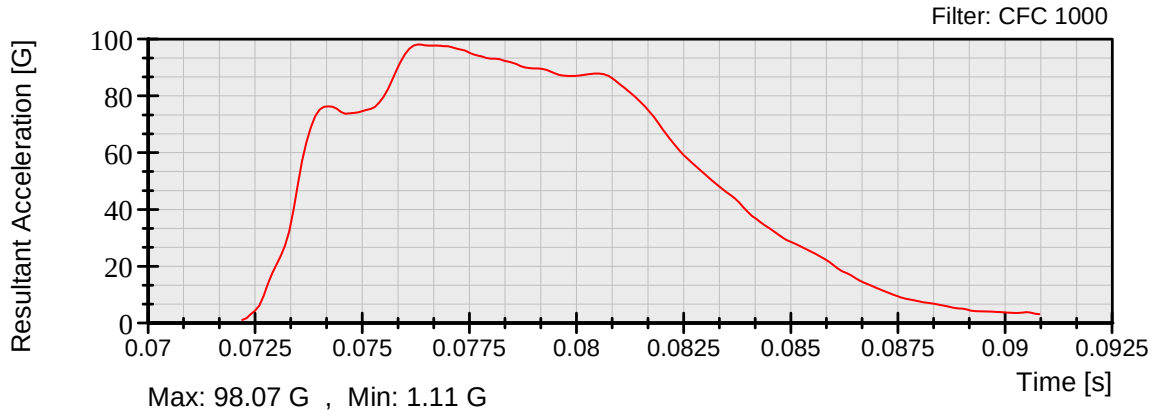
Max: 1.88 G , Min: -28.21 G

mga research corporation

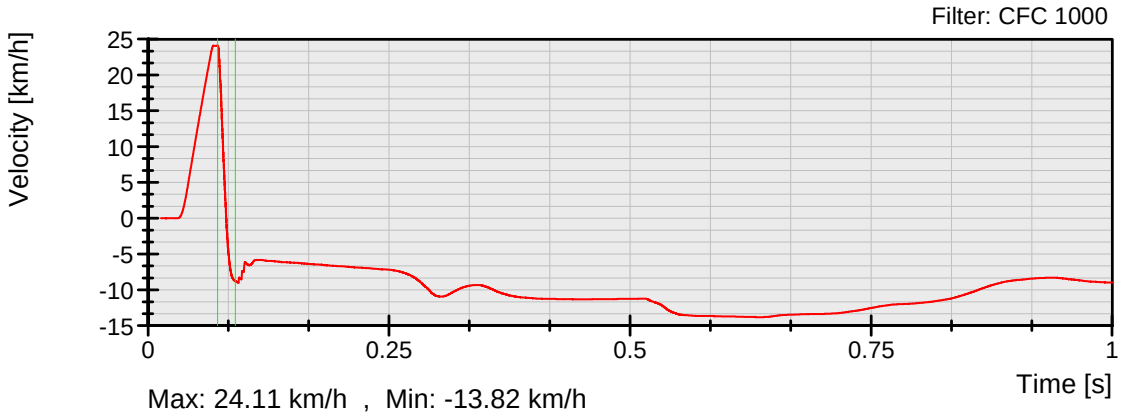
FMVSS 201U

Test No.: U15139 Report No.: G15I7-001.5

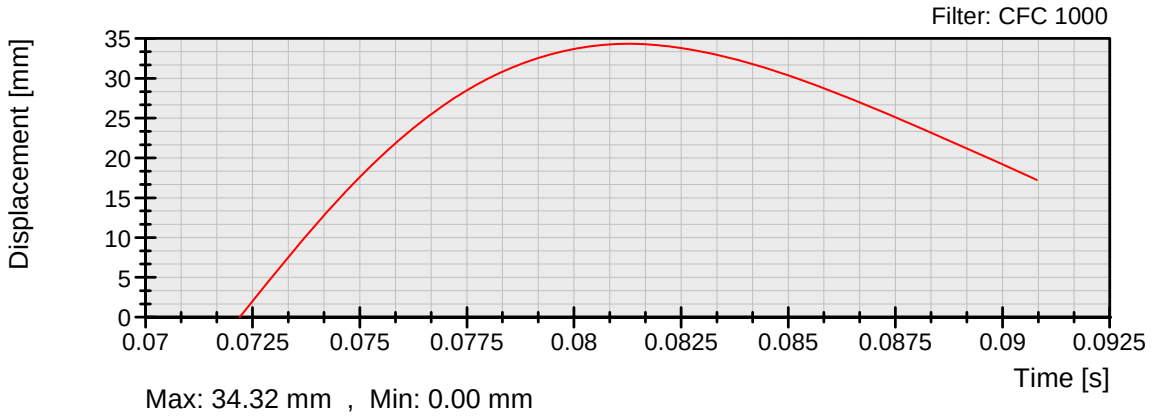
Customer: NHTSA Date: 07/14/2015



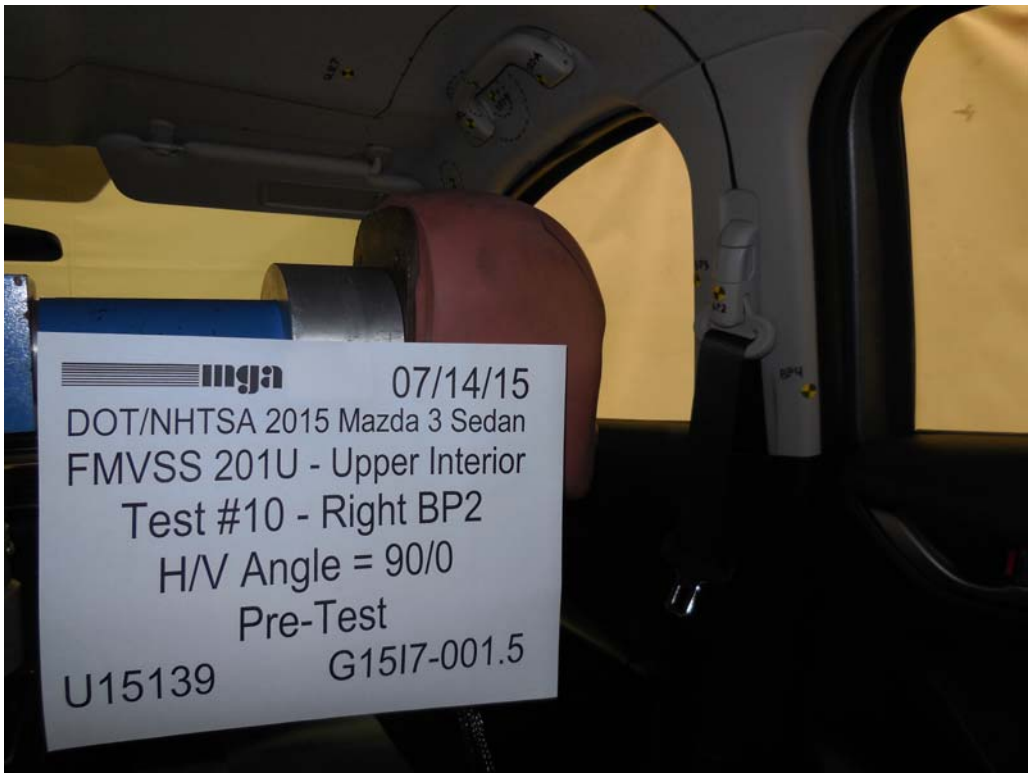
Max: 98.07 G , Min: 1.11 G



Max: 24.11 km/h , Min: -13.82 km/h



Max: 34.32 mm , Min: 0.00 mm


mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #10 - Right BP2
H/V Angle = 90/0
Pre-Test
U15139
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BP1
BP3
BP4
3R3-1
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #10 - Right BP2
H/V Angle = 90/0
Pre-Test
U15139
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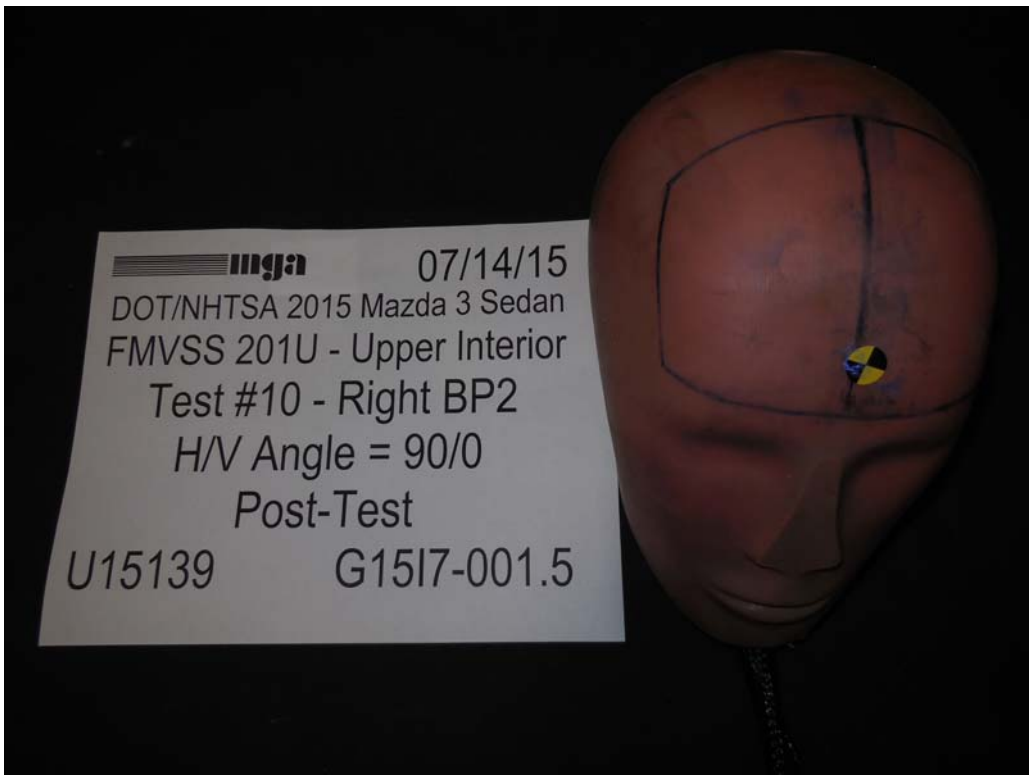
C20155401
U15139
Right BP2
H/V 90/0
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #10 - Right BP2
H/V Angle = 90/0
Post-Test
U15139
G15I7-001.5


C20155401
U15139
Right BP2
H/V 90/0
BP1
BP3
BP2
BP4
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #10 - Right BP2
H/V Angle = 90/0
Post-Test
U15139
G15I7-001.5


BP3
BP2
BP4


mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #10 - Right BP2
H/V Angle = 90/0
Post-Test
U15139
G15I7-001.5

Test U15142 Data

mga research corporation

FMVSS 201U
Test No.: U15142 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/15/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 13 Time: 8:56am

Horizontal Approach Angle: 40 deg Temperature: 21.3 °C

Vertical Approach Angle: -10 deg Humidity: 48.8 %RH

Impact Form ID No.: 37 Impact Form Mass: 4.54 kg

Target Location: Right RP2

Additional Description:

Test Results

Impact Velocity: 24.18 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	447.07	76.5	87	10.5
HIC 15	447.07	76.5	87	10.5
HIC (d)	503.7	76.5	87	10.5

3 ms Clip = 82.6 G , Time 1 = 80.83 ms , Time 2 = 83.83 ms

Impact Location on FMH: 28 mm Above Pt. 0 , 15 Left mm Lateral of Pt. 0

Post-Test Comments: Pillar trim dislodged.

Test Series Performed By: DB, KR

Recorded By: Dirk Brott Approved By: Helen A. Kalata

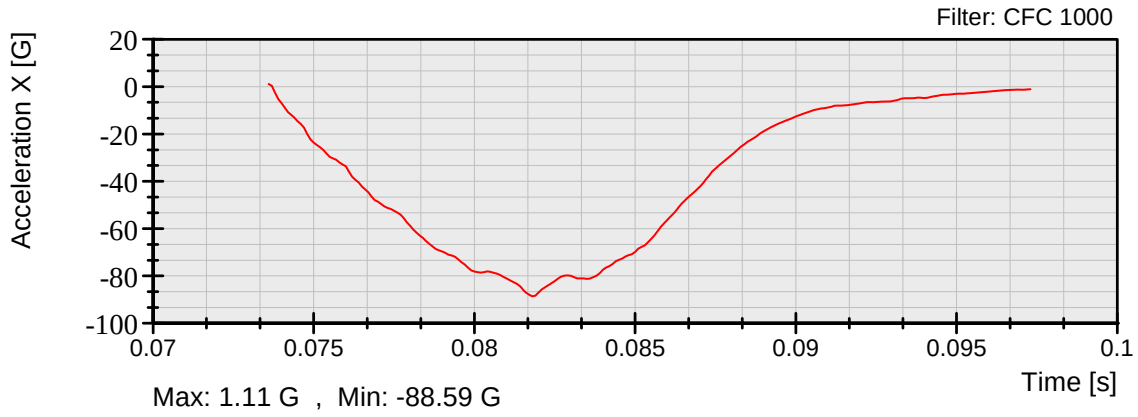
Date: July 15, 2015

mga research corporation

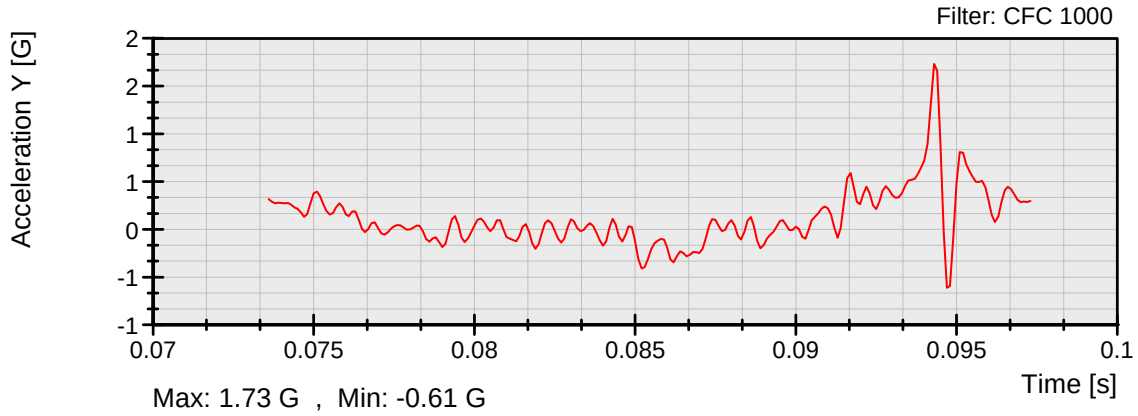
FMVSS 201U

Test No.: U15142 Report No.: G15I7-001.5

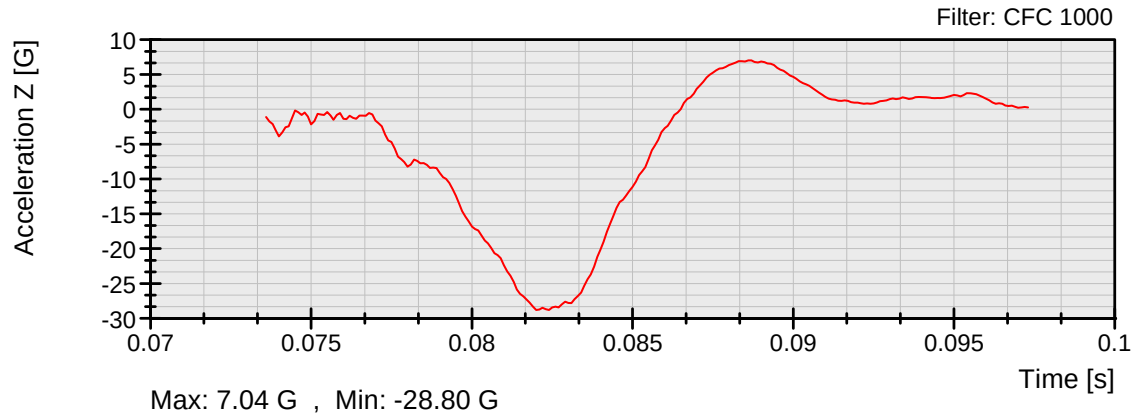
Customer: NHTSA Date: 07/15/2015



Max: 1.11 G , Min: -88.59 G



Max: 1.73 G , Min: -0.61 G



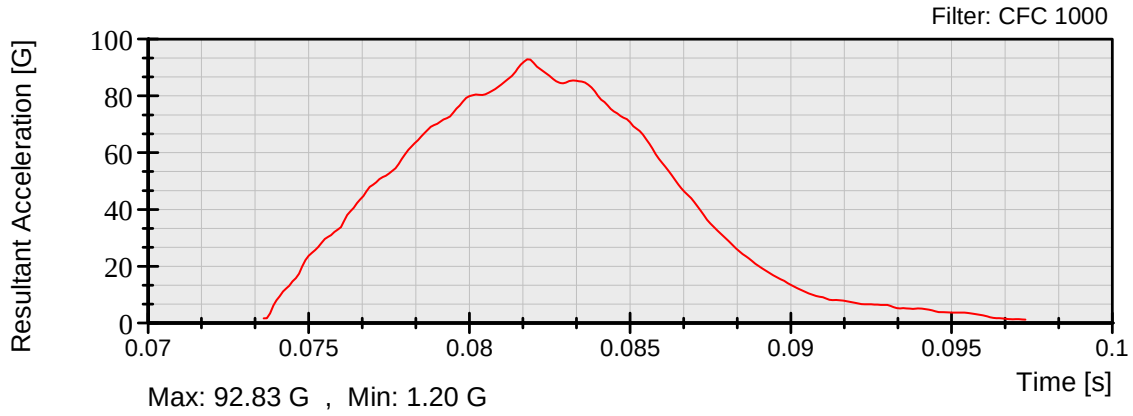
Max: 7.04 G , Min: -28.80 G

mga research corporation

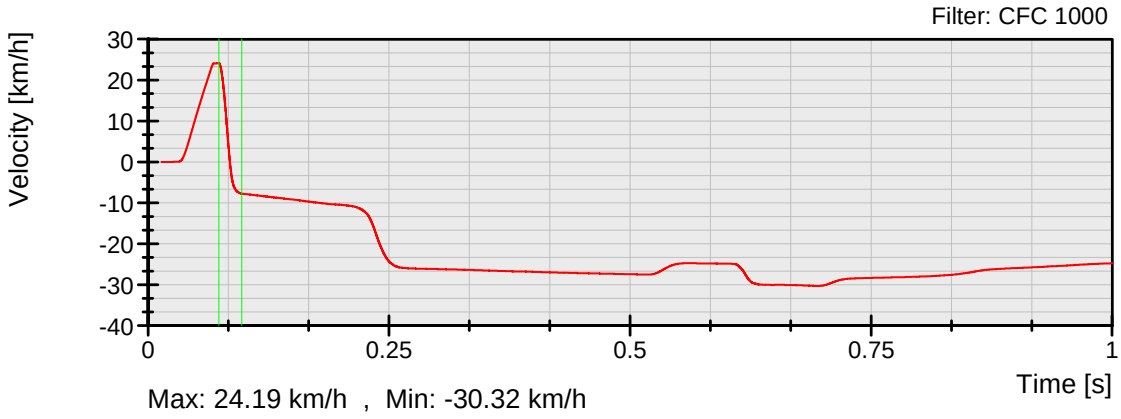
FMVSS 201U

Test No.: U15142 Report No.: G15I7-001.5

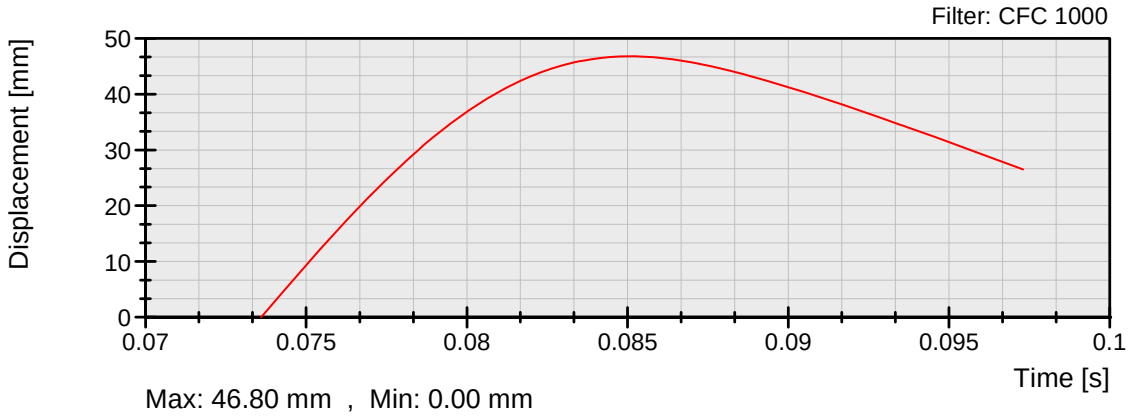
Customer: NHTSA Date: 07/15/2015



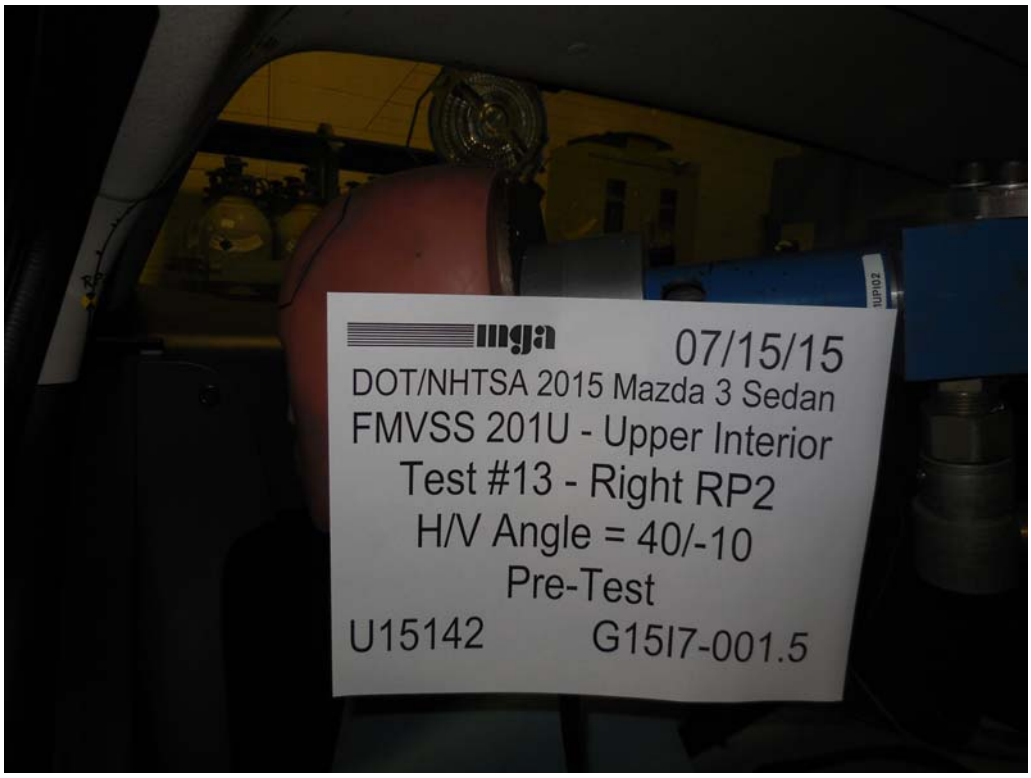
Max: 92.83 G , Min: 1.20 G



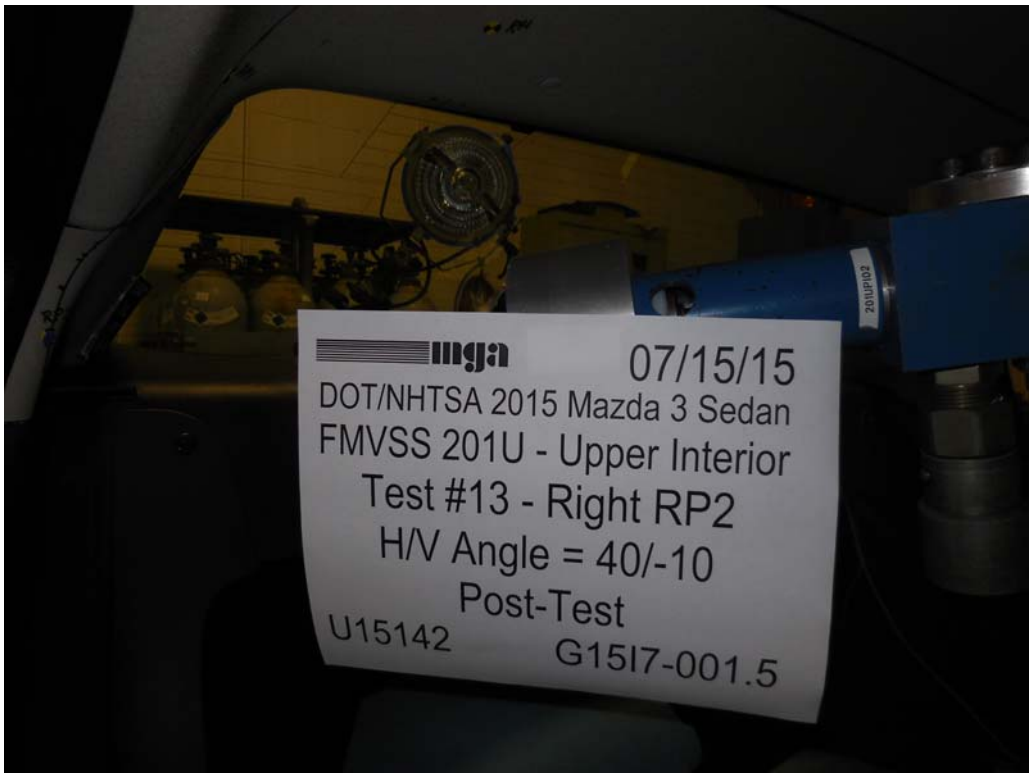
Max: 24.19 km/h , Min: -30.32 km/h



Max: 46.80 mm , Min: 0.00 mm

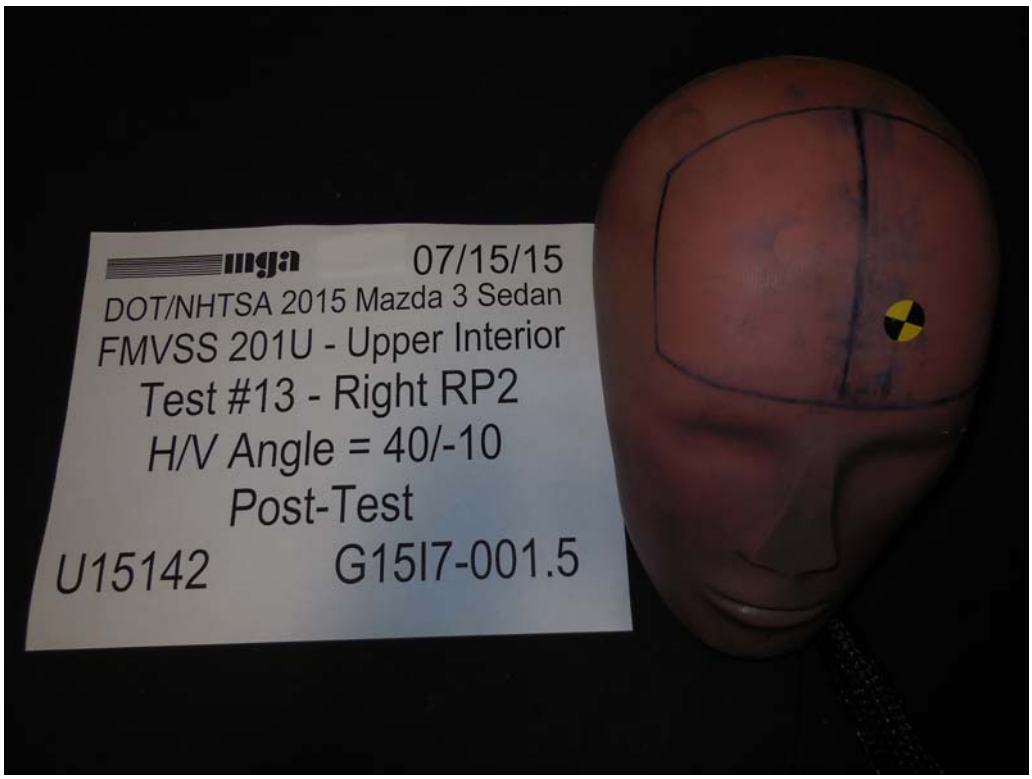

nga
07/15/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #13 - Right RP2
H/V Angle = 40/-10
Pre-Test
U15142
G15I7-001.5


C20155401
U15142
Right RP2
H/V 40/-10
nga
07/15/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #13 - Right RP2
H/V Angle = 40/-10
Pre-Test
G15I7-001.5
U15142


mga
07/15/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #13 - Right RP2
H/V Angle = 40/-10
Post-Test
U15142
G15I7-001.5


mga
07/15/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #13 - Right RP2
H/V Angle = 40/-10
Post-Test
G15I7-001.5
U15142


RP2


mga
07/15/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #13 - Right RP2
H/V Angle = 40/-10
Post-Test
U15142
G15I7-001.5

Test U15138 Data

mga research corporation

FMVSS 201U
Test No.: U15138 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/14/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 9 Time: 12:30pm

Horizontal Approach Angle: 90 deg Temperature: 21.5 °C

Vertical Approach Angle: 40 deg Humidity: 50.6 %RH

Impact Form ID No.: 35 Impact Form Mass: 4.51 kg

Target Location: Right SR2B

Additional Description:

Test Results

Impact Velocity: 18.89 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	295.53	84.7	95	10.3
HIC 15	295.53	84.7	95	10.3
HIC (d)	389.36	84.7	95	10.3

3 ms Clip = 69.11 G , Time 1 = 90.6 ms , Time 2 = 93.6 ms

Impact Location on FMH: 12 mm Above Pt. 0 , 1 Left mm Lateral of Pt. 0

Post-Test Comments: Grab handle pushed in; Headliner deformation.

Test Series Performed By: DB, KR

Page 1 of 3

Recorded By: [signature] Approved By: [signature]

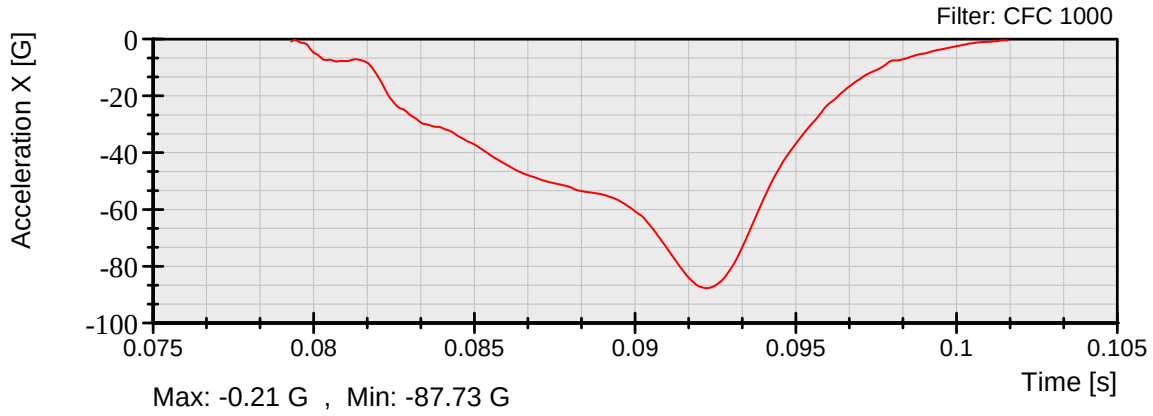
Date: July 13, 2015

mga research corporation

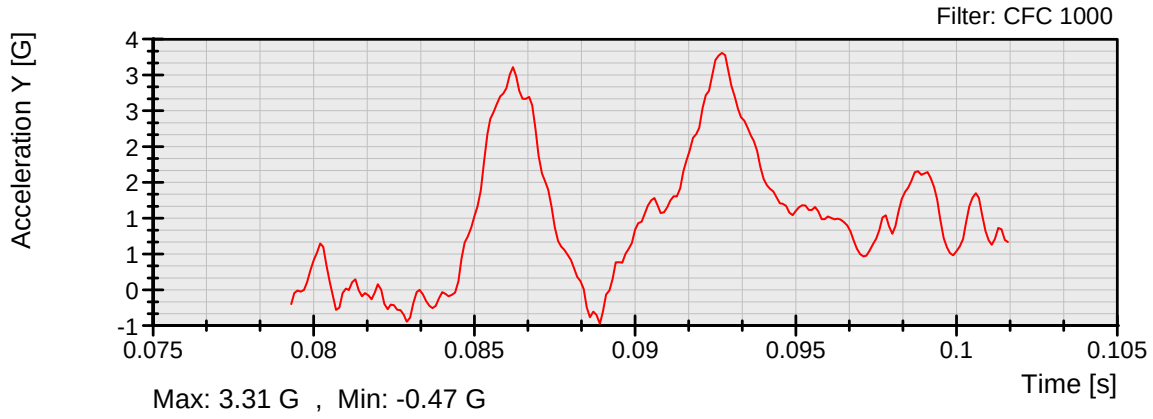
FMVSS 201U

Test No.: U15138 Report No.: G15I7-001.5

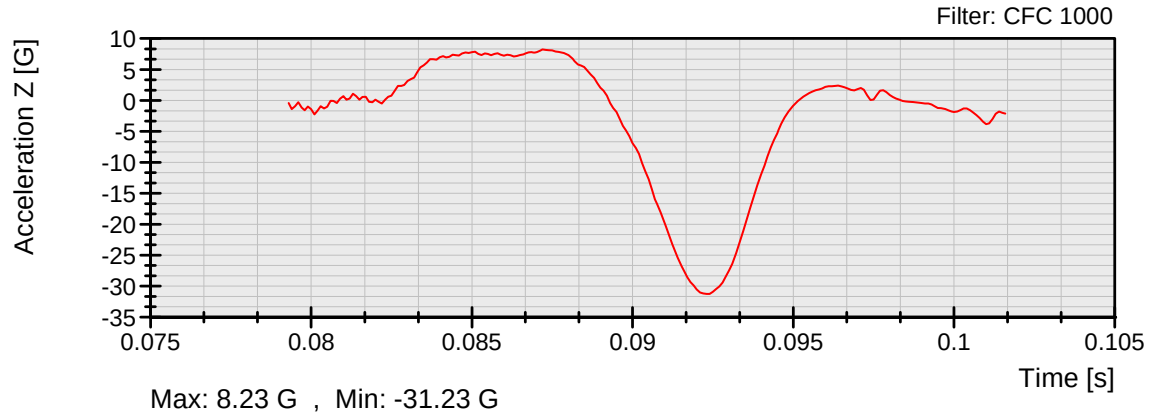
Customer: NHTSA Date: 07/14/2015



Max: -0.21 G , Min: -87.73 G



Max: 3.31 G , Min: -0.47 G



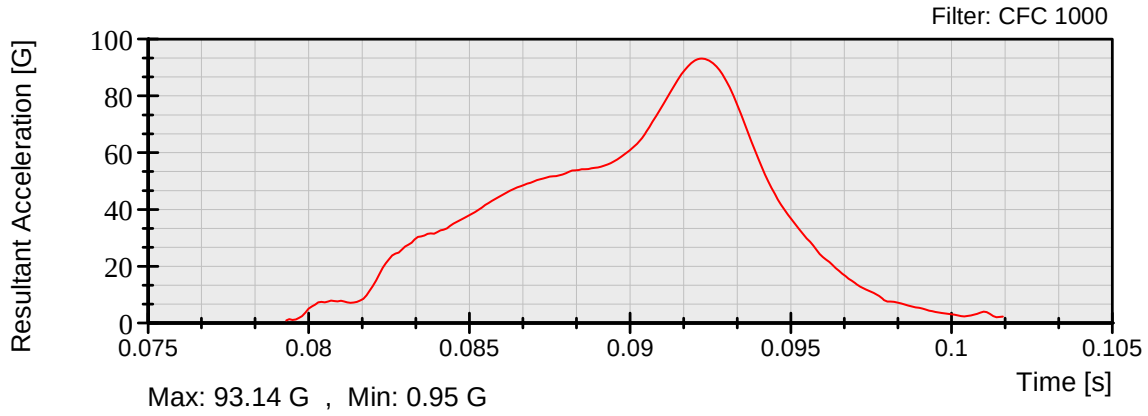
Max: 8.23 G , Min: -31.23 G

mga research corporation

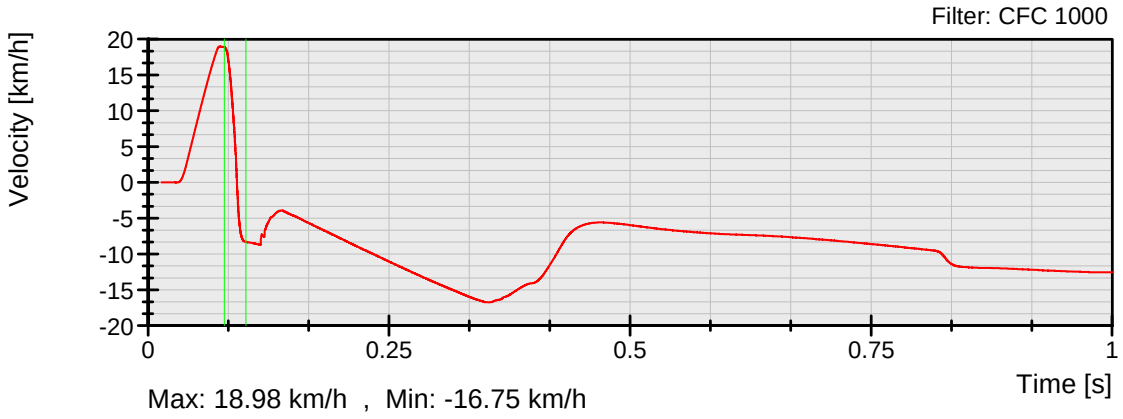
FMVSS 201U

Test No.: U15138 Report No.: G15I7-001.5

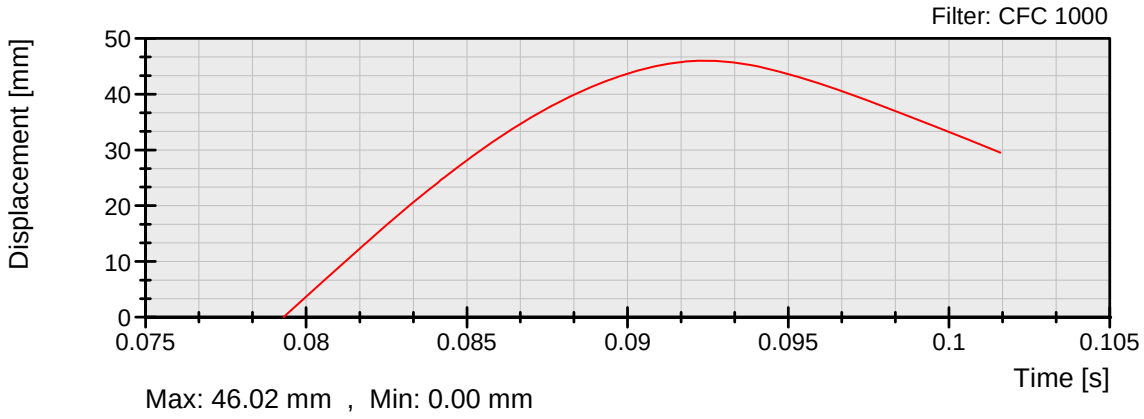
Customer: NHTSA Date: 07/14/2015



Max: 93.14 G , Min: 0.95 G



Max: 18.98 km/h , Min: -16.75 km/h



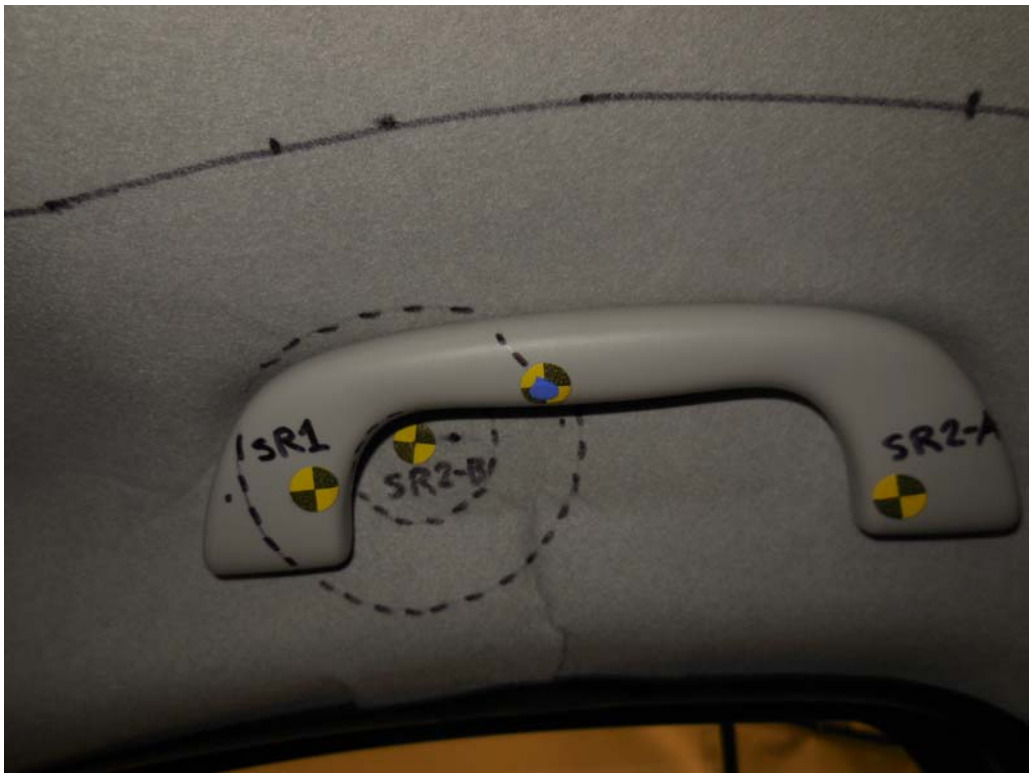
Max: 46.02 mm , Min: 0.00 mm

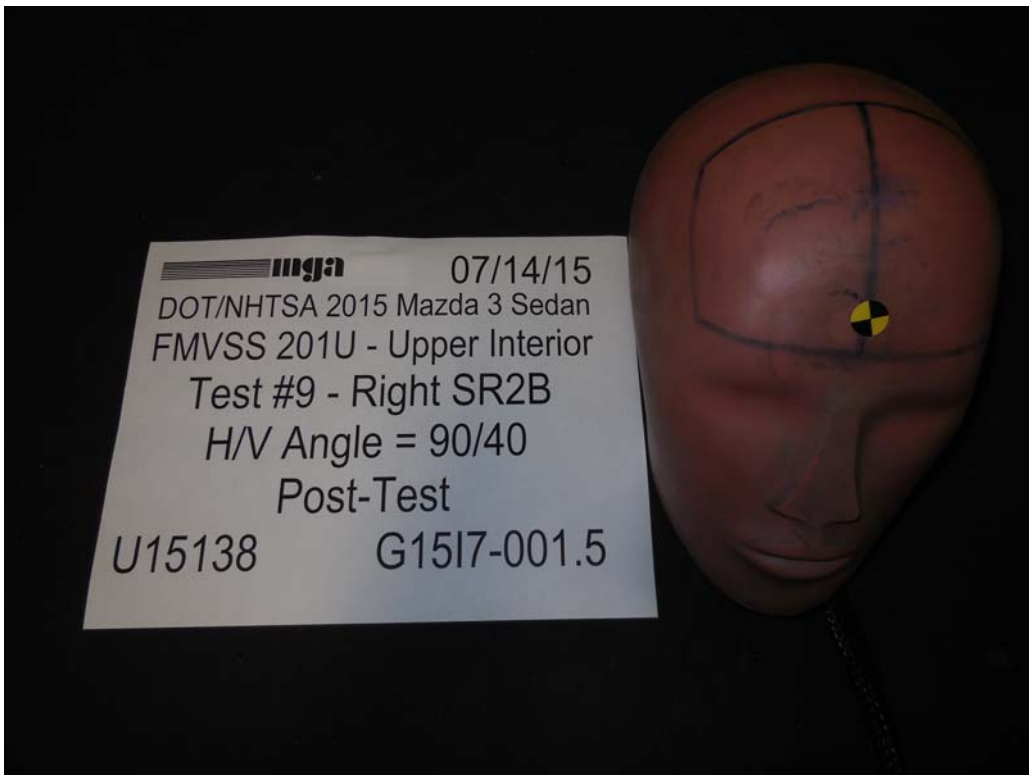

mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #9 - Right SR2B
H/V Angle = 90/40
Pre-Test
U15138
G15I7-001.5


mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #9 - Right SR2B
H/V Angle = 90/40
Pre-Test
U15138
G15I7-001.5


C20155401
U15138
Right SR2B
H/V 90/40
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #9 - Right SR2B
H/V Angle = 90/40
Post-Test
U15138
G15I7-001.5


UR8
UR7
UR9
SR2-A
BP1
AP1
C20155401
U15138
Right SR2B
H/V 90/40
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #9 - Right SR2B
H/V Angle = 90/40
Post-Test
U15138
G15I7-001.5


SR1
SR2-B
SR2-A


mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #9 - Right SR2B
H/V Angle = 90/40
Post-Test
U15138
G15I7-001.5

Test U15135 Data

mga research corporation

FMVSS 201U
Test No.: U15135 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/13/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 6 Time: 5:17pm

Horizontal Approach Angle: 0 deg Temperature: 23.7 °C

Vertical Approach Angle: 50 deg Humidity: 47.9 %RH

Impact Form ID No.: 38 Impact Form Mass: 4.51 kg

Target Location: Left RH

Additional Description:

Test Results

Impact Velocity: 24.03 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	272.35	77.1	91.5	14.4
HIC 15	272.35	77.1	91.5	14.4
HIC (d)	371.88	77.1	91.5	14.4

3 ms Clip = 64.02 G , Time 1 = 78.62 ms , Time 2 = 81.62 ms

Impact Location on FMH: 24 mm Above Pt. 0 , 8 Right mm Lateral of Pt. 0

Post-Test Comments: Headliner deformation.

Test Series Performed By: DB, KR

Recorded By: Dan Brott Approved By: Helen A. Kaleto

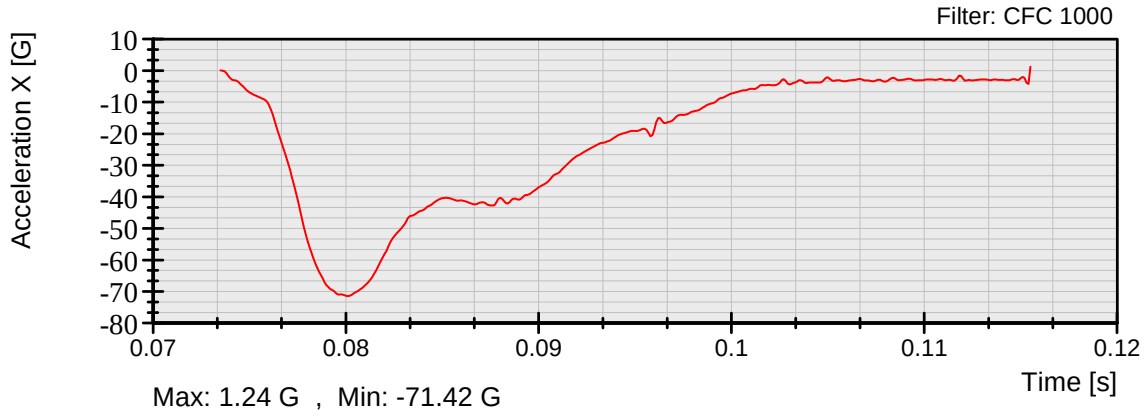
Date: July 13, 2015

mga research corporation

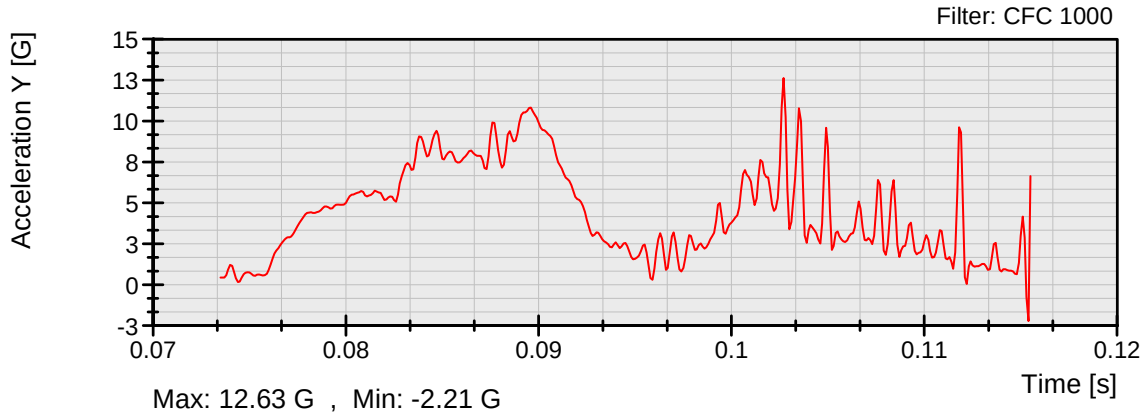
FMVSS 201U

Test No.: U15135 Report No.: G15I7-001.5

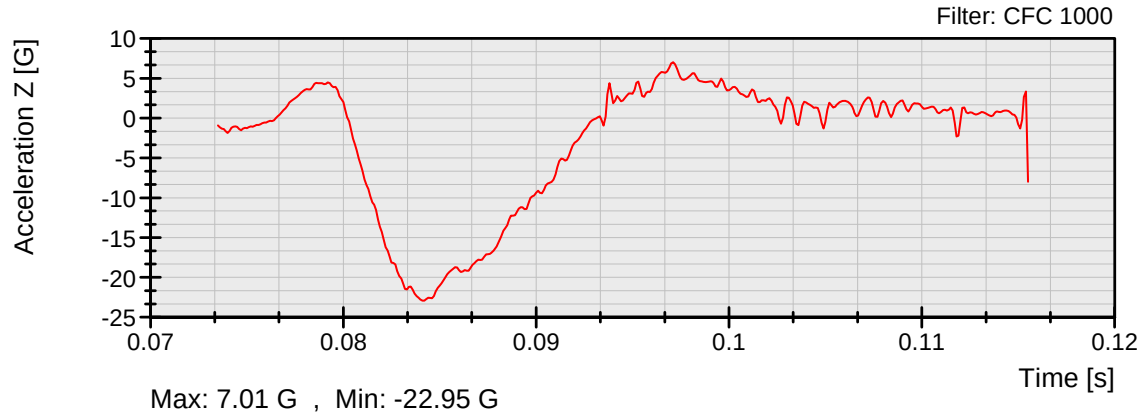
Customer: NHTSA Date: 07/13/2015



Max: 1.24 G , Min: -71.42 G



Max: 12.63 G , Min: -2.21 G



Max: 7.01 G , Min: -22.95 G

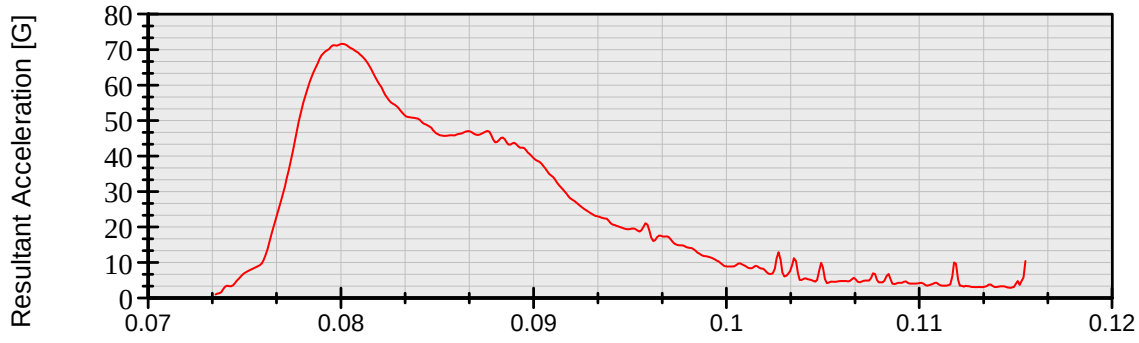
mga research corporation

FMVSS 201U

Test No.: U15135 Report No.: G15I7-001.5

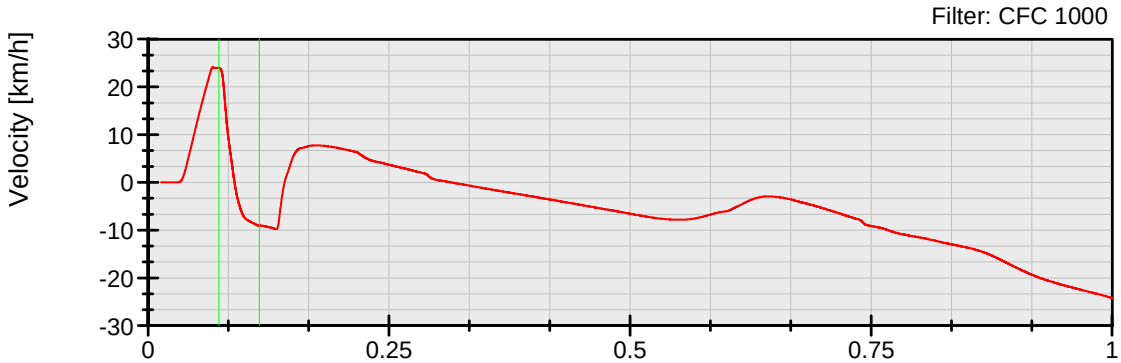
Customer: NHTSA Date: 07/13/2015

Filter: CFC 1000



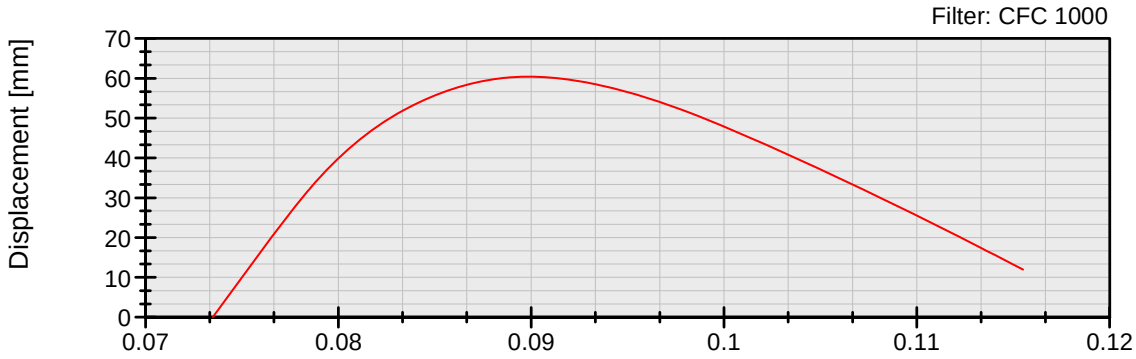
Max: 71.62 G , Min: 1.02 G

Filter: CFC 1000



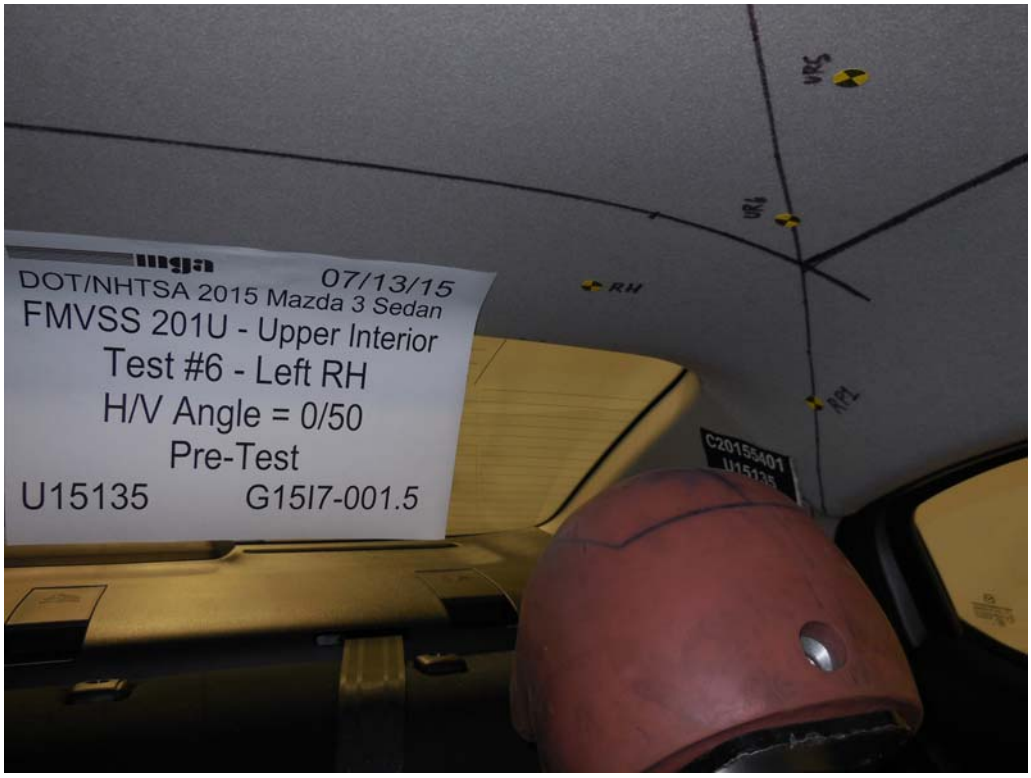
Max: 24.14 km/h , Min: -24.19 km/h

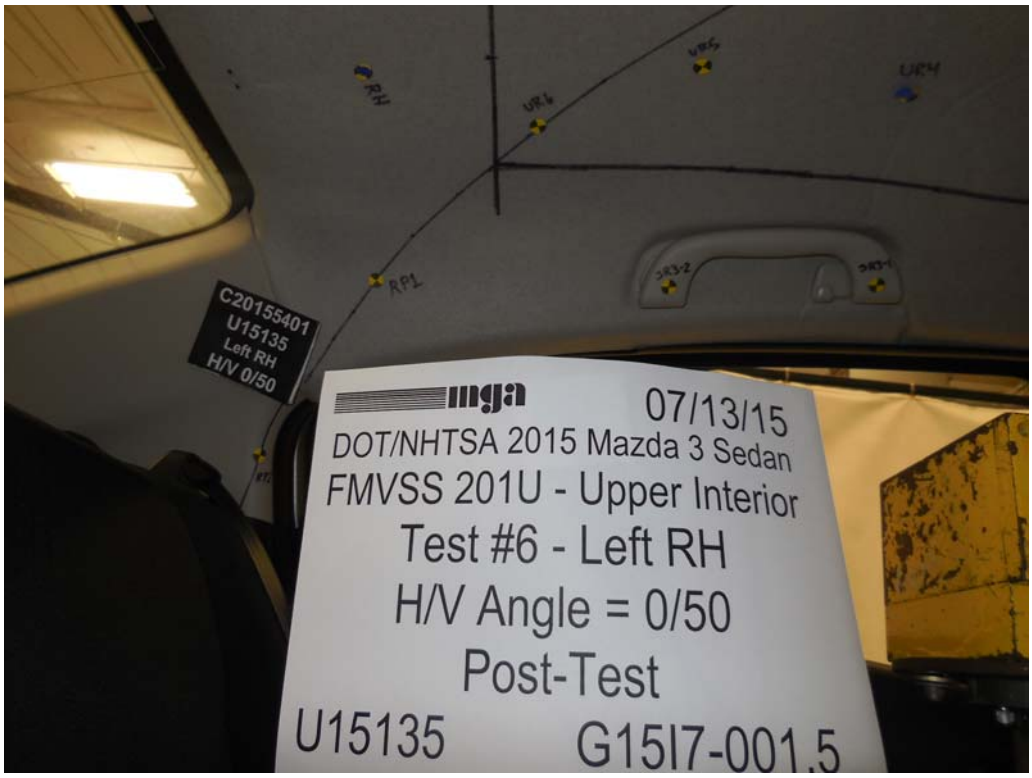
Filter: CFC 1000

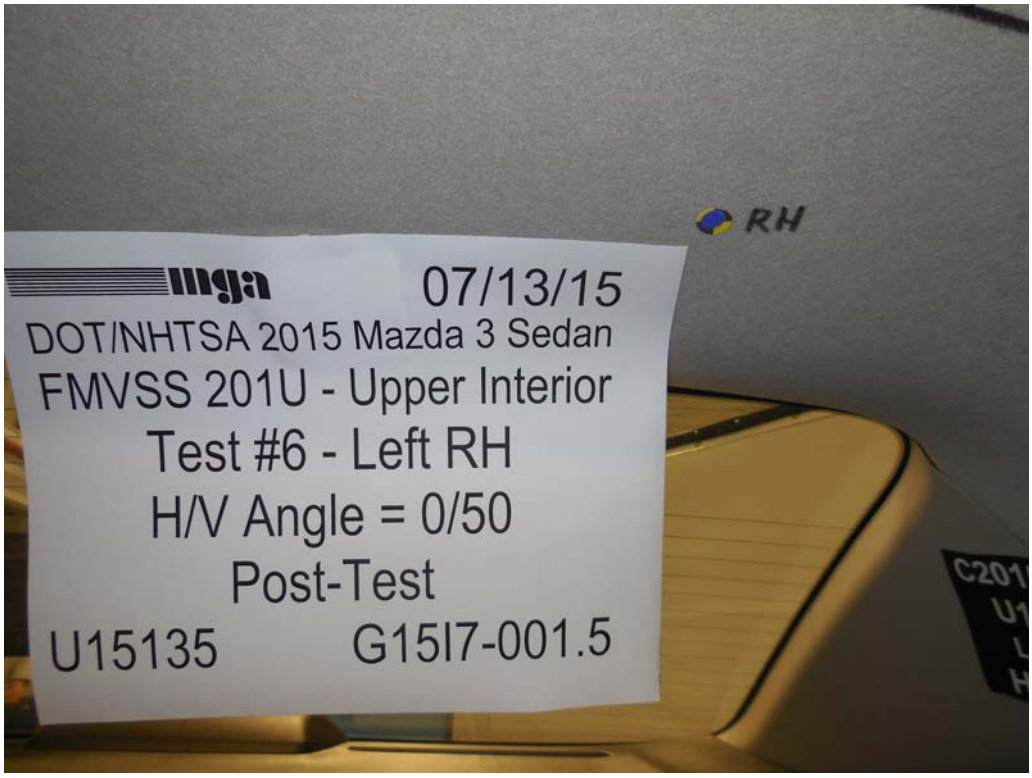


Max: 60.41 mm , Min: 0.00 mm

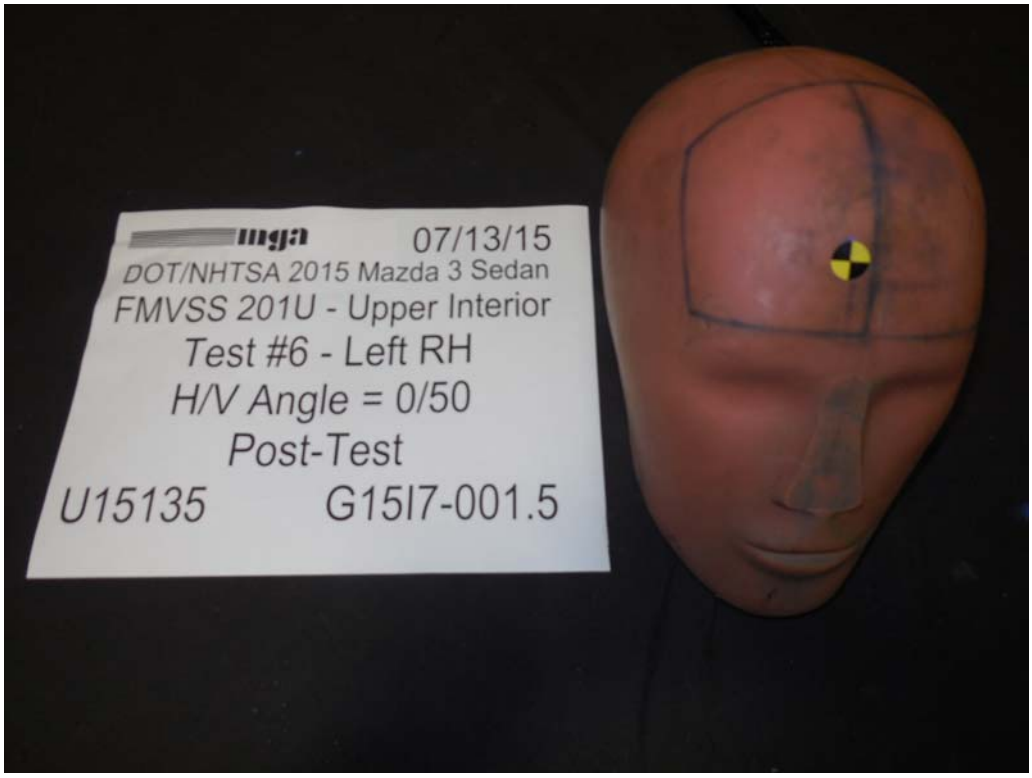

C20155401
U15135
Left RH
H/V 0/50
mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #6 - Left RH
H/V Angle = 0/50
Pre-Test
U15135
G15I7-001.5


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #6 - Left RH
H/V Angle = 0/50
Pre-Test
U15135
G15I7-001.5


C20155401
U15135
Left RH
H/V 0/50
mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #6 - Left RH
H/V Angle = 0/50
Post-Test
U15135
G15I7-001.5


RH
mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #6 - Left RH
H/V Angle = 0/50
Post-Test
U15135
G15I7-001.5


RH


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #6 - Left RH
H/V Angle = 0/50
Post-Test
U15135
G15I7-001.5

Test U15131 Data

mga research corporation

FMVSS 201U
Test No.: U15131 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/13/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 2 Time: 11:18am

Horizontal Approach Angle: 270 deg Temperature: 21.5 °C

Vertical Approach Angle: 50 deg Humidity: 47.5 %RH

Impact Form ID No.: 37 Impact Form Mass: 4.54 kg

Target Location: UR1 @ SR1 Left

Additional Description:

Test Results

Impact Velocity: 24.1 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	358.44	78.3	90.6	12.3
HIC 15	358.44	78.3	90.6	12.3
HIC (d)	436.83	78.3	90.6	12.3

3 ms Clip = 64.2 G , Time 1 = 79.7 ms , Time 2 = 82.7 ms

Impact Location on FMH: 48 mm Above Pt. 0 , 20 Right mm Lateral of Pt. 0

Post-Test Comments: Grab handle pushed in; Headliner deformation

Test Series Performed By: DB, KR

Recorded By: _____ Approved By: _____

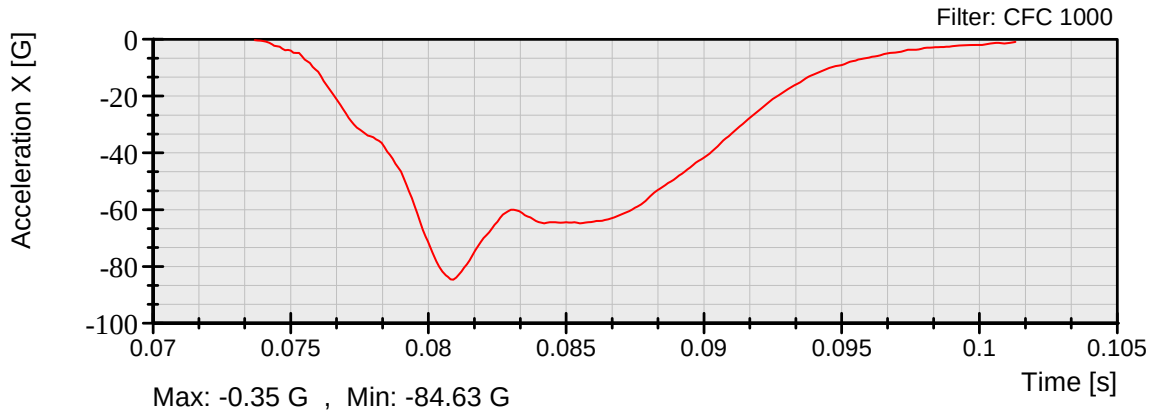
Date: July 13, 2015

mga research corporation

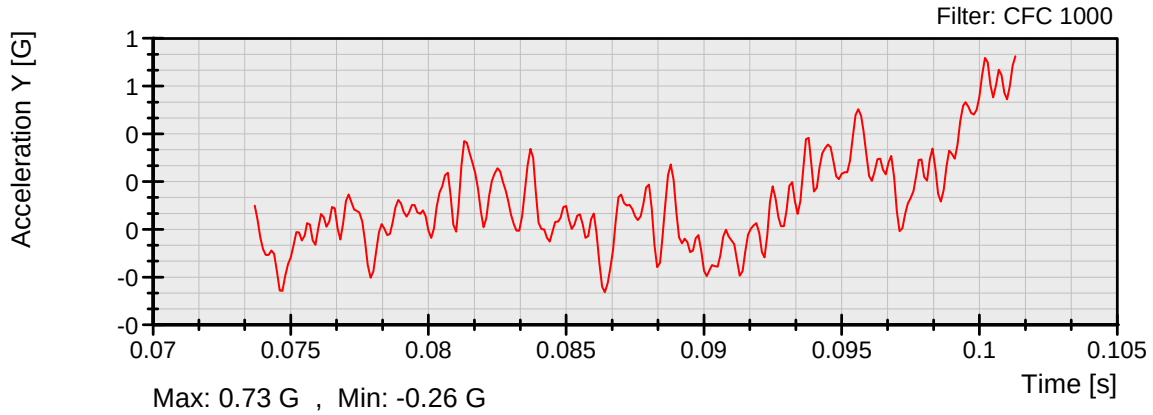
FMVSS 201U

Test No.: U15131 Report No.: G15I7-001.5

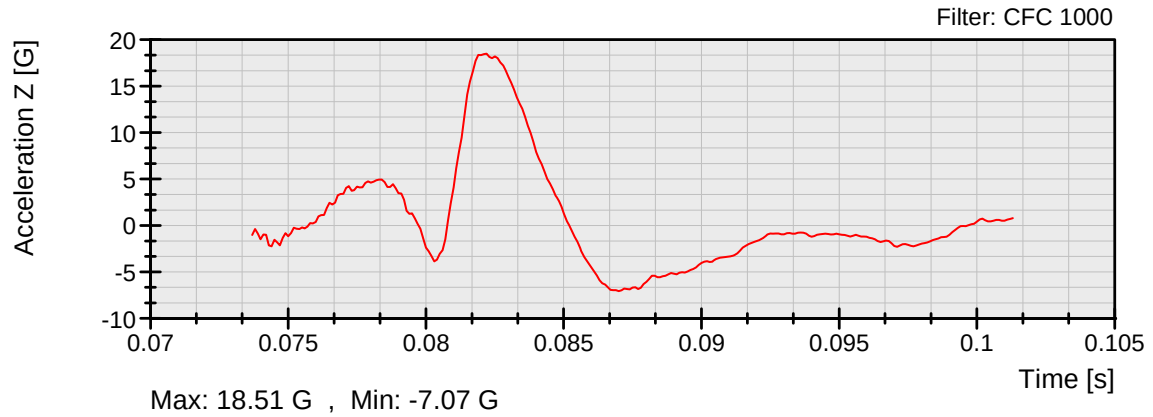
Customer: NHTSA Date: 07/13/2015



Max: -0.35 G , Min: -84.63 G

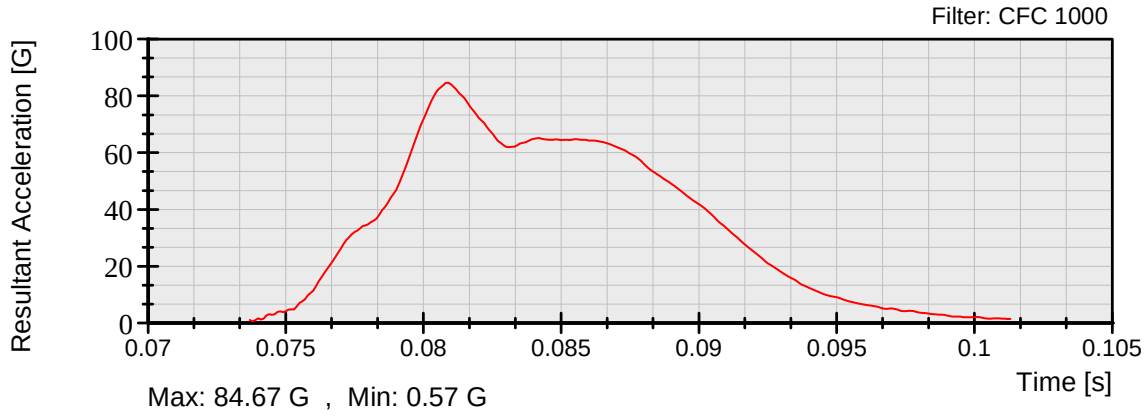


Max: 0.73 G , Min: -0.26 G

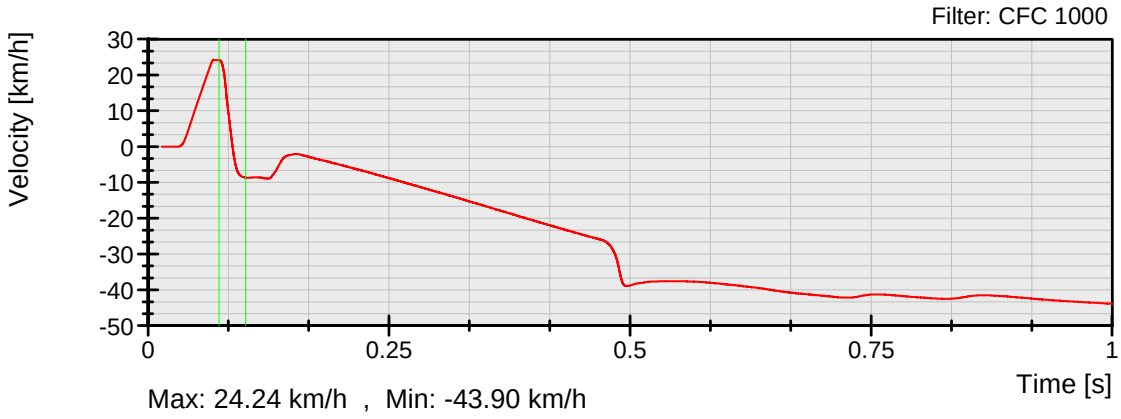


Max: 18.51 G , Min: -7.07 G

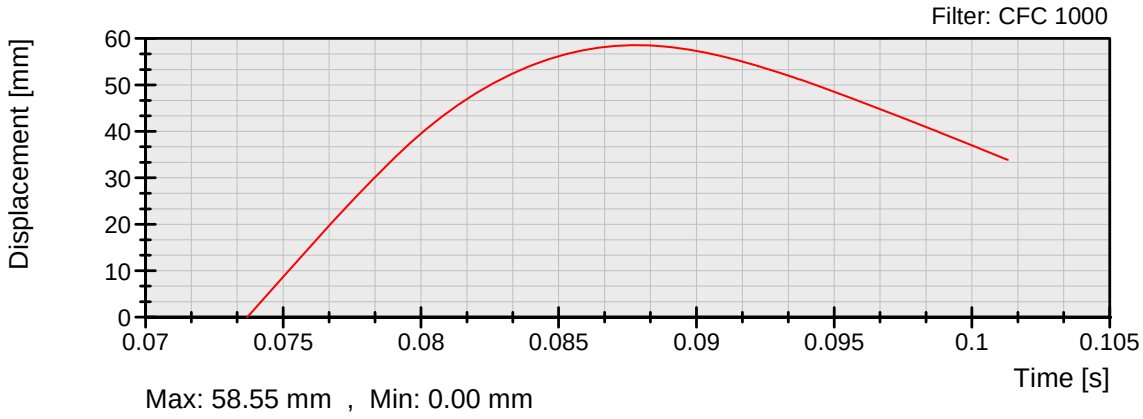
FMVSS 201U
Test No.: U15131
Customer: NHTSA
Report No.: G15I7-001.5
Date: 07/13/2015



Max: 84.67 G , Min: 0.57 G



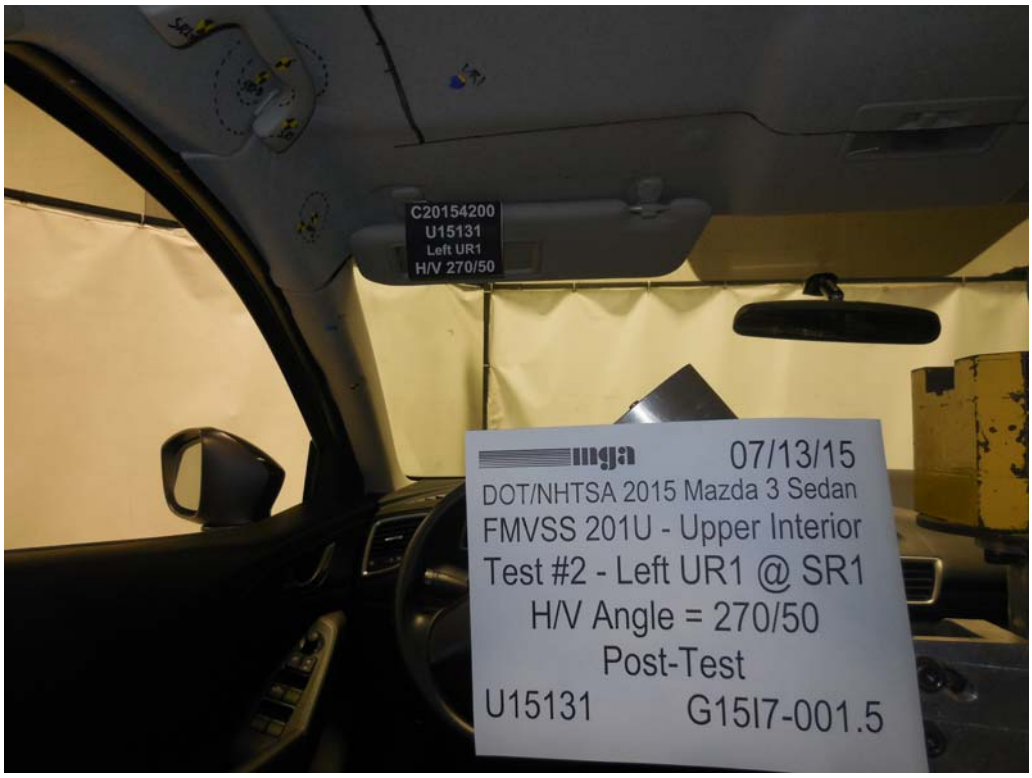
Max: 24.24 km/h , Min: -43.90 km/h



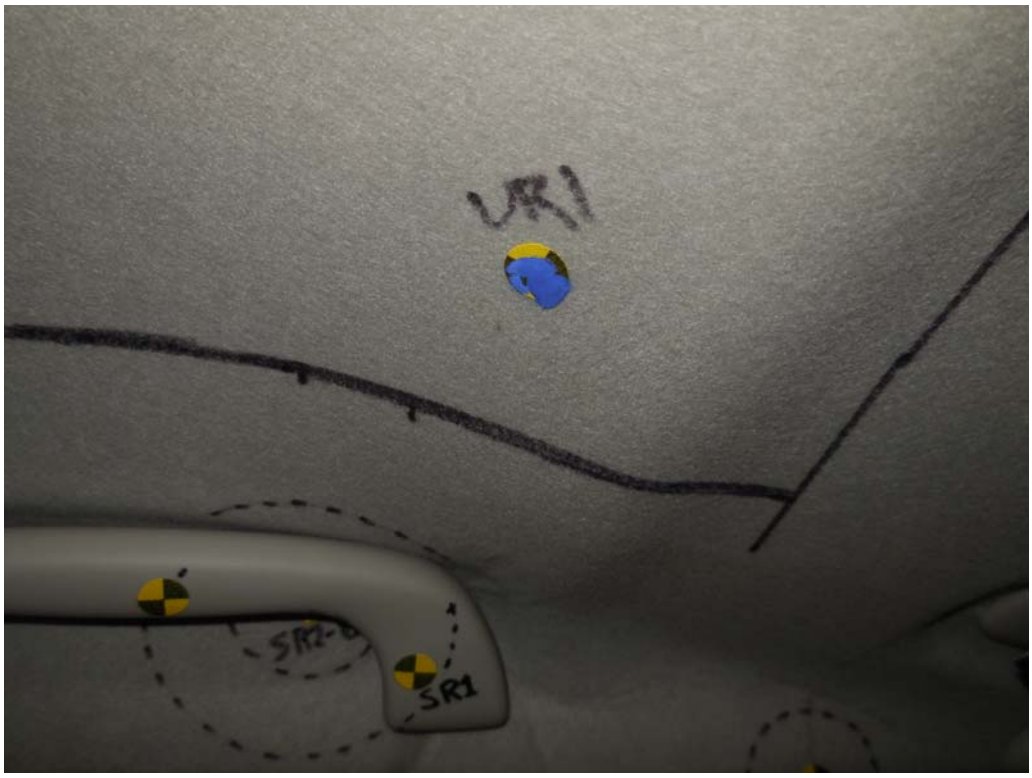
Max: 58.55 mm , Min: 0.00 mm

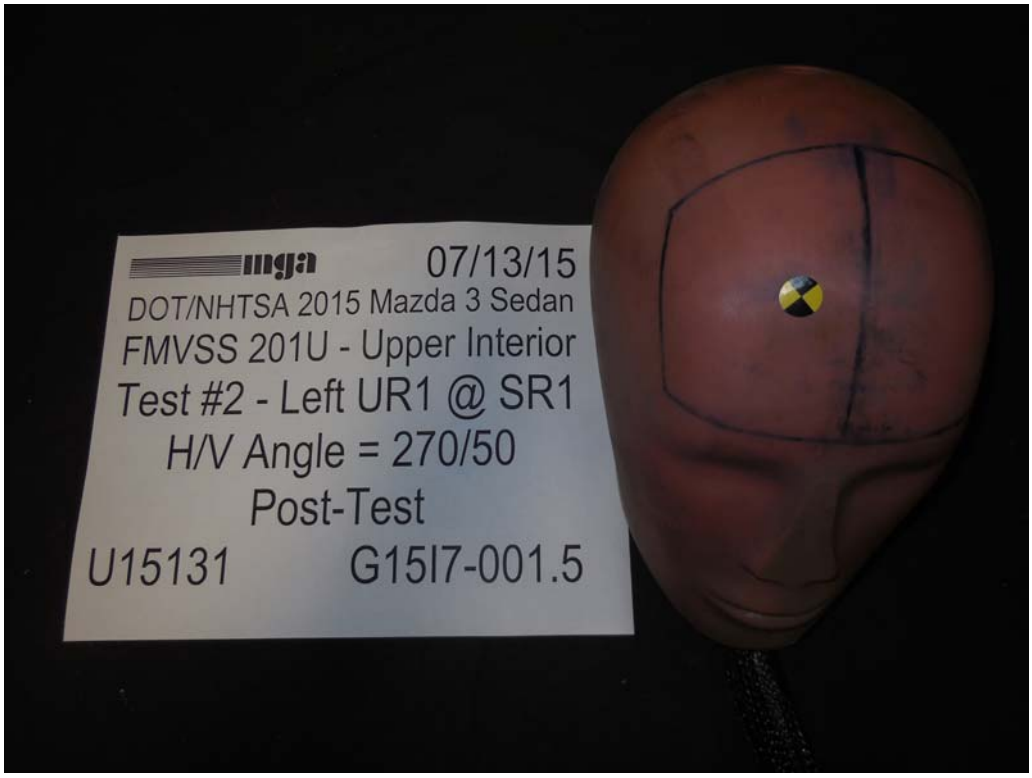

mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #2 - Left UR1 @ SR1
H/V Angle = 270/50
Pre-Test
U15131
G15I7-001.5


UR2
UR1
UR1
BP1
SR2A
SR1
mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #2 - Left UR1 @ SR1
H/V Angle = 270/50
Pre-Test
U15131
G15I7-001.5


C20154200
U15131
Left UR1
H/V 270/50
mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #2 - Left UR1 @ SR1
H/V Angle = 270/50
Post-Test
U15131
G15I7-001.5


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #2 - Left UR1 @ SR1
H/V Angle = 270/50
Post-Test
U15131
G15I7-001.5
C20154200
U15131
Left UR1
H/V 270/50


UR1
SR2
SR1


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #2 - Left UR1 @ SR1
H/V Angle = 270/50
Post-Test
U15131
G15I7-001.5

Test U15132 Data

mga research corporation

FMVSS 201U
Test No.: U15132 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/13/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 3 Time: 12:06pm

Horizontal Approach Angle: 270 deg Temperature: 21.5 °C

Vertical Approach Angle: 50 deg Humidity: 47.2 %RH

Impact Form ID No.: 38 Impact Form Mass: 4.51 kg

Target Location: UR3 @ BP Left

Additional Description:

Test Results

Impact Velocity: 24.15 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	639.48	78.2	86.4	8.2
HIC 15	639.48	78.2	86.4	8.2
HIC (d)	648.86	78.2	86.4	8.2

3 ms Clip = 98.4 G , Time 1 = 81.99 ms , Time 2 = 84.99 ms

Impact Location on FMH: 40 mm Above Pt. 0 , 2 Right mm Lateral of Pt. 0

Post-Test Comments: Headliner deformation.

Test Series Performed By: DB, KR

Recorded By: _____ Approved By: _____

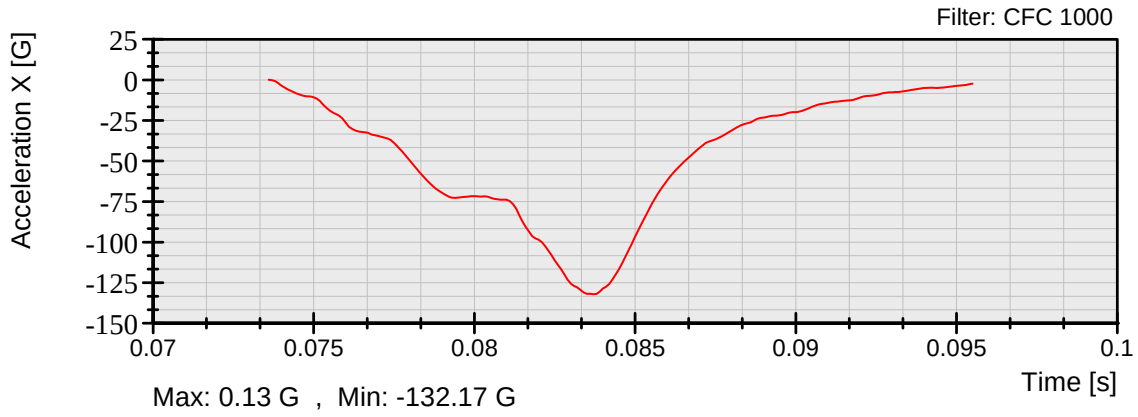
Date: July 13, 2015

mga research corporation

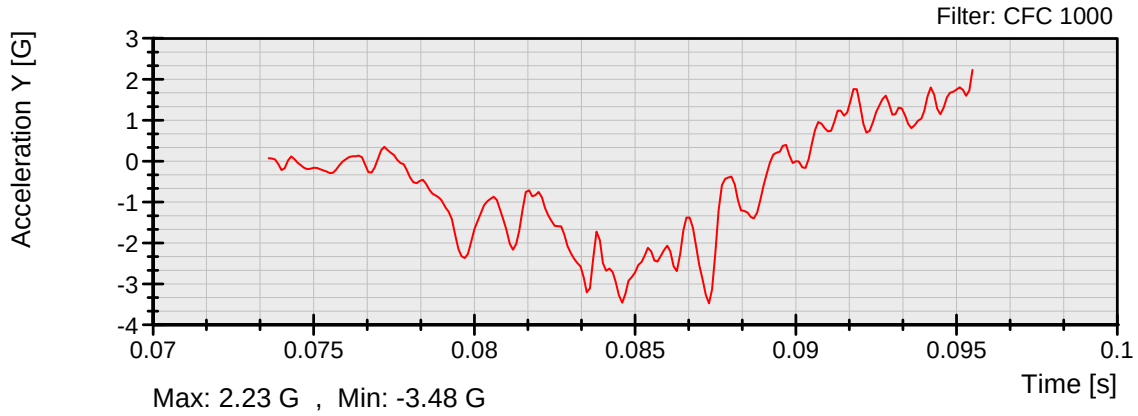
FMVSS 201U

Test No.: U15132 Report No.: G15I7-001.5

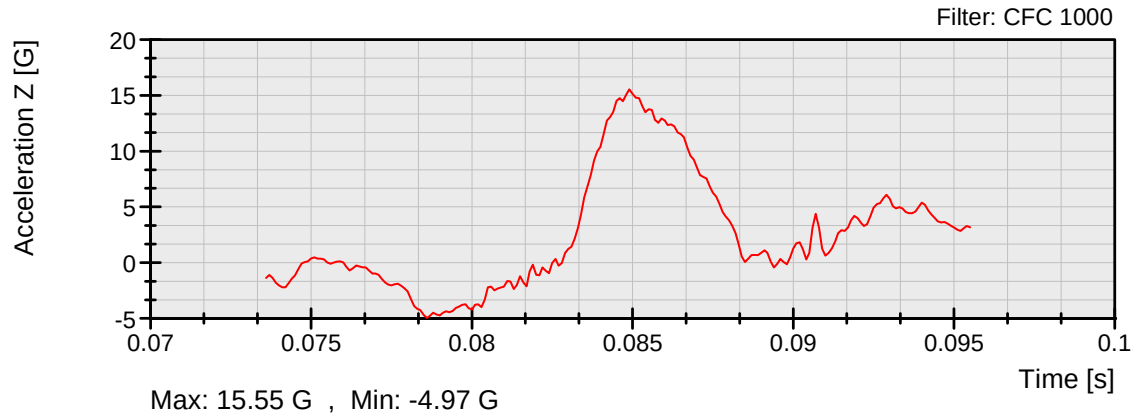
Customer: NHTSA Date: 07/13/2015



Max: 0.13 G , Min: -132.17 G



Max: 2.23 G , Min: -3.48 G



Max: 15.55 G , Min: -4.97 G

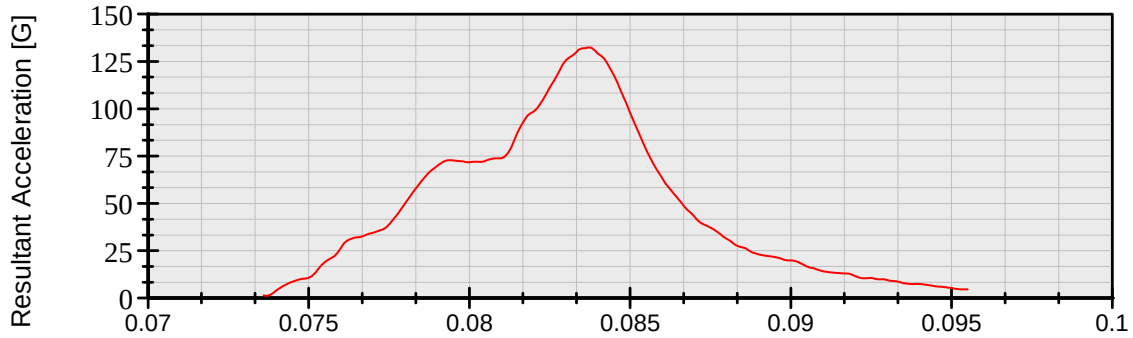
mga research corporation

FMVSS 201U

Test No.: U15132 Report No.: G15I7-001.5

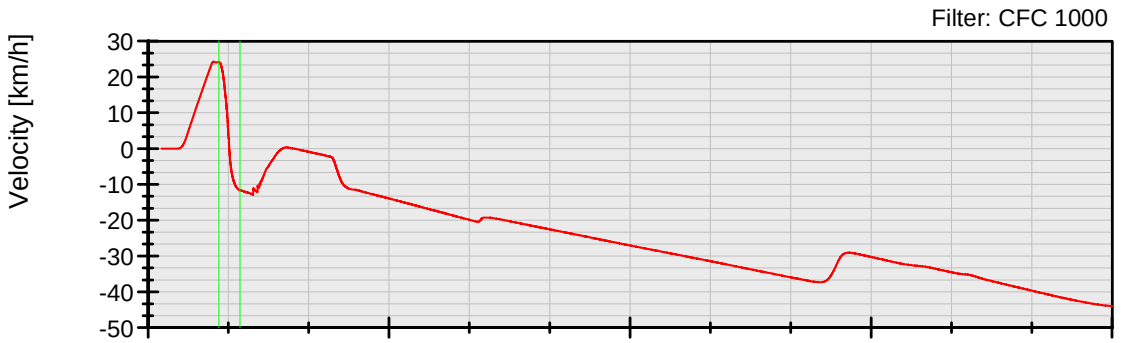
Customer: NHTSA Date: 07/13/2015

Filter: CFC 1000



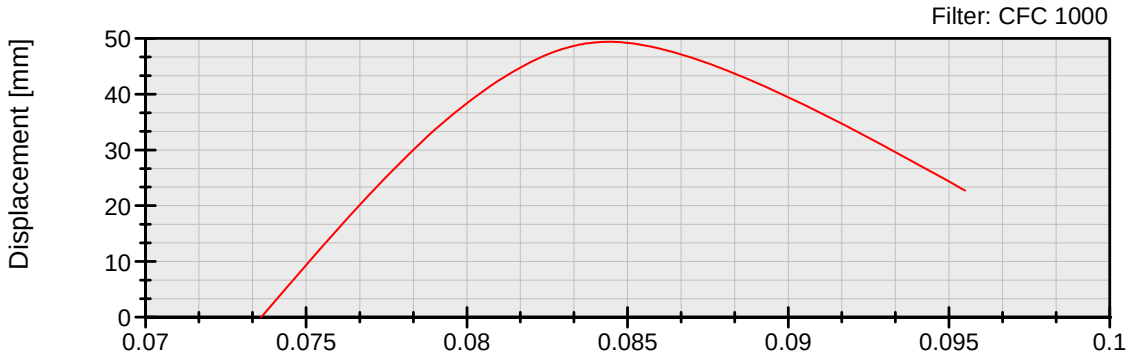
Max: 132.42 G , Min: 1.13 G

Filter: CFC 1000



Max: 24.25 km/h , Min: -43.91 km/h

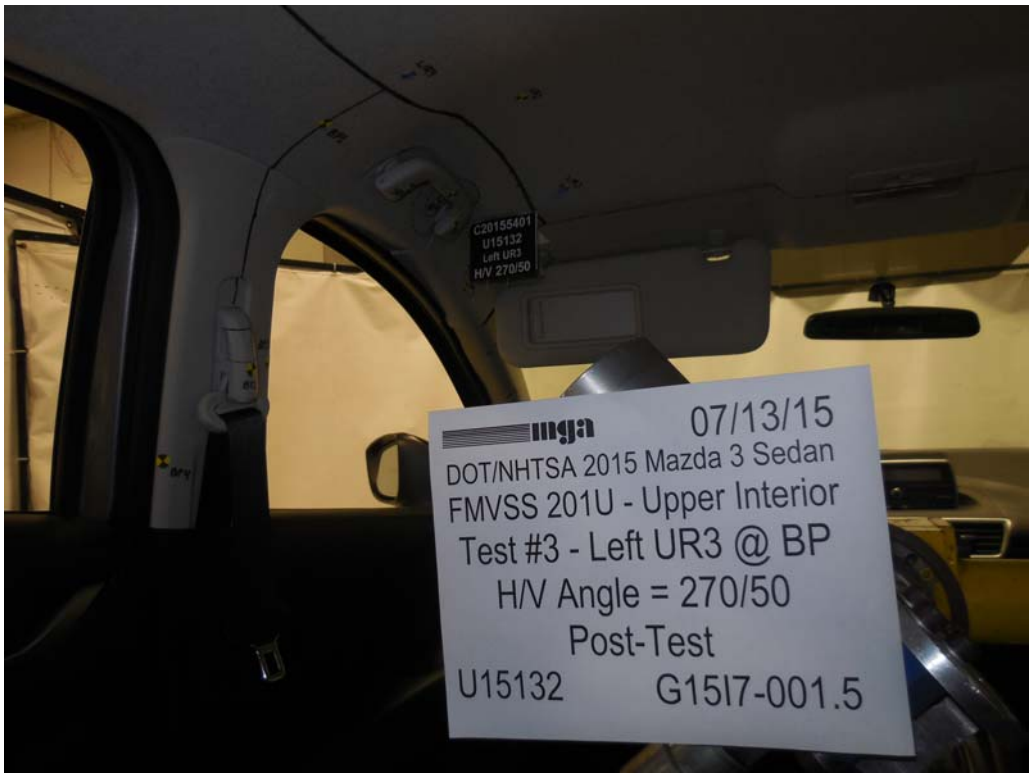
Filter: CFC 1000



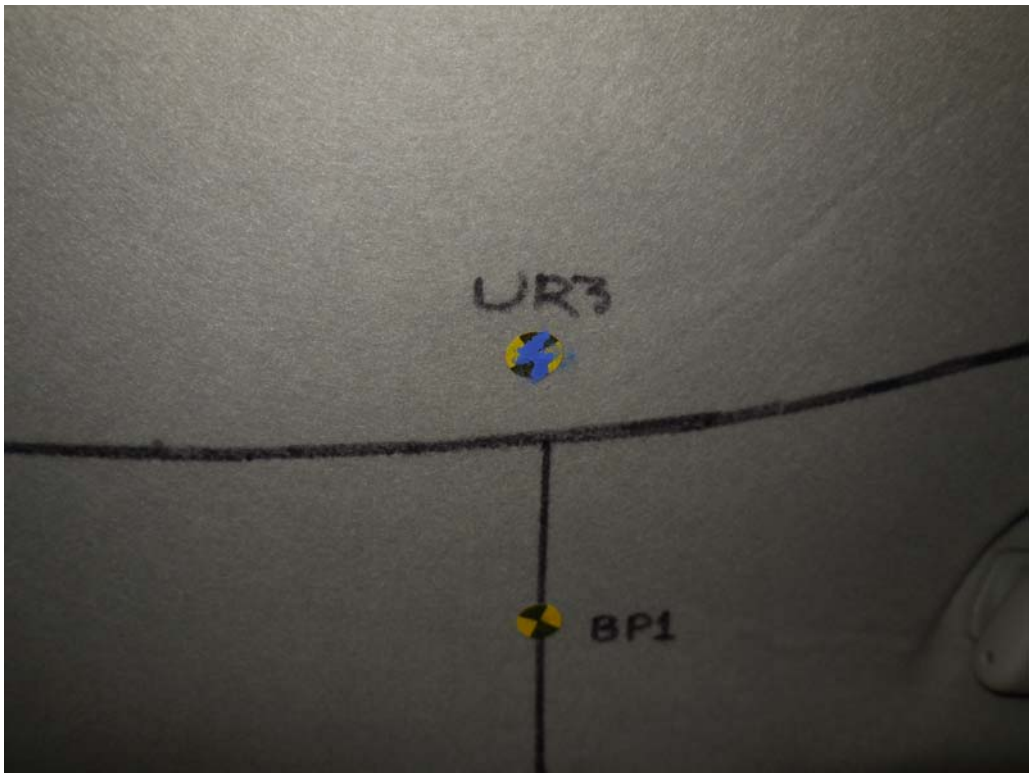
Max: 49.41 mm , Min: 0.00 mm

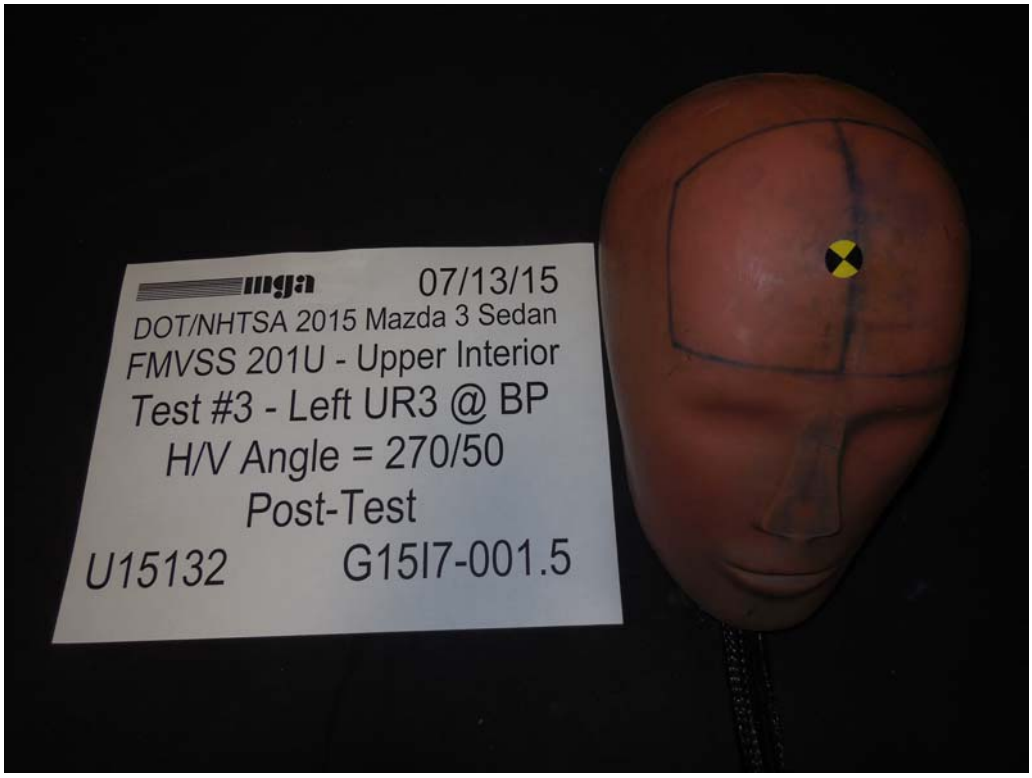

mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #3 - Left UR3 @ BP
H/V Angle = 270/50
Pre-Test
U15132
G15I7-001.5


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #3 - Left UR3 @ BP
H/V Angle = 270/50
Pre-Test
U15132
G15I7-001.5


C20155401
U15132
Left UR3
H/V 270/50
mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #3 - Left UR3 @ BP
H/V Angle = 270/50
Post-Test
U15132
G15I7-001.5


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #3 - Left UR3 @ BP
H/V Angle = 270/50
Post-Test
U15132
G15I7-001.5


UR3
BP1


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #3 - Left UR3 @ BP
H/V Angle = 270/50
Post-Test
U15132
G15I7-001.5

Test U15134 Data

mga research corporation

FMVSS 201U
Test No.: U15134 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/13/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 5 Time: 4:10pm

Horizontal Approach Angle: 270 deg Temperature: 24.0 °C

Vertical Approach Angle: 50 deg Humidity: 53.5 %RH

Impact Form ID No.: 37 Impact Form Mass: 4.54 kg

Target Location: Left UR4 @ SR3-1

Additional Description:

Test Results

Impact Velocity: 23.88 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	476.77	77.5	88.1	10.6
HIC 15	476.77	77.5	88.1	10.6
HIC (d)	526.11	77.5	88.1	10.6

3 ms Clip = 82.67 G , Time 1 = 78.9 ms , Time 2 = 82.46 ms

Impact Location on FMH: 36 mm Above Pt. 0 , 6 Left mm Lateral of Pt. 0

Post-Test Comments: Grab handle pushed in; Headliner deformation.

Test Series Performed By: DB, KR

Recorded By: Dirk Brott Approved By: Helen A. Kaleto

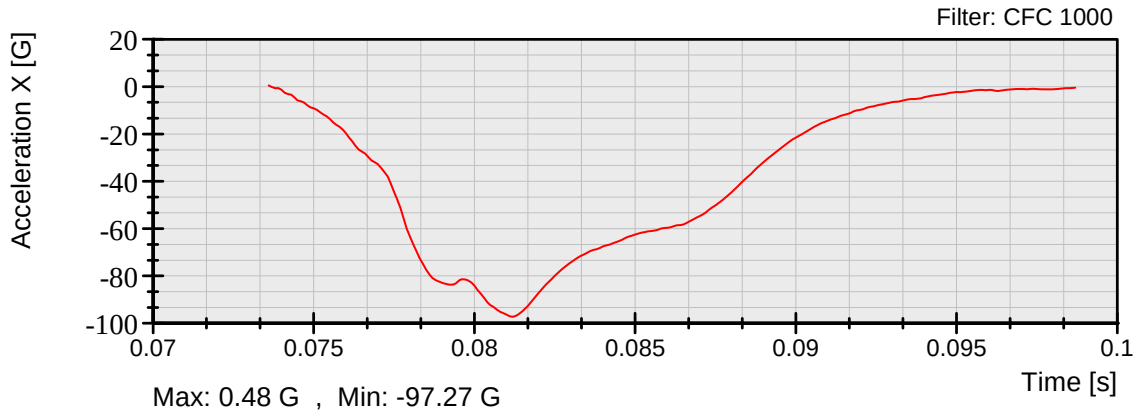
Date: July 13, 2015

mga research corporation

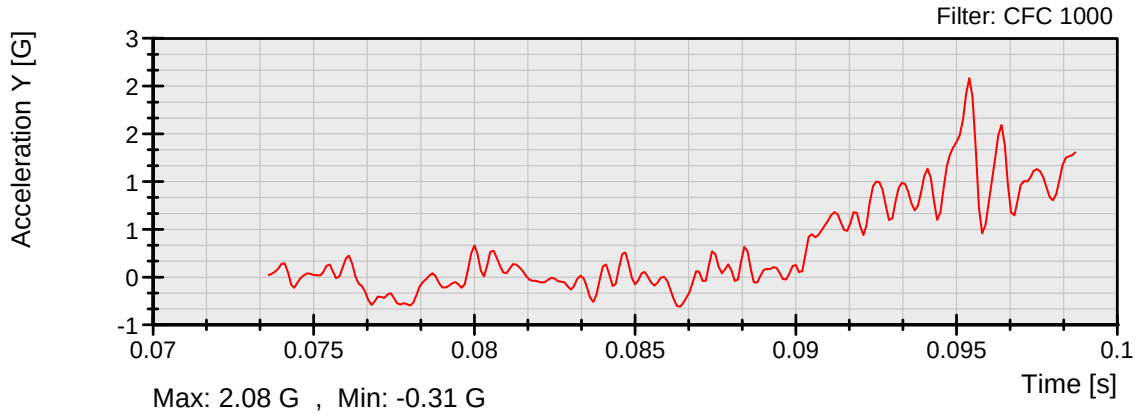
FMVSS 201U

Test No.: U15134 Report No.: G15I7-001.5

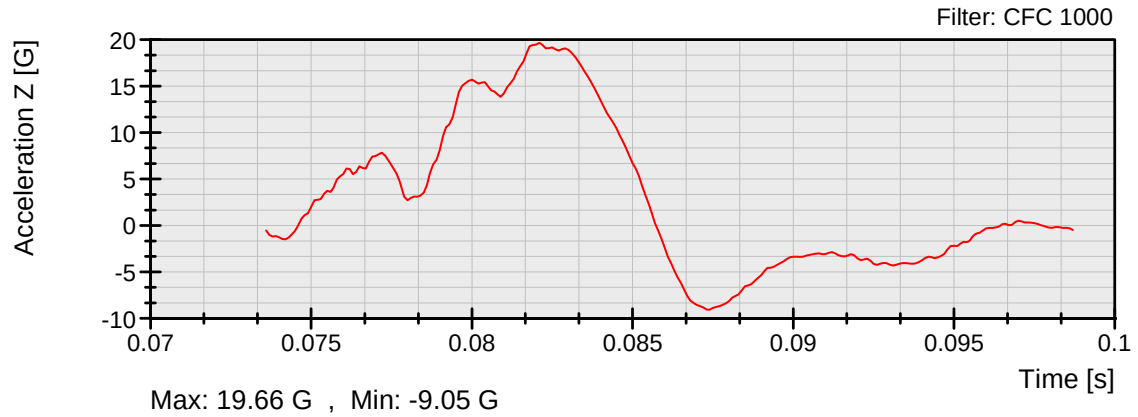
Customer: NHTSA Date: 07/13/2015



Max: 0.48 G , Min: -97.27 G



Max: 2.08 G , Min: -0.31 G



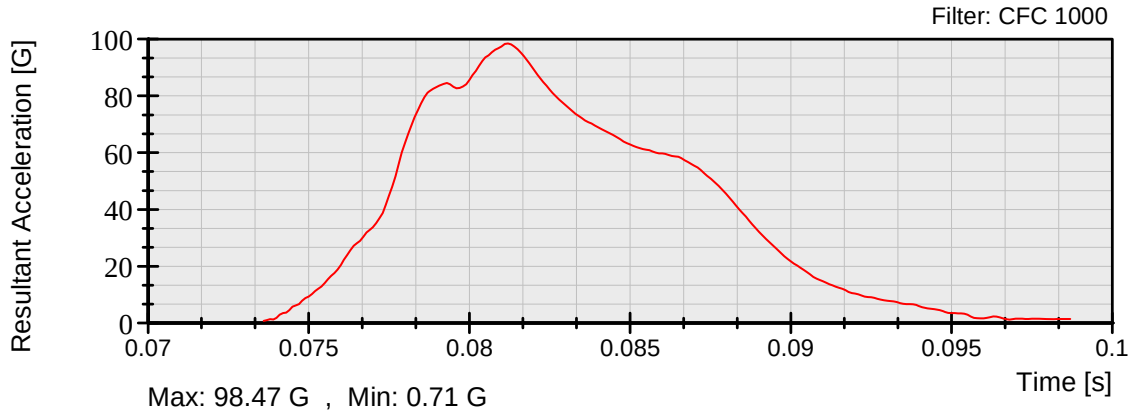
Max: 19.66 G , Min: -9.05 G

mga research corporation

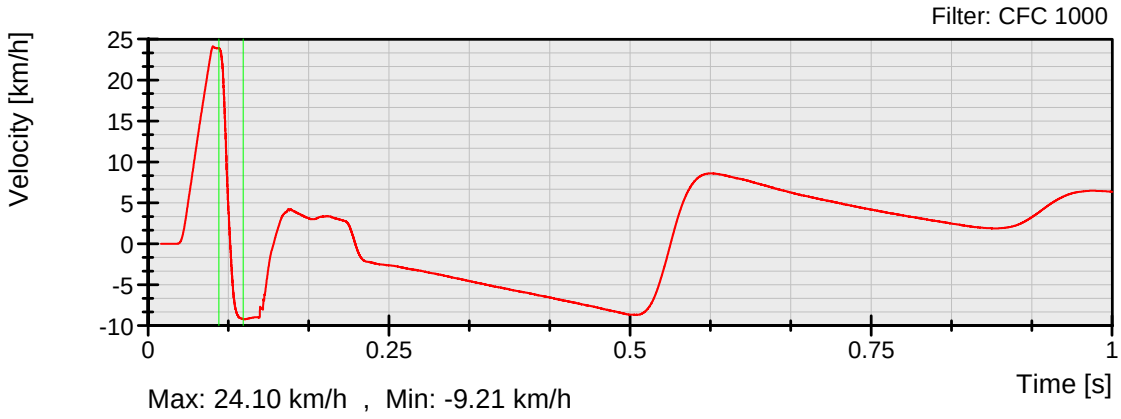
FMVSS 201U

Test No.: U15134 Report No.: G15I7-001.5

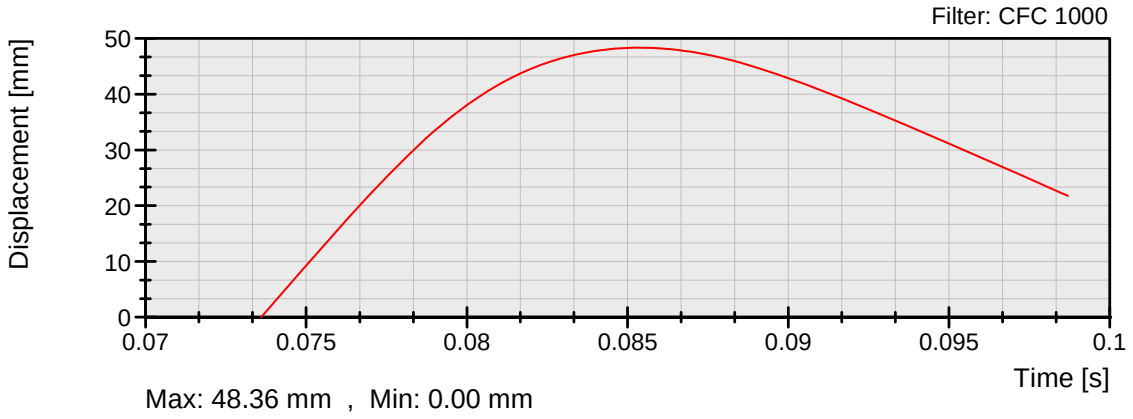
Customer: NHTSA Date: 07/13/2015



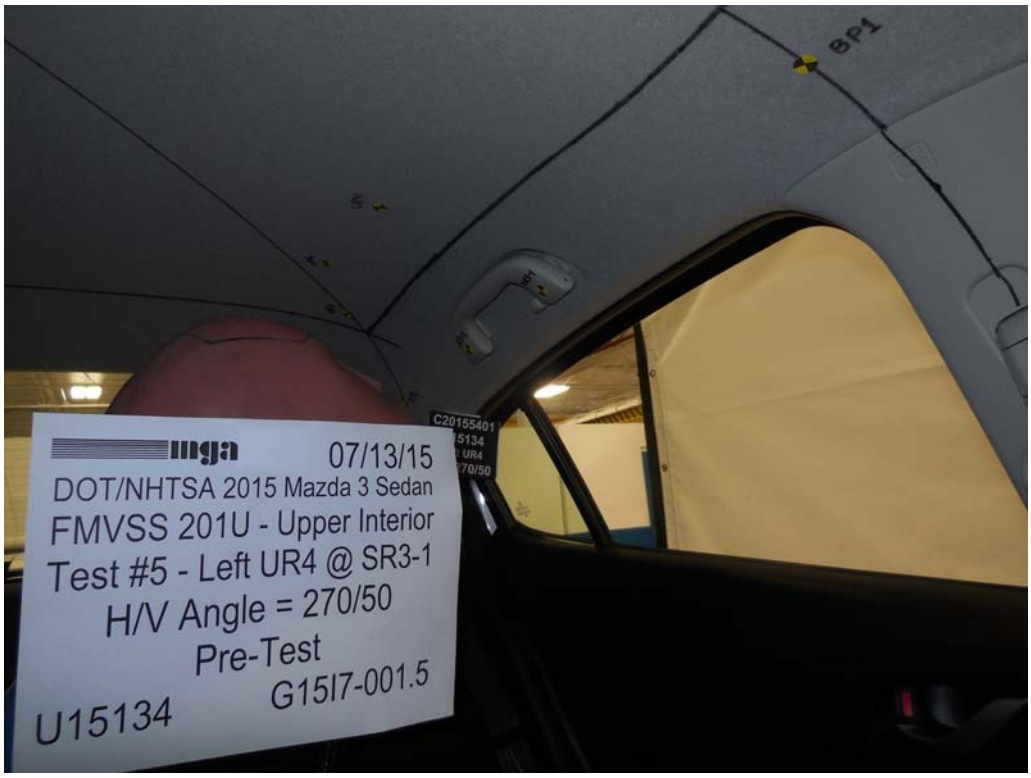
Max: 98.47 G , Min: 0.71 G

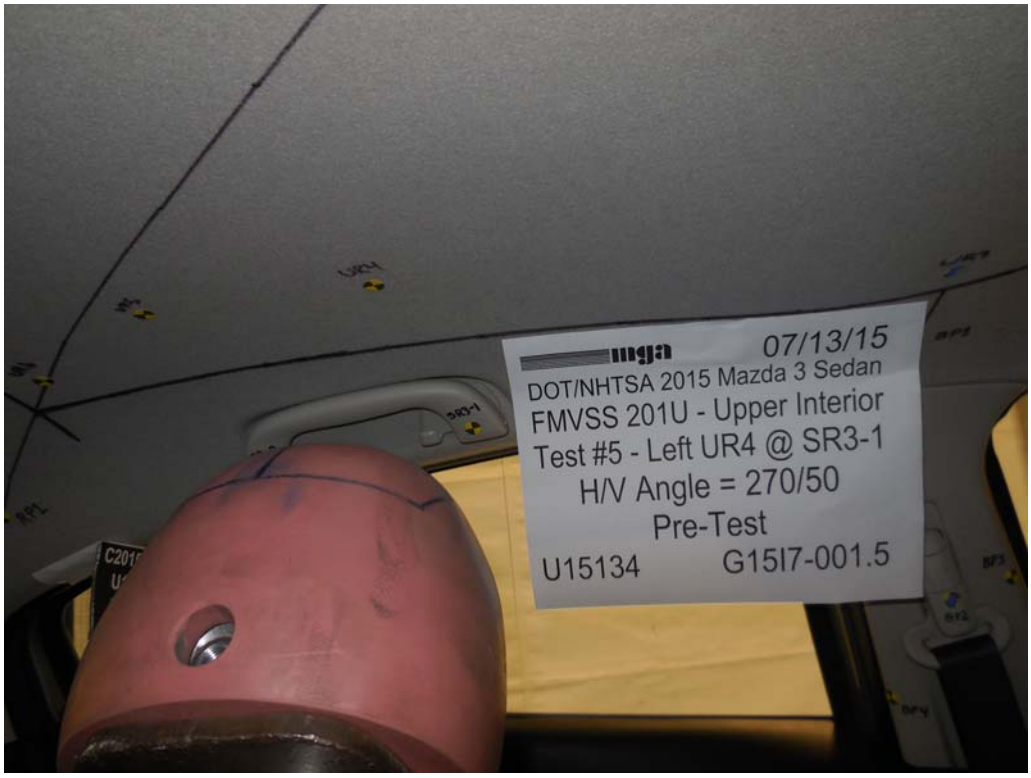


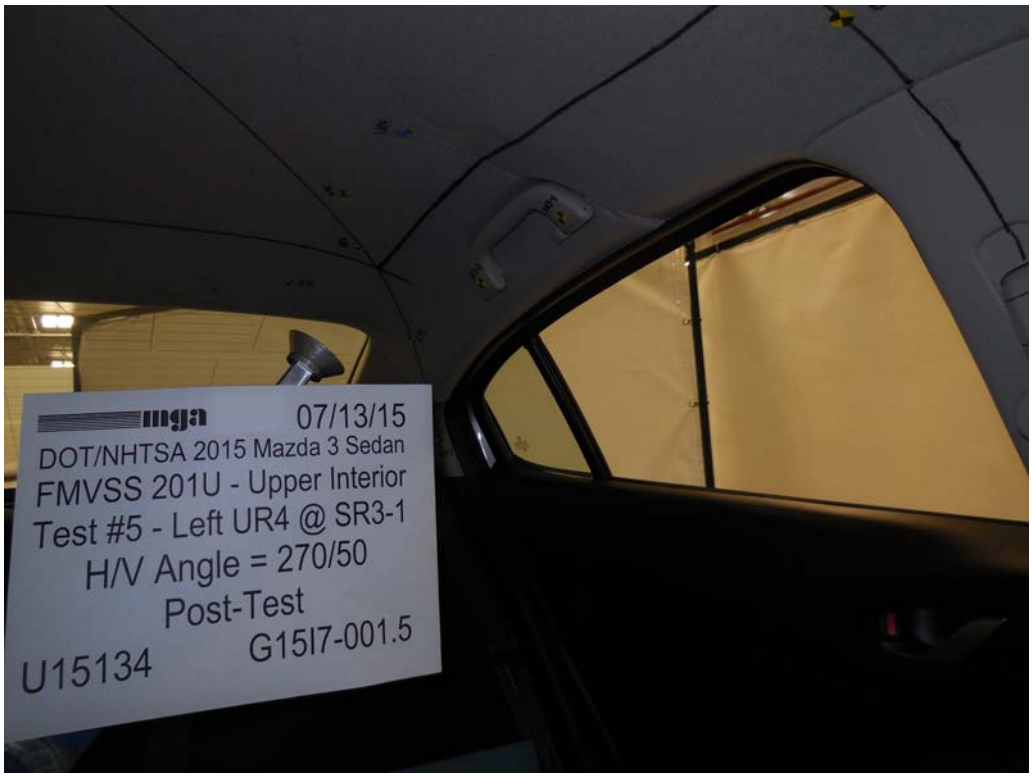
Max: 24.10 km/h , Min: -9.21 km/h



Max: 48.36 mm , Min: 0.00 mm

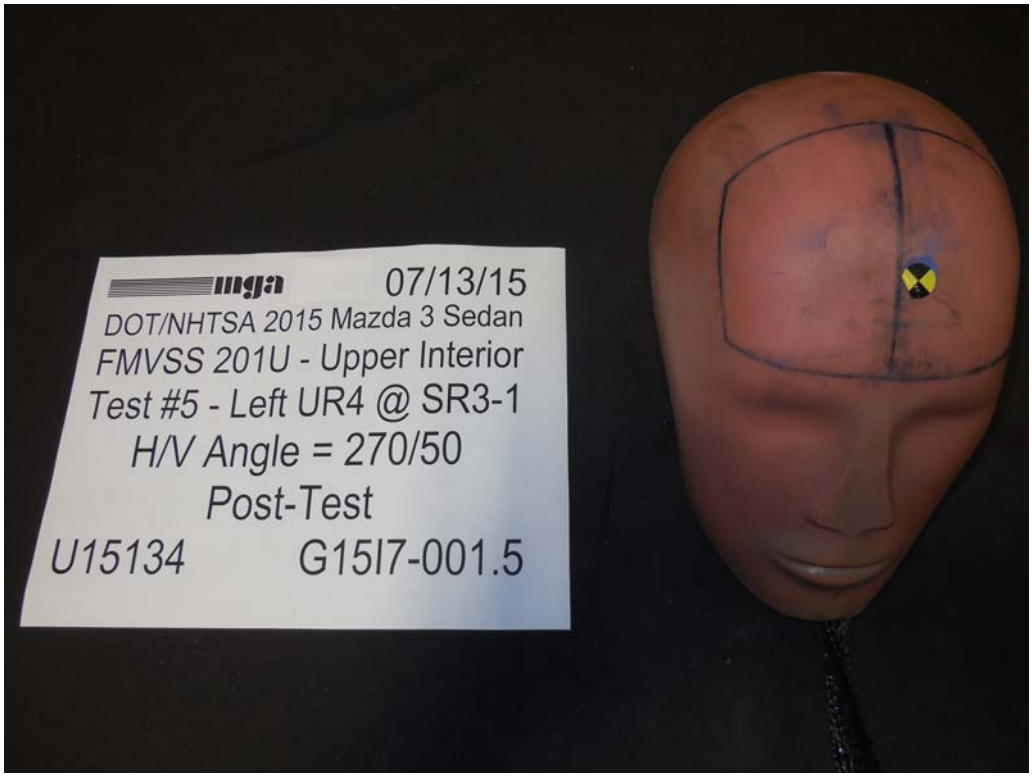

mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #5 - Left UR4 @ SR3-1
H/V Angle = 270/50
Pre-Test
U15134
G15I7-001.5


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #5 - Left UR4 @ SR3-1
H/V Angle = 270/50
Pre-Test
U15134
G15I7-001.5


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #5 - Left UR4 @ SR3-1
H/V Angle = 270/50
Post-Test
U15134
G15I7-001.5


UR4
SR3-2
SR3-1
mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #5 - Left UR4 @ SR3-1
H/V Angle = 270/50
Post-Test
U15134
G15I7-001.5


UR4
SR3-1
SR3-2


mga
07/13/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #5 - Left UR4 @ SR3-1
H/V Angle = 270/50
Post-Test
U15134
G15I7-001.5

Test U15141 Data

mga research corporation

FMVSS 201U
Test No.: U15141 Report No.: G15I7-001.5
Customer: NHTSA Date: 07/14/2015

Summary of the Test

Setup Information

Sample Description: 2015 Mazda 3 Sedan

Test Sequence No.: 12 Time: 3:45pm

Horizontal Approach Angle: 90 deg Temperature: 20.8 °C

Vertical Approach Angle: 50 deg Humidity: 48.8 %RH

Impact Form ID No.: 35 Impact Form Mass: 4.51 kg

Target Location: Right UR11 @ SR3-2

Additional Description:

Test Results

Impact Velocity: 23.9 km/h

HIC Type	HIC Value	Time 1 (ms)	Time 2 (ms)	Delta-T (ms)
HIC 36	495.31	74.8	84.3	9.5
HIC 15	495.31	74.8	84.3	9.5
HIC (d)	540.09	74.8	84.3	9.5

3 ms Clip = 85.04 G , Time 1 = 75.72 ms , Time 2 = 78.72 ms

Impact Location on FMH: 51 mm Above Pt. 0 , 5 Left mm Lateral of Pt. 0

Post-Test Comments: Grab handle pushed in; Headliner deformation.

Test Series Performed By: DB, KR

Recorded By: _____ Approved By: _____

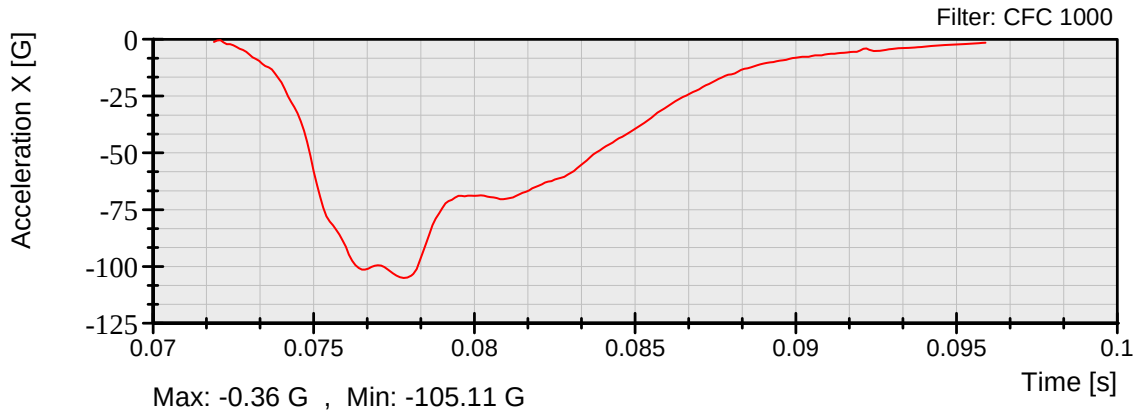
Date: July 14, 2015

mga research corporation

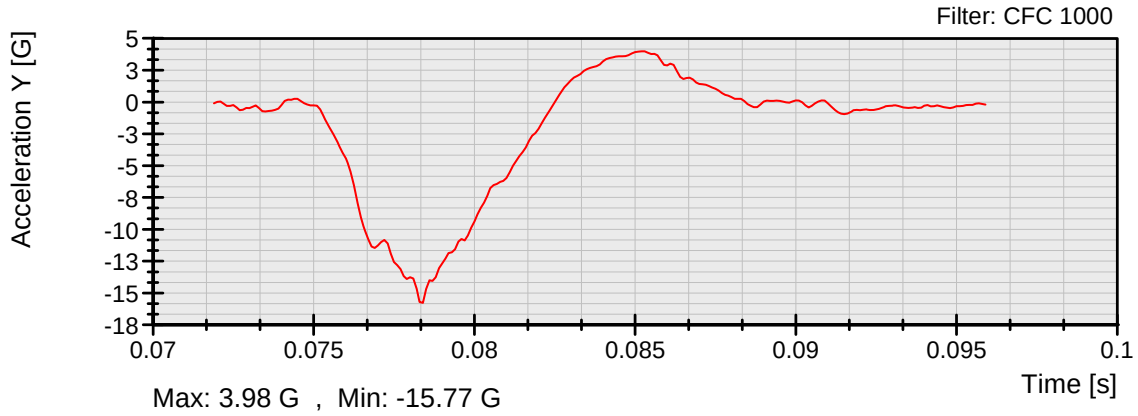
FMVSS 201U

Test No.: U15141 Report No.: G15I7-001.5

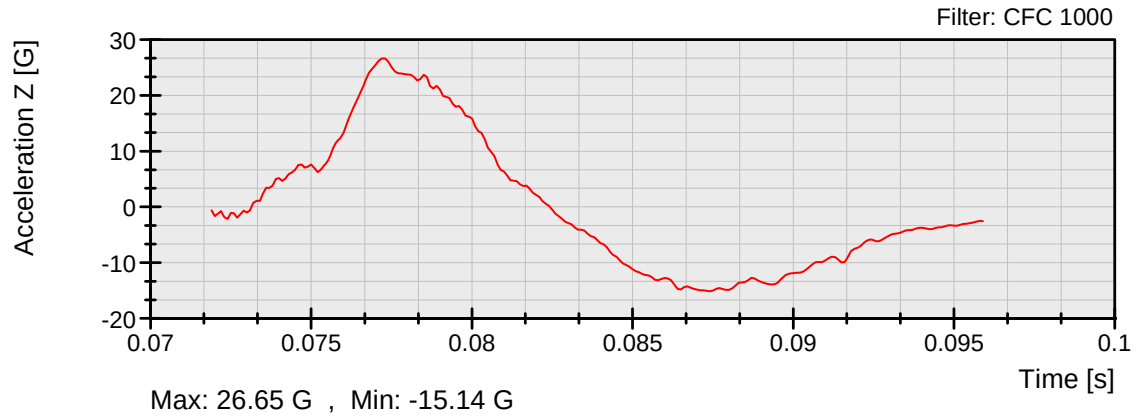
Customer: NHTSA Date: 07/14/2015



Max: -0.36 G , Min: -105.11 G

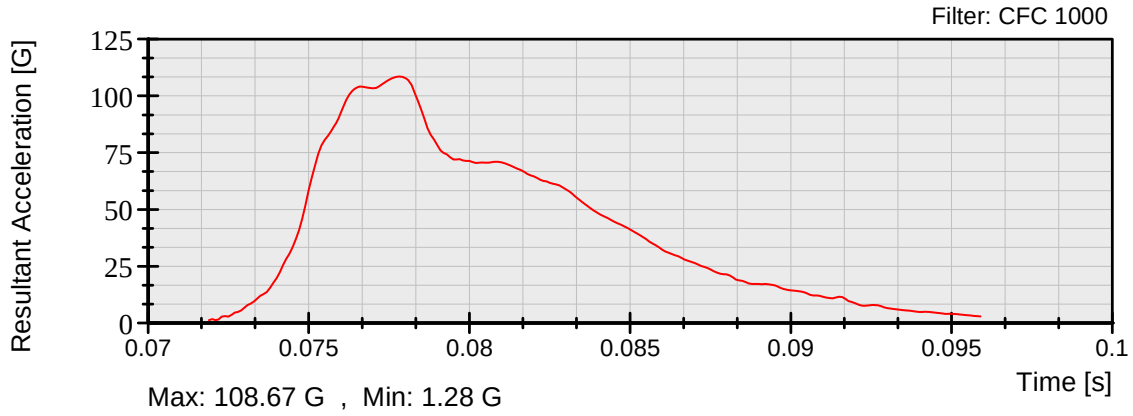


Max: 3.98 G , Min: -15.77 G

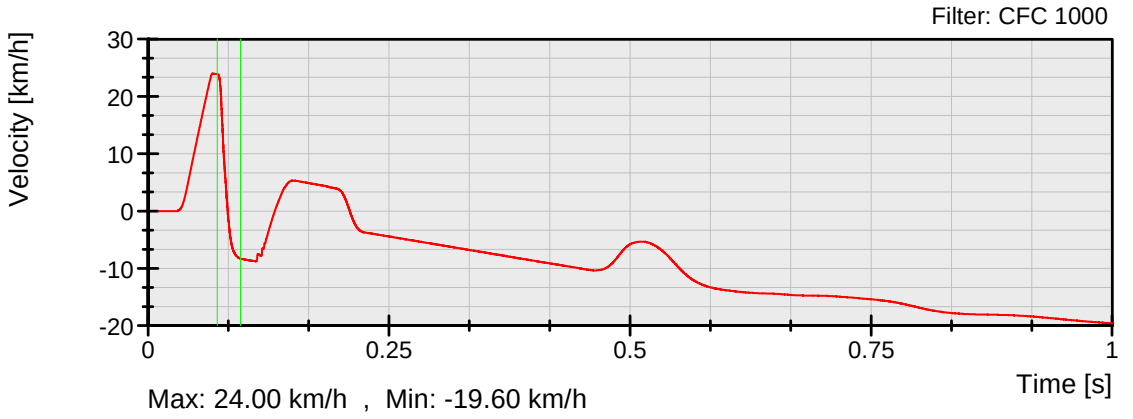


Max: 26.65 G , Min: -15.14 G

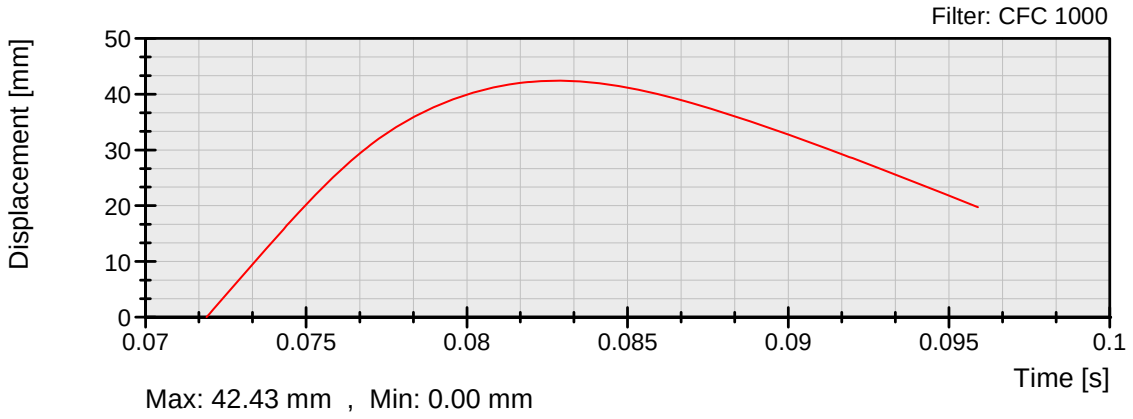
FMVSS 201U
Test No.: U15141
Customer: NHTSA
Report No.: G15I7-001.5
Date: 07/14/2015



Max: 108.67 G , Min: 1.28 G

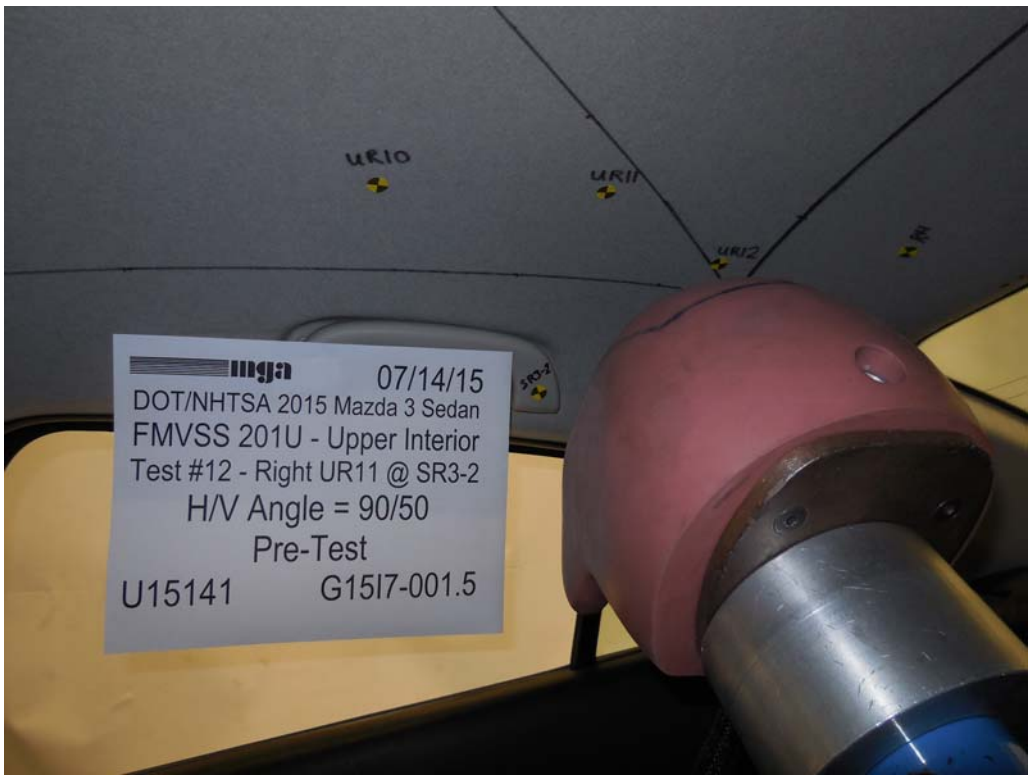


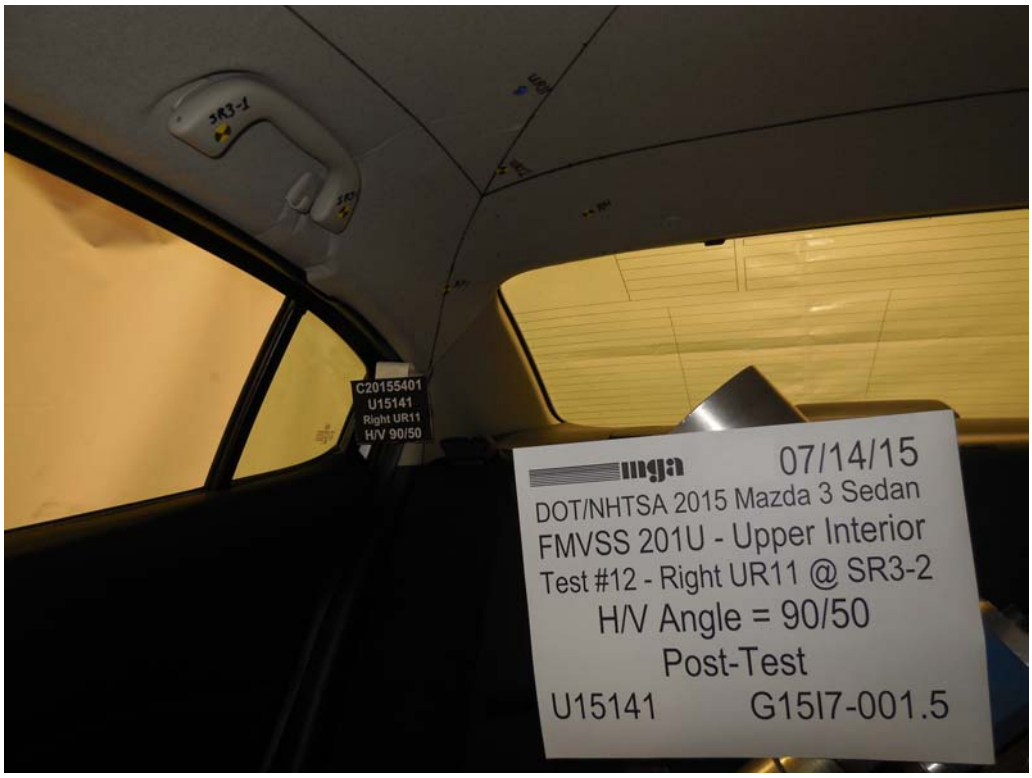
Max: 24.00 km/h , Min: -19.60 km/h

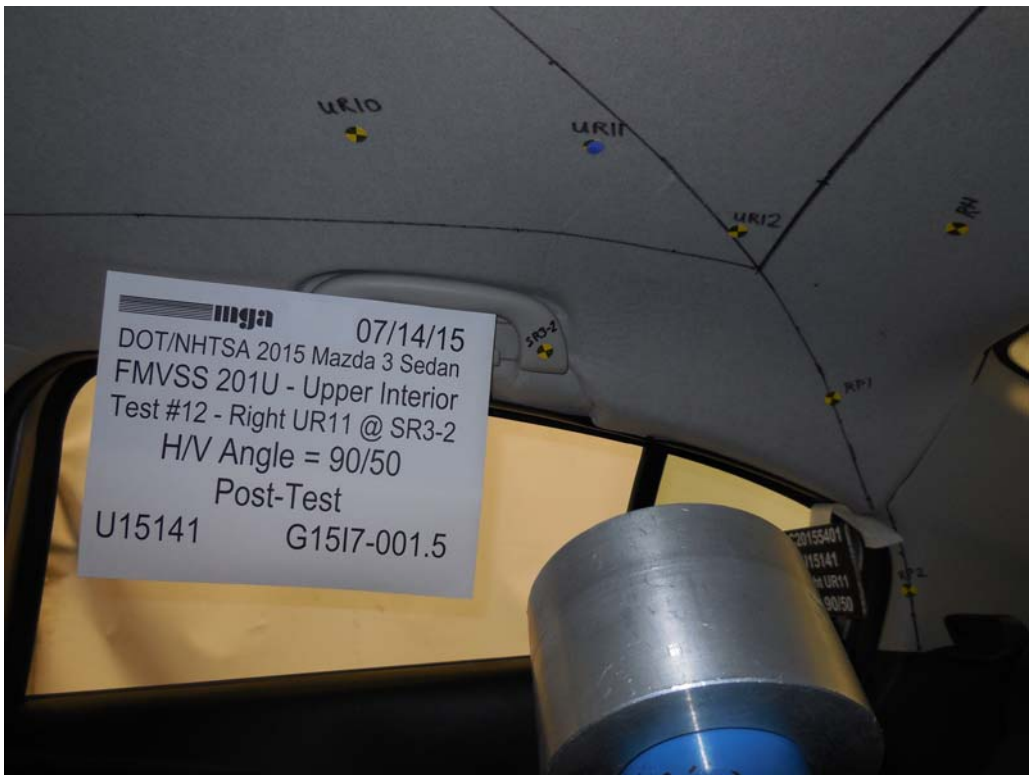


Max: 42.43 mm , Min: 0.00 mm

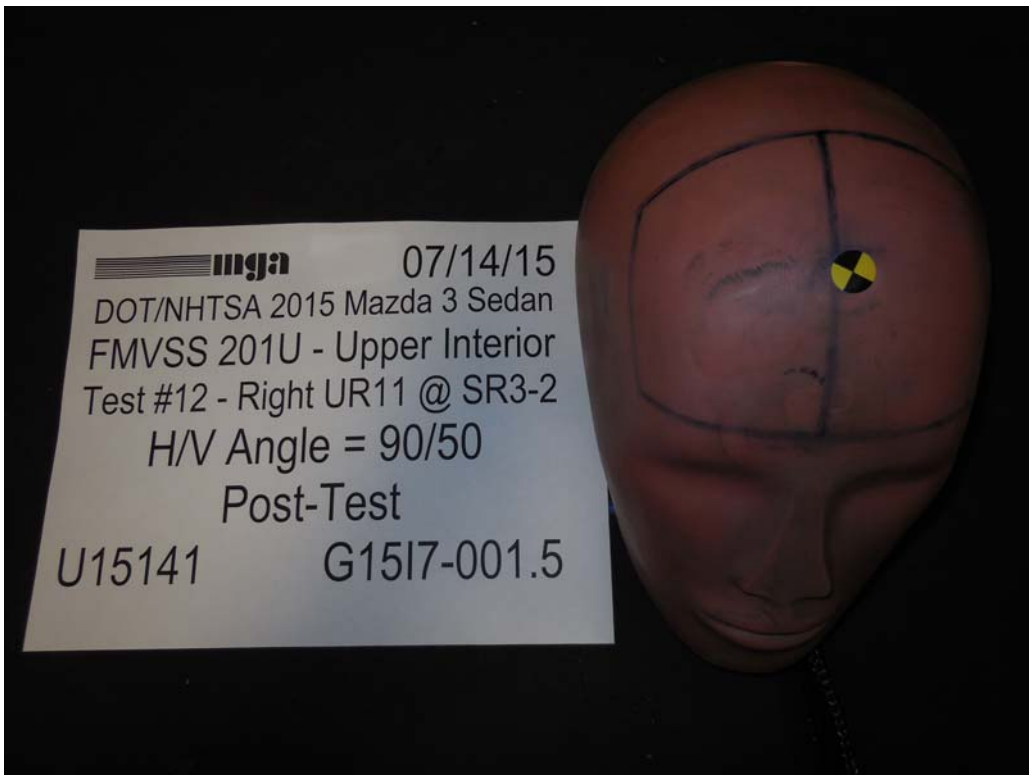

SR3-1
UR10
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #12 - Right UR11 @ SR3-2
H/V Angle = 90/50
Pre-Test
U15141
G15I7-001.5


UR10
UR11
UR12
SR3-1
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #12 - Right UR11 @ SR3-2
H/V Angle = 90/50
Pre-Test
U15141
G15I7-001.5


SR3-1
C20155401
U15141
Right UR11
H/V 90/50
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #12 - Right UR11 @ SR3-2
H/V Angle = 90/50
Post-Test
U15141
G15I7-001.5


UR10
UR11
UR12
RH
SR3-2
RP1
mga
07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #12 - Right UR11 @ SR3-2
H/V Angle = 90/50
Post-Test
U15141
G15I7-001.5


URI1
URI2
SR3-2


07/14/15
DOT/NHTSA 2015 Mazda 3 Sedan
FMVSS 201U - Upper Interior
Test #12 - Right UR11 @ SR3-2
H/V Angle = 90/50
Post-Test
U15141
G15I7-001.5

4.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

The following section lists the test equipment for the compliance test series. Items marked with an asterisk are calibrated by an external lab. An additional summary table is given for the pre and post-test calibration data for the Free Motion Headforms. The temperature trace to confirm testing was conducted between 66ºF and 78ºF (19ºC – 26ºC) is included in Appendix A. Calibration certificates can be found in Appendix B.

TABLE 4-1 LIST OF ITEMS USED

ITEM	MANUFACTURER NAME	MODEL #	FUNCTION OF ITEM	ACCURACY	CAL. INTERNAL
Head Drop Tower (includes test frame and DAS)	MGA Research Corp.	MGA-100-DC	FMH Calibration	N/A	N/A
Accelerometers	Endevco	7264-2000	Acceleration Data	±0.5%	6 months
FMVSS 201U Test Frame (includes the propulsion control system, actuator, test frame, and DAS)	TDAS	LM0321	Test System	N/A	N/A
Free Motion Headforms	UTAMA UTAMA UTAMA	035 037 038	Test Device	N/A	Pre and Post-Test Series
High Speed Video	Vision Research	Miro Ex4	Record Event	N/A	N/A
*FARO™	Faro Technologies	P08-05-10-26072	Targeting	0.1 mm	Annual
Measuring Devices: - Tape Measure - Plumb Bobs - Digital Protractor	 Stanley N/A Mitutoyo	 TPM001-70 -- MGA00821	 Measurement Targeting FMH setup Horizontal Measurement	 1 mm N/A 0.5°	Annual
*Temperature/RH Data Logger	Omega	0514B1305F	Record Temperature and Humidity	± 1°C ± 1% RH	Annual
* Scale	Detecto	MGA00783	Weigh FMH Head	± 0.01 lb	Annual
*Vehicle Scale	Intercomp	26032389	Weighing Vehicle	± .5 kg	Annual

Each headform was calibrated by an engineer after the headform had soaked in an environment of 66ºF to 78ºF (19ºC to 26ºC) for a period of at least four hours.

Each headform was found to comply with the performance criteria under Part 572L for pre and post-test calibrations. That is, the peak resultant acceleration was between 225 and 275 G's, the peak lateral acceleration was less than 15 G's, the headform weighed between 9.9 and 10.1 lbs., the pulse was determined to be unimodal, and there was no major damage to the headform.

TABLE 4-2 FMH CALIBRATION SUMMARY

FMH Serial #		Headform Calibration Date	Weight (kg)	Temp (ºC)	% Humidity	Peak Resultant Acceleration (G's)	Peak Lateral Acceleration (G's)	Unimodal
35	Pre	07/08/15	4.51	22.4	47.6	271.32	8.15	Yes
35	Post	07/15/15	4.51	21.2	47.8	269.54	7.78	Yes
37	Pre	07/08/15	4.54	21.7	46.8	268.90	2.64	Yes
37	Post	07/15/15	4.54	21.9	42.8	272.72	2.47	Yes
38	Pre	07/08/15	4.51	21.4	45.5	267.68	12.69	Yes
38	Post	07/15/15	4.51	21.3	48.1	268.59	13.36	Yes

4-1 Pre-Test Calibration

Calibration Series: FMVSS 201U FMH

Test No.: H35010 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/8/2015

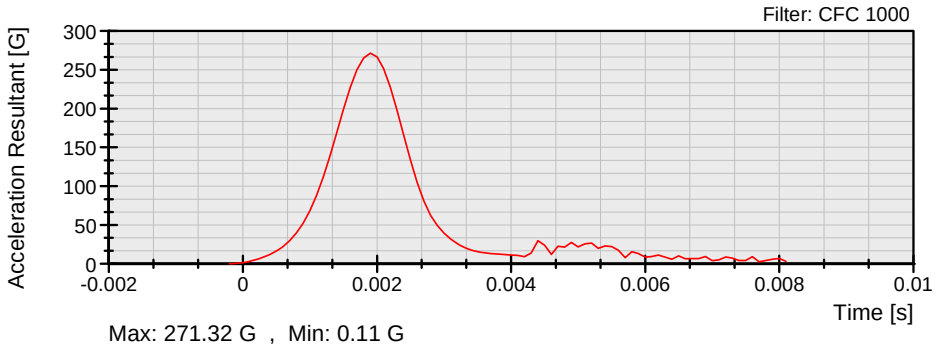
Summary of Results:

Impact Form ID No.: H35

Item Description	Result	Requirement
Temperature (°C)	22.4 °C	19ºC and 26ºC
Humidity (%RH)	47.6 % RH	10% to 70% RH
Impact Form Mass (kg)	4.51 kg	4.54 ± 0.05 kg
Resultant Acceleration (G)	271.32 G	225 to 275 G
Peak Y-Acceleration (G)	8.15 G	< 15 G
Unimodal?	Yes	Yes

Calibration Performed By: KR

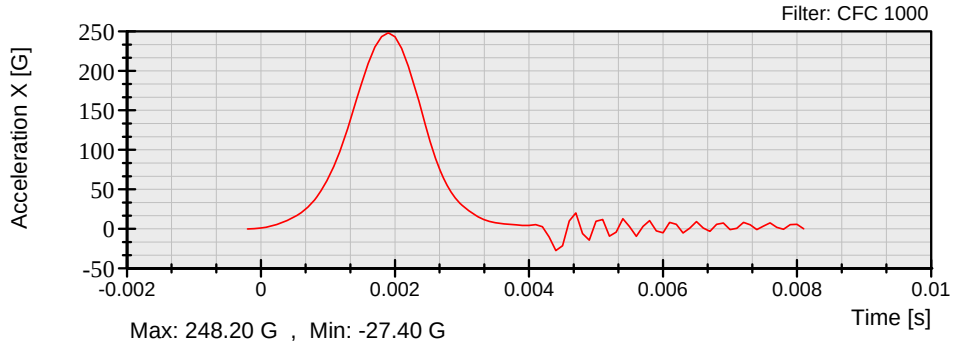
Comments: NA



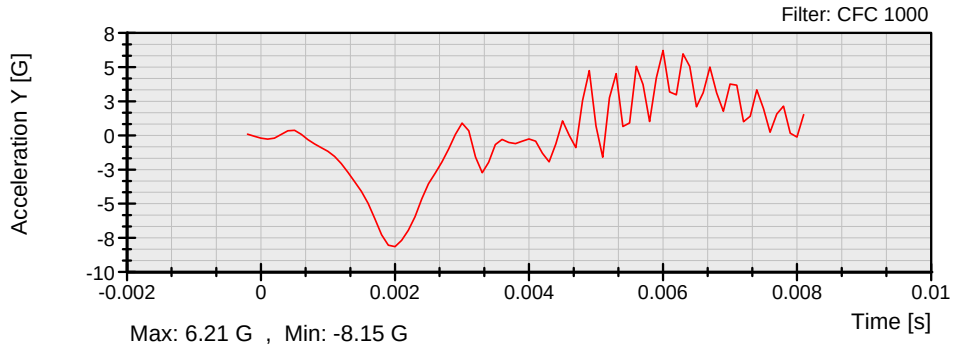
Max: 271.32 G , Min: 0.11 G

Calibration Series: FMVSS 201U FMH

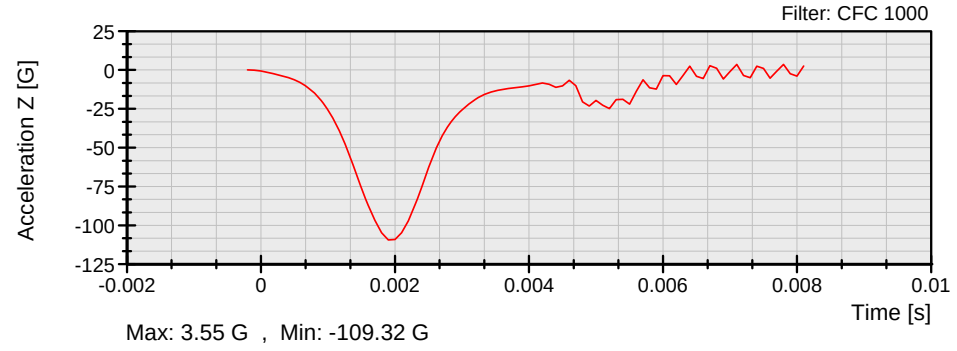
Test No: H35010 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/8/2015



Max: 248.20 G , Min: -27.40 G



Max: 6.21 G , Min: -8.15 G



Max: 3.55 G , Min: -109.32 G

Page 2 of 2

Recorded By: _____ **Approved By:** _____
Date: July 8, 2015

4-2 Post-Test Calibration

Calibration Series: FMVSS 201U FMH

Test No.: H35011 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/15/2015

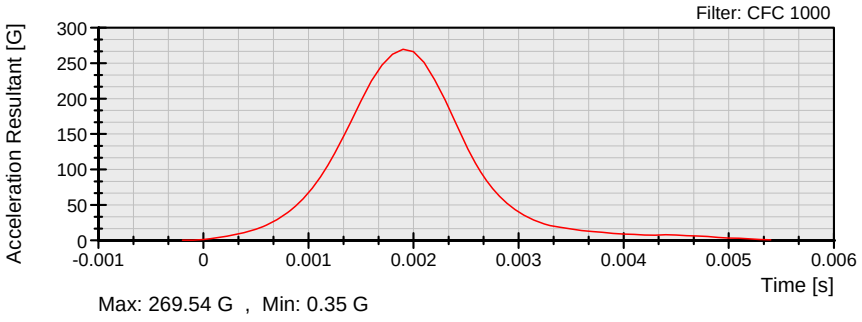
Summary of Results:

Impact Form ID No.: H35

Item Description	Result	Requirement
Temperature (°C)	21.2 °C	19ºC and 26ºC
Humidity (%RH)	47.8 % RH	10% to 70% RH
Impact Form Mass (kg)	4.51 kg	4.54 ± 0.05 kg
Resultant Acceleration (G)	269.54 G	225 to 275 G
Peak Y-Acceleration (G)	7.78 G	< 15 G
Unimodal?	Yes	Yes

Calibration Performed By: KR

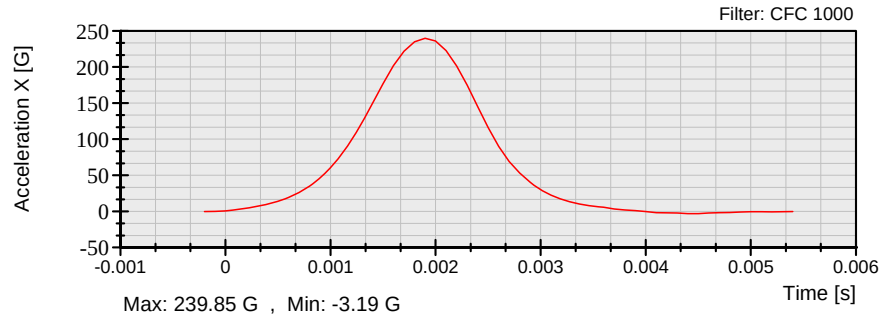
Comments: NA



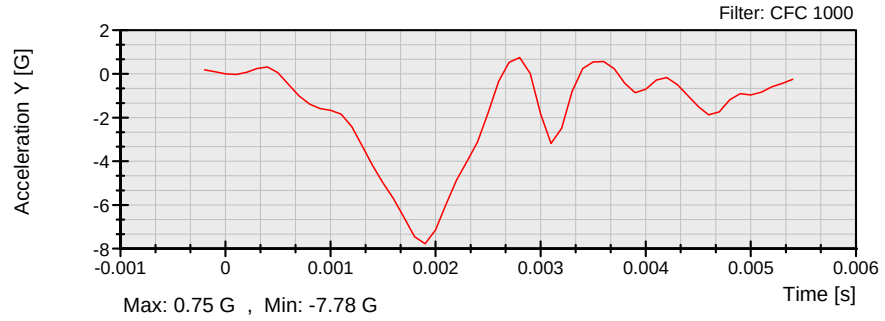
Max: 269.54 G , Min: 0.35 G

Calibration Series: FMVSS 201U FMH

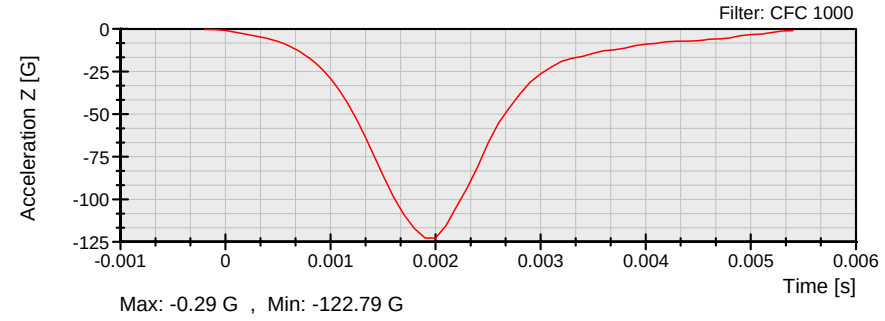
Test No: H35011 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/15/2015



Max: 239.85 G , Min: -3.19 G



Max: 0.75 G , Min: -7.78 G



Max: -0.29 G , Min: -122.79 G

Page 2 of 2

Recorded By: _____ **Approved By:** _____
Date: July 15, 2015

4-3 Pre-Test Calibration

Calibration Series: FMVSS 201U FMH

Test No.: H37009 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/8/2015

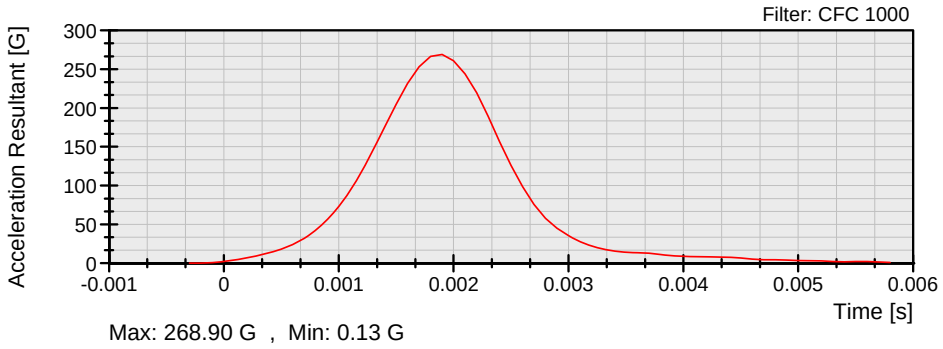
Summary of Results:

Impact Form ID No.: H37

Item Description	Result	Requirement
Temperature (°C)	21.7 °C	19ºC and 26ºC
Humidity (%RH)	46.8 % RH	10% to 70% RH
Impact Form Mass (kg)	4.54 kg	4.54 ± 0.05 kg
Resultant Acceleration (G)	268.90 G	225 to 275 G
Peak Y-Acceleration (G)	2.64 G	< 15 G
Unimodal?	Yes	Yes

Calibration Performed By: KR

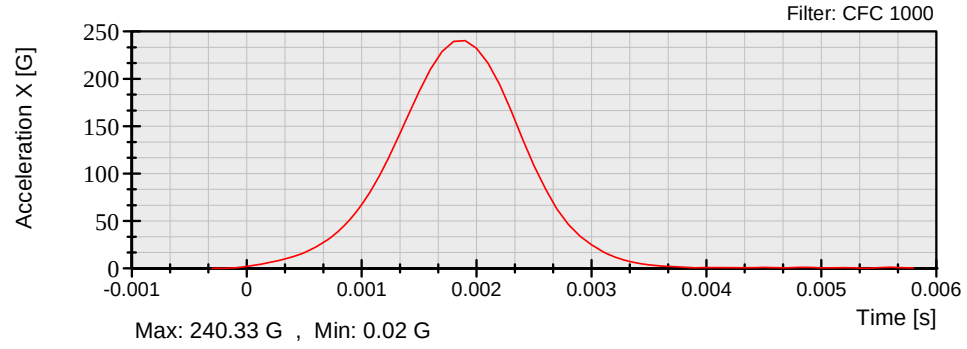
Comments: NA



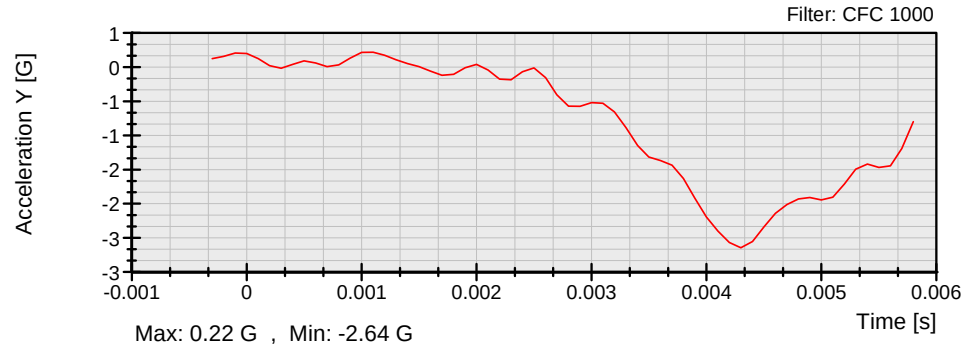
Max: 268.90 G , Min: 0.13 G

Calibration Series: FMVSS 201U FMH

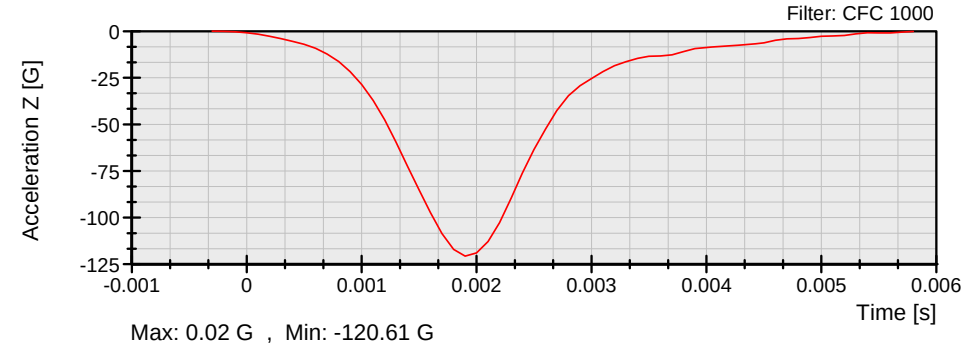
Test No: H37009 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/8/2015



Max: 240.33 G , Min: 0.02 G



Max: 0.22 G , Min: -2.64 G



Max: 0.02 G , Min: -120.61 G

Page 2 of 2

Recorded By: _____ **Approved By:** _____
Date: July 8, 2015

4-4 Post-Test Calibration

Calibration Series: FMVSS 201U FMH

Test No.: H37010 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/15/2015

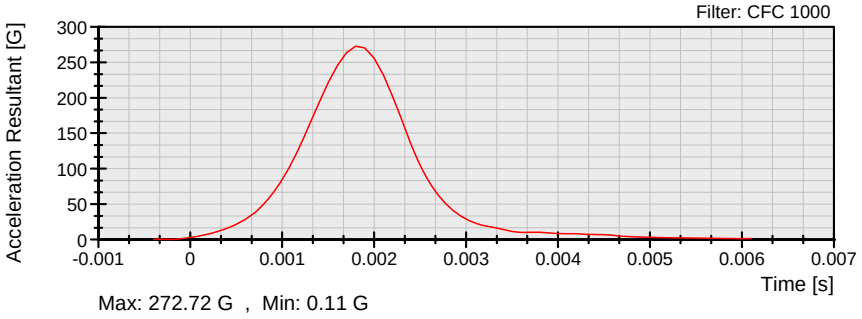
Summary of Results:

Impact Form ID No.: H37

Item Description	Result	Requirement
Temperature (°C)	21.9 °C	19ºC and 26ºC
Humidity (%RH)	42.8 % RH	10% to 70% RH
Impact Form Mass (kg)	4.54 kg	4.54 ± 0.05 kg
Resultant Acceleration (G)	272.72 G	225 to 275 G
Peak Y-Acceleration (G)	2.47 G	< 15 G
Unimodal?	Yes	Yes

Calibration Performed By: KR

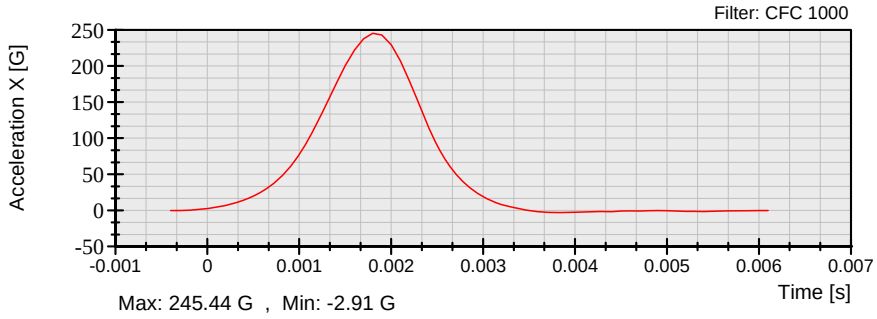
Comments: NA



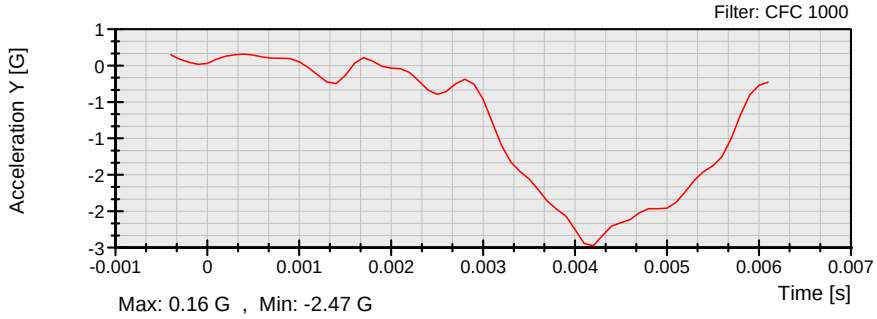
Max: 272.72 G , Min: 0.11 G

Calibration Series: FMVSS 201U FMH

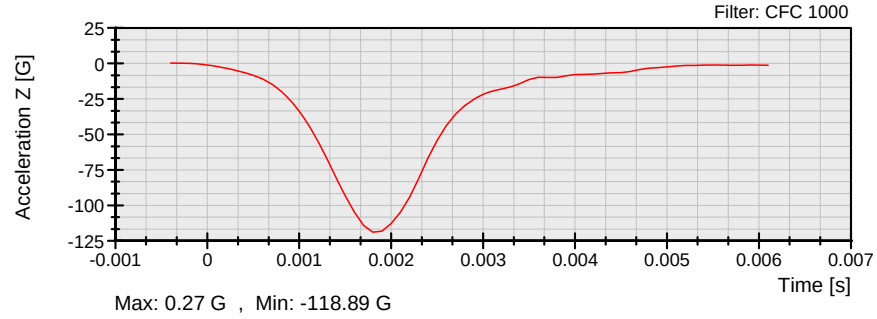
Test No: H37010 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/15/2015



Max: 245.44 G , Min: -2.91 G



Max: 0.16 G , Min: -2.47 G



Max: 0.27 G , Min: -118.89 G

Page 2 of 2

Recorded By: _____ **Approved By:** _____
Date: July 15, 2015

4-5 Pre-Test Calibration

Calibration Series: FMVSS 201U FMH

Test No.: H38010 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/8/2015

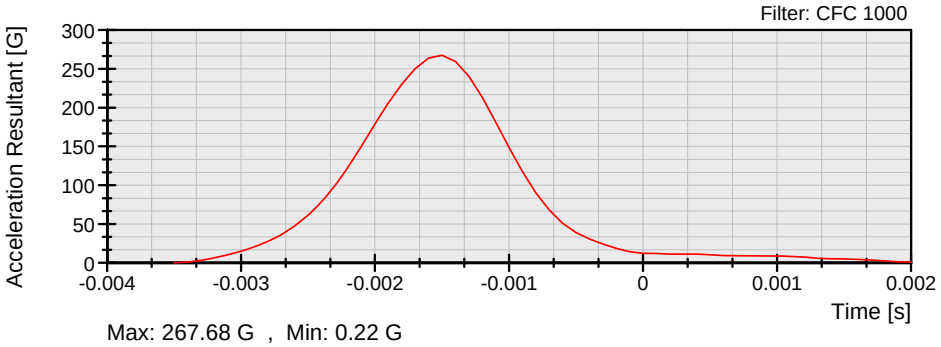
Summary of Results:

Impact Form ID No.: H38

Item Description	Result	Requirement
Temperature (°C)	21.4 °C	19ºC and 26ºC
Humidity (%RH)	45.5 % RH	10% to 70% RH
Impact Form Mass (kg)	4.51 kg	4.54 ± 0.05 kg
Resultant Acceleration (G)	267.68 G	225 to 275 G
Peak Y-Acceleration (G)	12.69 G	< 15 G
Unimodal?	Yes	Yes

Calibration Performed By: KR

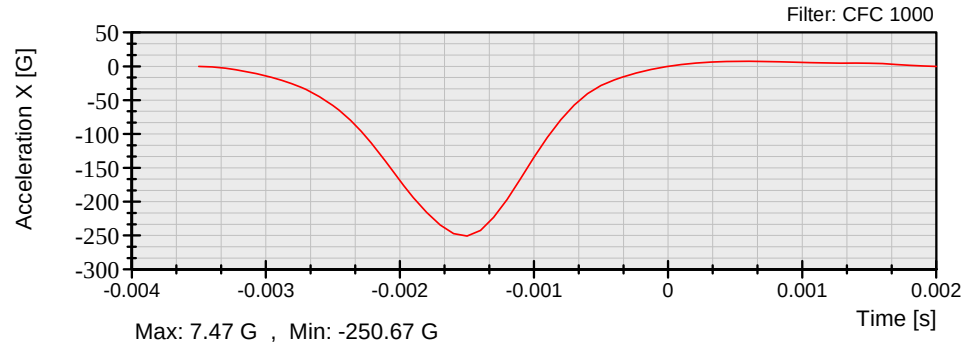
Comments: NA



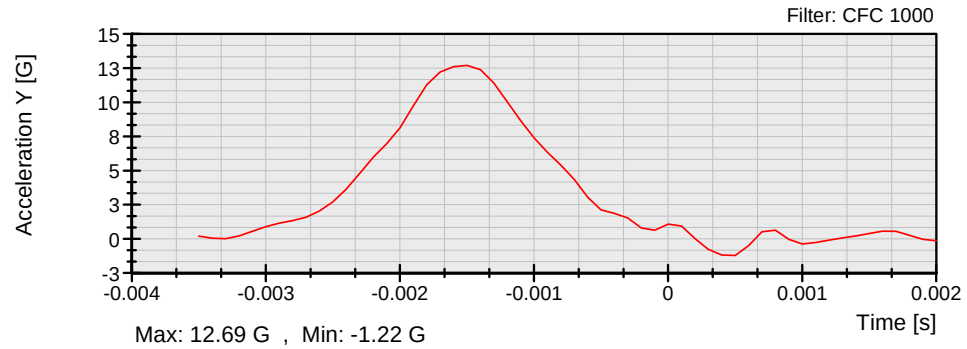
Max: 267.68 G , Min: 0.22 G

Calibration Series: FMVSS 201U FMH

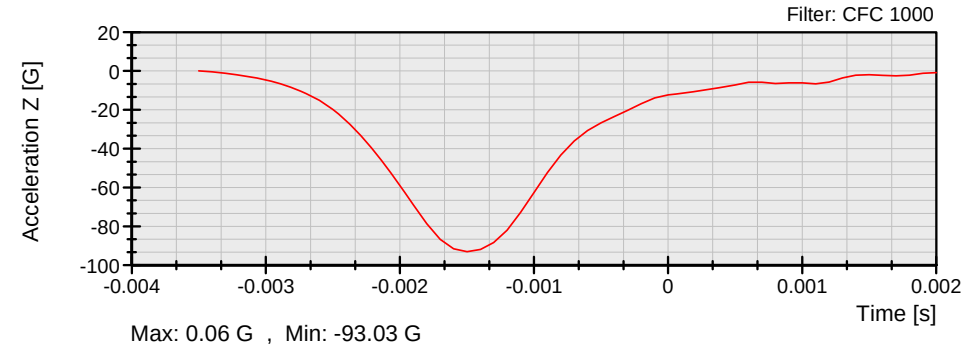
Test No: H38010 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/8/2015



Max: 7.47 G , Min: -250.67 G



Max: 12.69 G , Min: -1.22 G



Max: 0.06 G , Min: -93.03 G

Page 2 of 2

Recorded By: _____ **Approved By:** _____
Date: July 8, 2015

4-6 Post-Test Calibration

Calibration Series: FMVSS 201U FMH

Test No.: H38011 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/15/2015

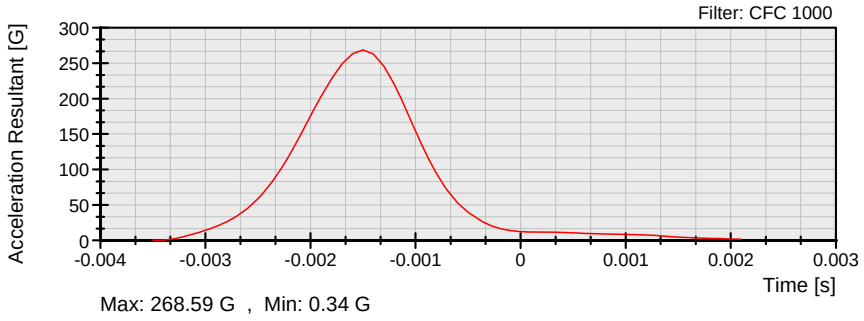
Summary of Results:

Impact Form ID No.: H38

Item Description	Result	Requirement
Temperature (°C)	21.3 °C	19ºC and 26ºC
Humidity (%RH)	48.1 % RH	10% to 70% RH
Impact Form Mass (kg)	4.51 kg	4.54 ± 0.05 kg
Resultant Acceleration (G)	268.59 G	225 to 275 G
Peak Y-Acceleration (G)	13.36 G	< 15 G
Unimodal?	Yes	Yes

Calibration Performed By: KR

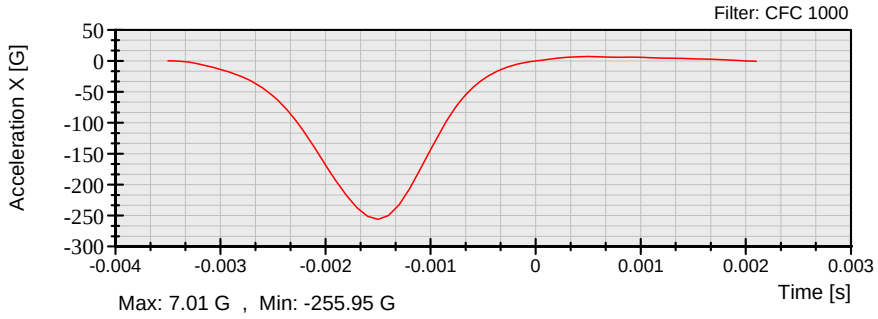
Comments: NA



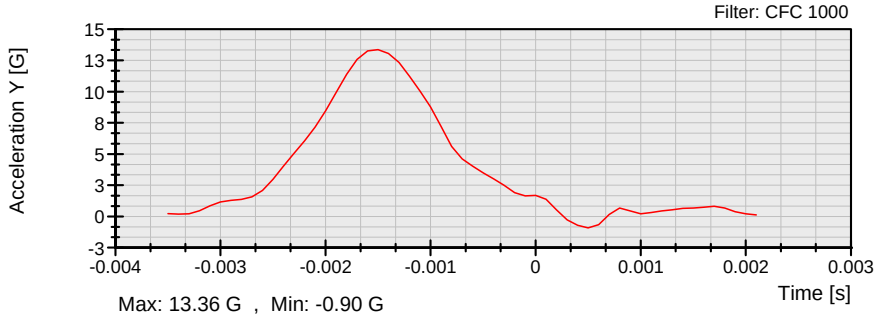
Max: 268.59 G , Min: 0.34 G

Calibration Series: FMVSS 201U FMH

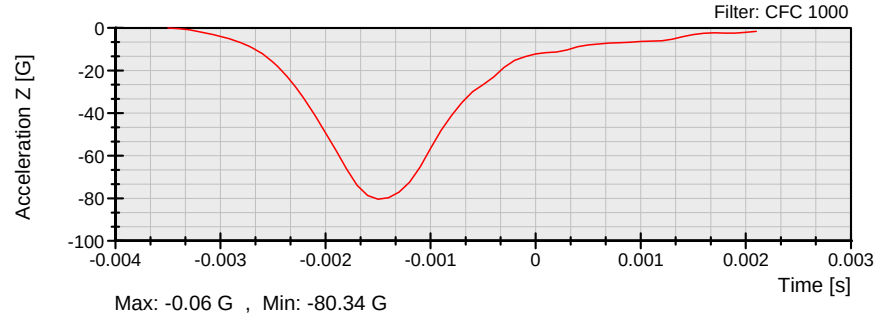
Test No: H38011 Report No.: G15I7-001.5
Customer: NHTSA Date: 7/15/2015



Max: 7.01 G , Min: -255.95 G



Max: 13.36 G , Min: -0.90 G



Max: -0.06 G , Min: -80.34 G

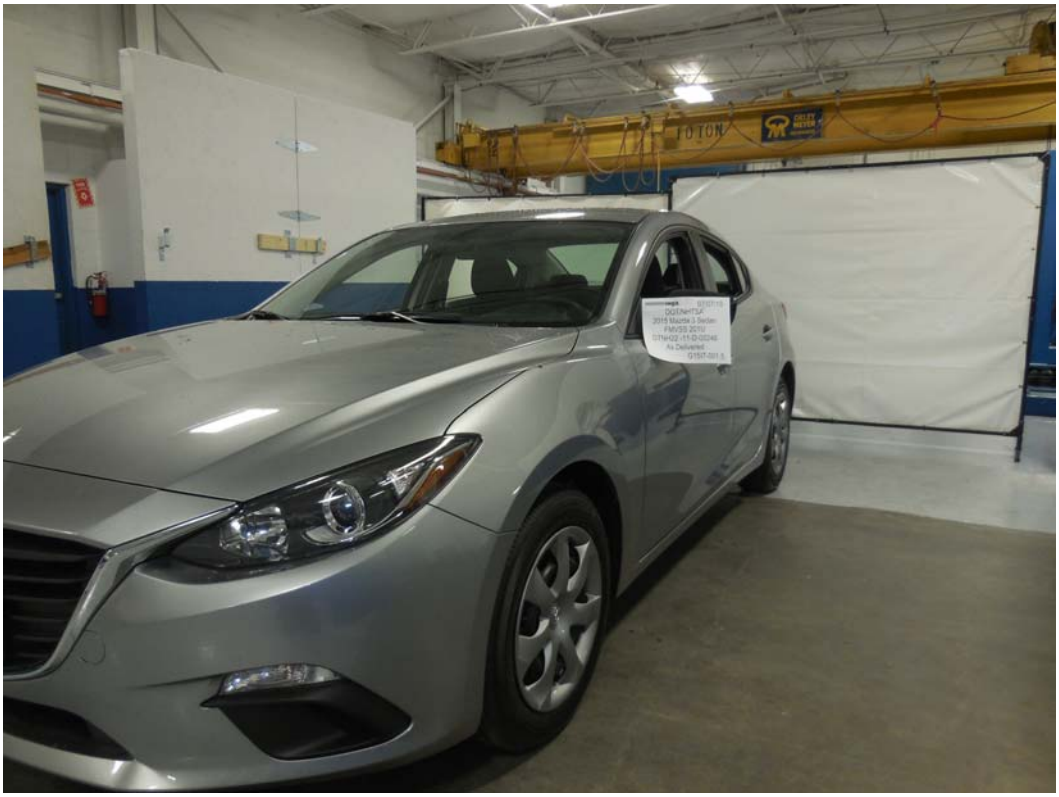
Page 2 of 2

Recorded By: _____ **Approved By:** _____
Date: July 15, 2015

5.0 PHOTOGRAPHS

As Delivered – Left Side View

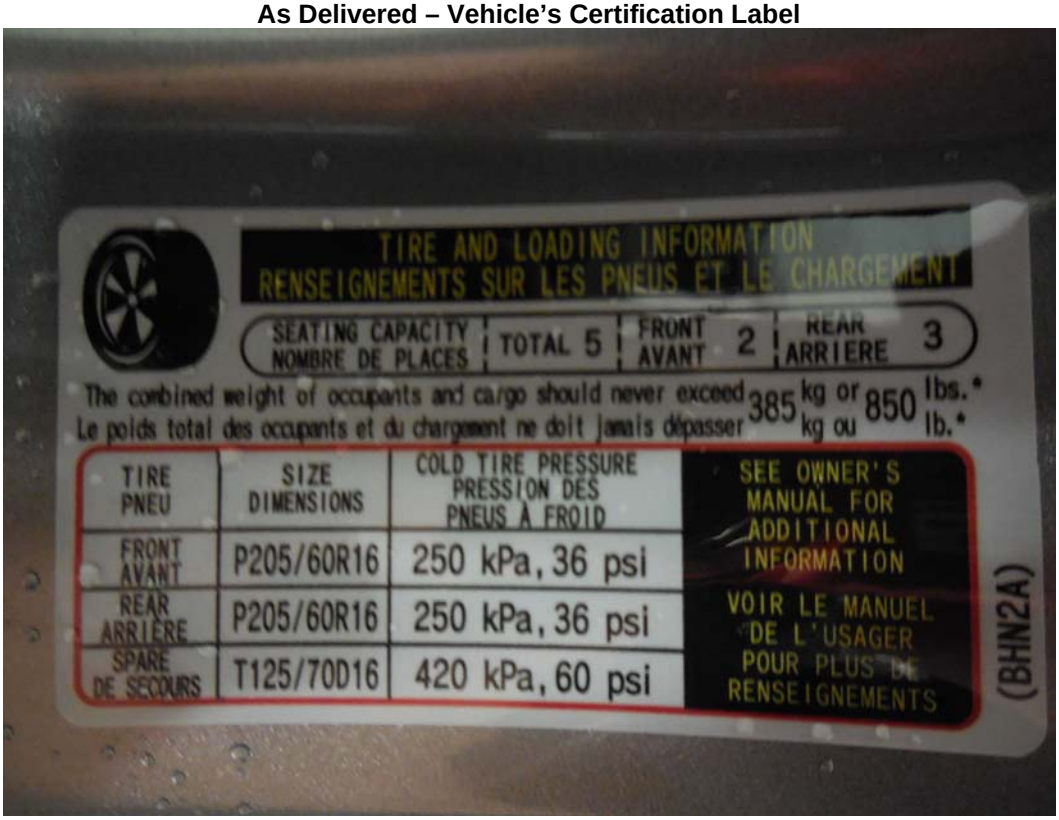
As Delivered – Right Side View



As Delivered – ¾ Front View From Left Side

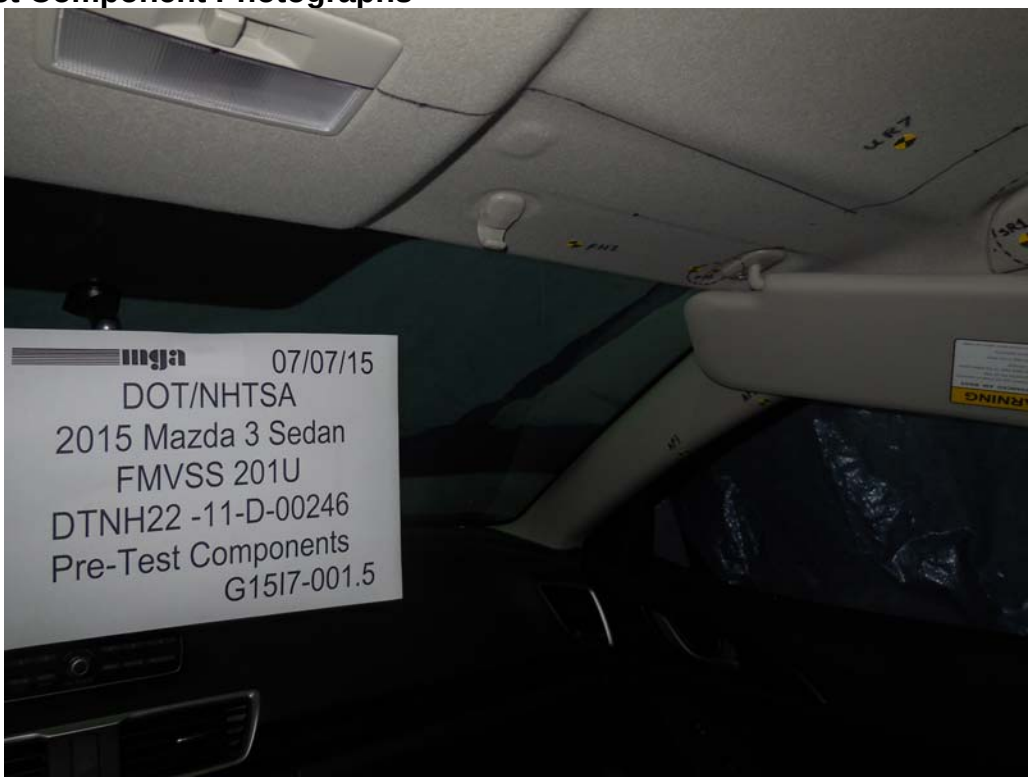
As Delivered – ¾ Rear View From Right Side

As Delivered – Vehicle's Certification Label



As Delivered – Vehicle's Tire Information Label

Pre-Test Component Photographs

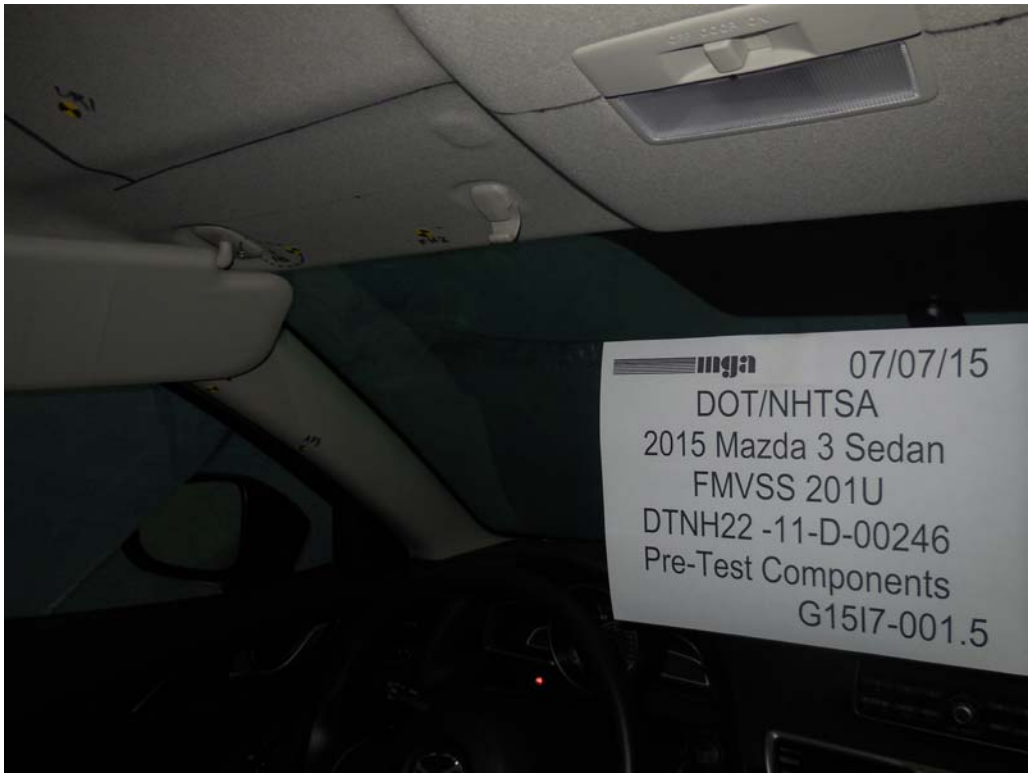



URI0
URI1
URI2
BP1
BP3
BP4
RP1
RP2
mga 07/07/15
DOT/NHTSA
2015 Mazda 3 Sedan
FMVSS 201U
DTNH22 -11-D-00246
Pre-Test Components
G15I7-001.5

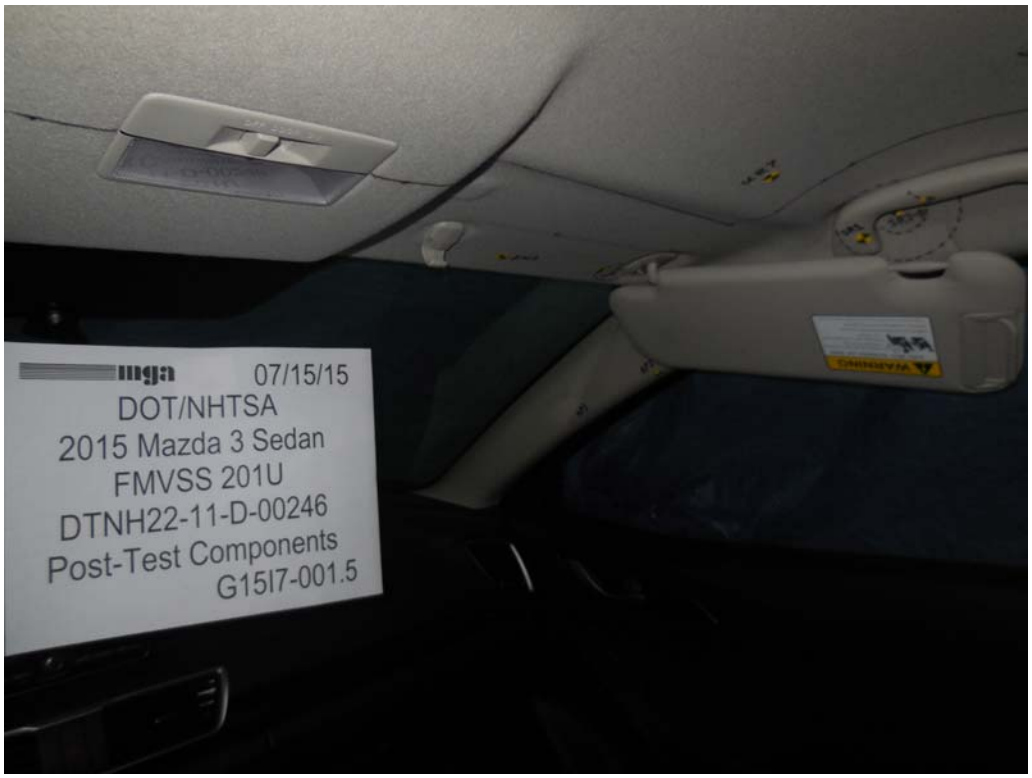

mga 07/07/15
DOT/NHTSA
2015 Mazda 3 Sedan
FMVSS 201U
DTNH22 -11-D-00246
Pre-Test Components
G15I7-001.5


07/07/15
DOT/NHTSA
2015 Mazda 3 Sedan
FMVSS 201U
DTNH22 -11-D-00246
Pre-Test Components
G15I7-001.5

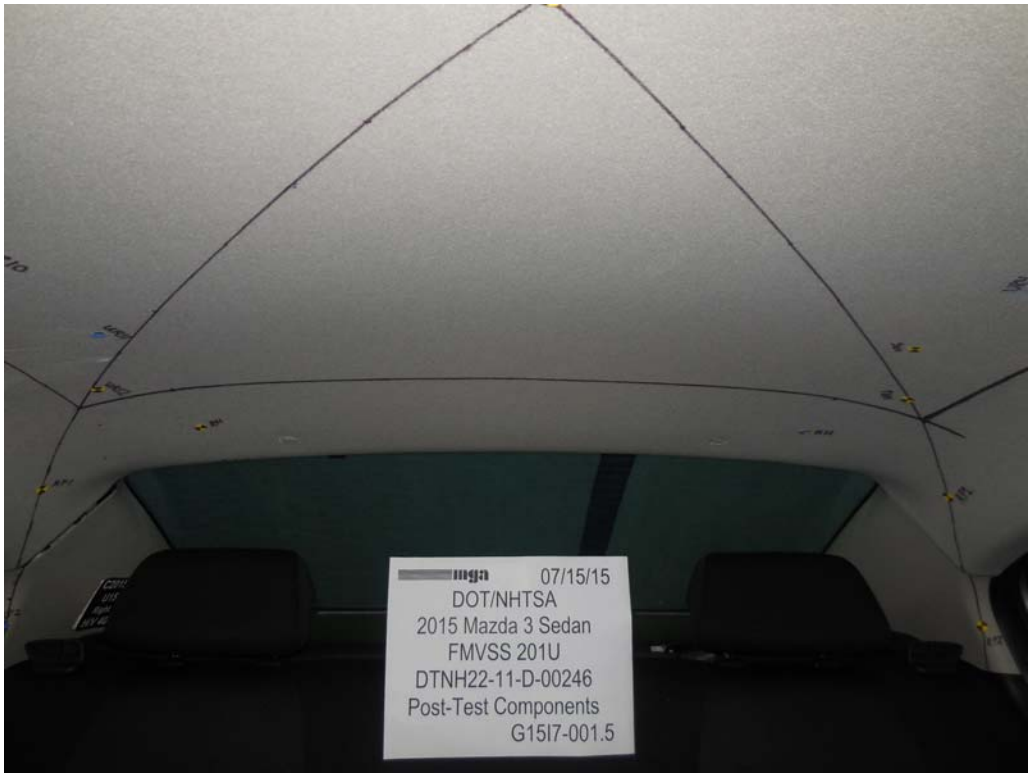

WARNING
07/07/15
DOT/NHTSA
2015 Mazda 3 Sedan
FMVSS 201U
DTNH22 -11-D-00246
Pre-Test Components
G15I7-001.5


mga
07/07/15
DOT/NHTSA
2015 Mazda 3 Sedan
FMVSS 201U
DTNH22 -11-D-00246
Pre-Test Components
G15I7-001.5

Post-Test Component Photographs




URIO
URII
URI2
RP1
RP3
RP2
RP4
mga 07/15/15
DOT/NHTSA
2015 Mazda 3 Sedan
FMVSS 201U
DTNH22-11-D-00246
Post-Test Components
G15I7-001.5


mga 07/15/15
DOT/NHTSA
2015 Mazda 3 Sedan
FMVSS 201U
DTNH22-11-D-00246
Post-Test Components
G15I7-001.5

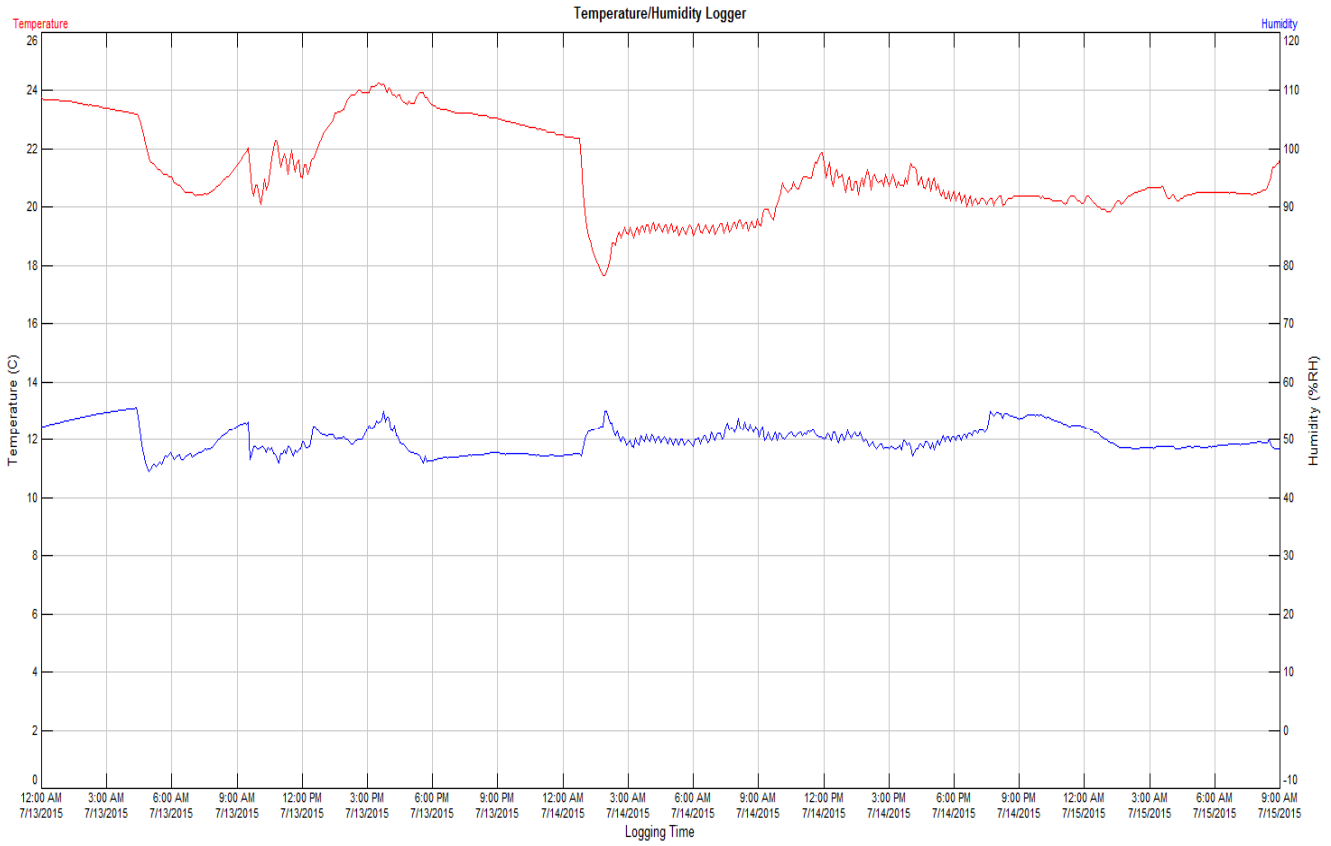

07/15/15
DOT/NHTSA
2015 Mazda 3 Sedan
FMVSS 201U
DTNH22-11-D-00246
Post-Test Components
G15I7-001.5


WARNING
07/15/15
DOT/NHTSA
2015 Mazda 3 Sedan
FMVSS 201U
DTNH22-11-D-00246
Post-Test Components
G15I7-001.5


07/15/15
DOT/NHTSA
2015 Mazda 3 Sedan
FMVSS 201U
DTNH22-11-D-00246
Post-Test Components
G15I7-001.5

Appendix A – Temperature Trace

C20155401
2015 Mazda 3 Sedan
FMVSS 201U



Appendix B – Calibration Certificates

NovaStar SOLUTIONS
Metrology Management Services

Calibration Certificate

ACCREDITED Calibration #1277.01

35200 Plymouth Rd. / Livonia, MI 48150

Certificate # Z54778:103835

PCB 352C03 ACCELEROMETER

SERIAL NUMBER:	95980	WORK ORDER:	TC081814009
ASSET NUMBER:	Z54778	TEST RESULT:	PASS
CUST ASSET NUMBER:	N/A	PERFORMED ON:	08/18/14
PROCEDURE NAME:	MOD 9150	CAL DUE DATE:	08/18/15
PROCEDURE REV:	D	DATA TYPE:	FOUND-LEFT
CALIBRATED BY:	Thomas Cairns	TEMPERATURE:	23.00 °C
CUSTOMER:	MGA RESEARCH 446 EXECUTIVE DRIVE TROY, MI 48083	HUMIDITY:	47 %
PRIMARY CONTACT:	SCOTT ARSEN		

This instrument has been processed and calibrated in accordance with the NovaStar Solutions Quality System Manual and is traceable to the National Institute of Standards and Technology (NIST) or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques. The NovaStar Solutions quality system is accredited ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994.

The results reported herein apply only to the calibration of the item described above. No sampling plan was used for this calibration.

The ratio of the tolerance of the instrument or parameter being calibrated to the expanded uncertainty of the standard (TUR) is greater than 4:1 unless otherwise specified. Expanded uncertainties are expressed at the approximate 95% level of confidence using a K=2. Due to any number of factors, the recommended due date on the item does not imply continuing conformance to specifications during the recommended interval. Unless otherwise stated the unit under test meets or exceeds manufacturer specifications.

For range and best measurement capability specifications for the standards used to perform this calibration, see the most recent calibration report maintained by this calibration laboratory (available upon request).

This report may not be reproduced, except in full, without written approval from NovaStar Solutions.

AS RECEIVED CONDITION:	IN TOLERANCE	REMARKS:
AS RETURNED CONDITION:	IN TOLERANCE	
ACTION TAKEN:	FULL CALIBRATION	

Standards Used

Asset #	Cert #	Description	Cal Date	Due Date
002664	002664:1091515041	VERITEQ 5000A-RH/T RH/TEMPERATURE DATA LOGGER	03/18/2014	03/18/2015
1727	1727:1193650836	MODAL SHOP 9150C ACCELEROMETER CAL SYSTEM	10/29/2013	10/29/2014

QA Signature: Date: 8/20/2014

8/22/2014

- Calibration Certificate -

ID Number	TC081814009
Manufacturer	PCB
Model No.	352C03
Serial No.	95980

Uncertainty @95%K=2; 2.1% @ 5-2000Hz, 2.7 @ 2-10kHz

Key Specifications:

Range	500	+/- g
Resolution	.00005	g
Temperature Range	-65/+250	°F

Calibration Data:

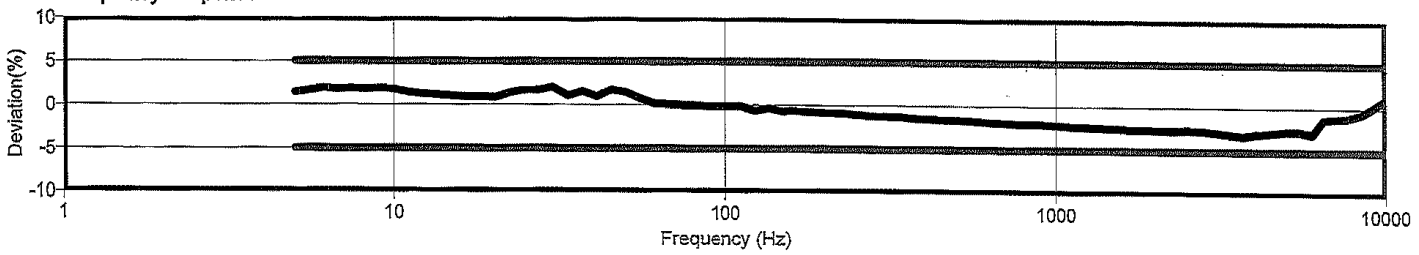
Voltage Sensitivity	9.950	mV/g
Test Accel. Level	1	g

Notes:

Deviation Table

	Frequency(Hz)	Deviation(%)
	5	1.370
	10	1.770
	15	0.968
	30	2.048
	50	1.448
Ref Freq.	100	0.000
	300	-1.191
	500	-1.644
	1000	-2.174
	3000	-2.780
	5000	-2.676
	7000	0.000
	10000	1.121

Frequency Response



NovaStar Solutions
Metrology Management Services

Calibration Date: 08/18/2014
Due Date:
Calibrated by: Tom Cairns

mga research corporation

Certificate of Calibration

Test Accelerometer:

Serial No.: J22700
Model No.: Endevco 7264-2000TZ
Capacity (G's): 2,000
Calibration Date: 11/5/2014
Calibrated By: Scott Arsen
Calibration Time: 15:52:44

Reference Accelerometer:

Serial No.: 95980
Model No.: PCB 352C03
Capacity (G's): 250
Calibration Date: 8/18/2014
Calibrated By: Novastar

Certificate No.: J22700_2014-11-05

		New vs Old
Sensitivity :	0.0263 mV/V/g	0.98 %
DLR (100K Shunt):	94.76 g	-1.02 %

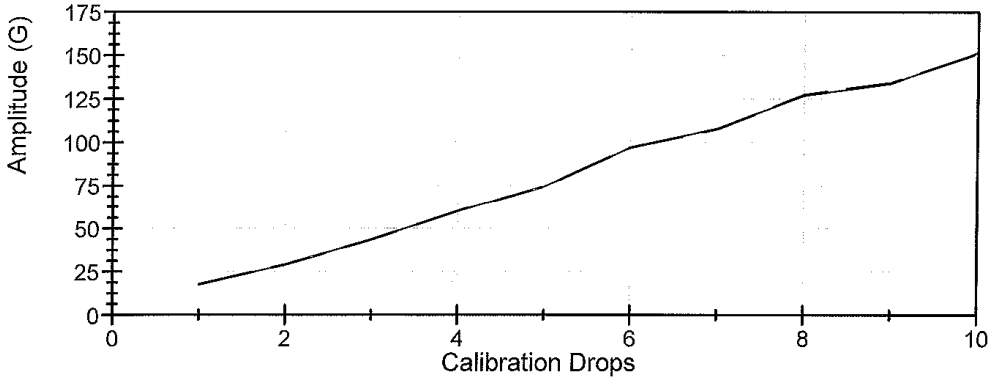
Excitation Voltage: 10 V
Error: 0.3129 %
Linearity (R-Squared): 1.0000

Temperature: 21.9 °C
Relative Humidity: 35.0 %RH
Software Version: CalDLR.vbs v2014.03.05

Approved By: Helen Kaleto

Helen A. Kaleto

Reference (g) vs Predicted (g)



All calibrations are traceable to the National Institute of Standards and Technology.
Estimated uncertainty of the measurement is ±3.816%. All certification data and equipment are on file for inspection at your request.
Best uncertainties represent expanded uncertainties expressed at
approximately the 95% confidence level using a coverage factor k=2.

www.mgaresearch.com 446 Executive Drive, Troy, MI 48083 Phone: (248) 577-5001, Fax: (248) 577-5025

mga research corporation

Certificate of Calibration

Test Accelerometer:

Serial No.: J36197
Model No.: Endevco 7264-2000TZ
Capacity (G's): 2,000
Calibration Date: 11/5/2014
Calibrated By: Scott Arsen
Calibration Time: 15:52:44

Reference Accelerometer:

Serial No.: 95980
Model No.: PCB 352C03
Capacity (G's): 250
Calibration Date: 8/18/2014
Calibrated By: Novastar

Certificate No.: J36197_2014-11-05

		New vs Old
Sensitivity :	0.0230 mV/V/g	0.54 %
DLR (100K Shunt):	108.06 g	-0.47 %

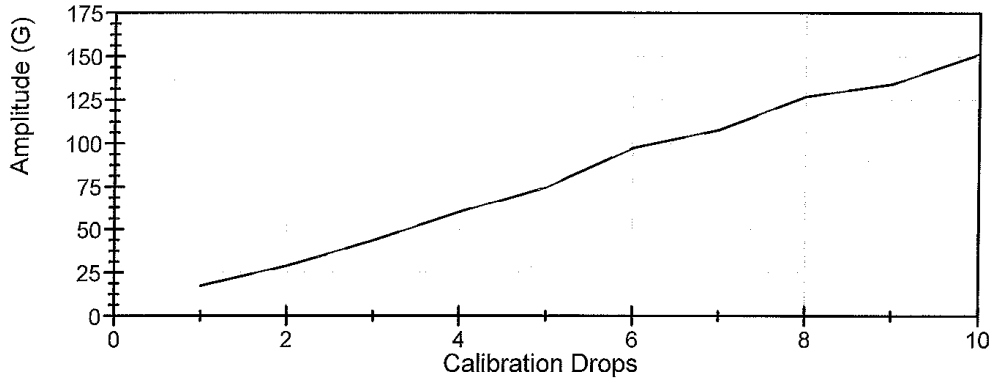
Excitation Voltage: 10 V
Error: 0.2611 %
Linearity (R-Squared): 1.0000

Temperature: 21.9 °C
Relative Humidity: 35.0 %RH
Software Version: CalDLR.vbs v2014.03.05

Approved By: Helen Kaleto

Helen A. Kaleto

Reference (g) vs Predicted (g)



All calibrations are traceable to the National Institute of Standards and Technology.
Estimated uncertainty of the measurement is ±3.816%. All certification data and equipment are on file for inspection at your request.
Best uncertainties represent expanded uncertainties expressed at
approximately the 95% confidence level using a coverage factor k=2.

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mga research corporation

Certificate of Calibration

Test Accelerometer:

Serial No.: J36353
Model No.: Endevco 7264-2000TZ
Capacity (G's): 2,000
Calibration Date: 11/5/2014
Calibrated By: Scott Arsen
Calibration Time: 15:52:44

Reference Accelerometer:

Serial No.: 95980
Model No.: PCB 352C03
Capacity (G's): 250
Calibration Date: 8/18/2014
Calibrated By: Novastar

Certificate No.: J36353_2014-11-05

		New vs Old
Sensitivity :	0.0255 mV/V/g	1.05 %
DLR (100K Shunt):	97.65 g	-1.01 %

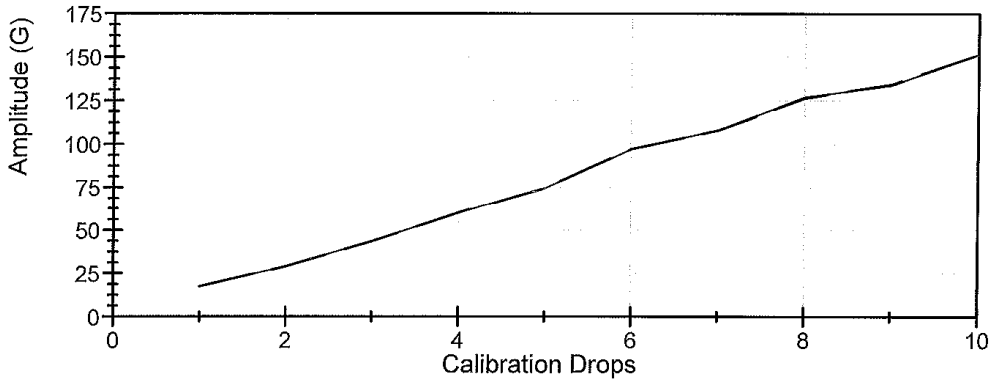
Excitation Voltage: 10 V
Error: 0.4198 %
Linearity (R-Squared): 1.0000

Temperature: 21.9 °C
Relative Humidity: 35.0 %RH
Software Version: CalDLR.vbs v2014.03.05

Approved By: Helen Kaleto

Helen A Kaleto

Reference (g) vs Predicted (g)



All calibrations are traceable to the National Institute of Standards and Technology.
Estimated uncertainty of the measurement is ±3.816%. All certification data and equipment are on file for inspection at your request.
Best uncertainties represent expanded uncertainties expressed at
approximately the 95% confidence level using a coverage factor k=2.

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mga research corporation

Certificate of Calibration

Test Accelerometer:

Serial No.: J40831
Model No.: Endevco 7264-2000TZ
Capacity (G's): 2,000
Calibration Date: 11/5/2014
Calibrated By: Scott Arsen
Calibration Time: 15:02:26

Reference Accelerometer:

Serial No.: 95980
Model No.: PCB 352C03
Capacity (G's): 250
Calibration Date: 8/18/2014
Calibrated By: Novastar

Certificate No.: J40831_2014-11-05

		New vs Old
Sensitivity :	0.0259 mV/V/g	-0.27 %
DLR (100K Shunt):	95.91 g	0.24 %

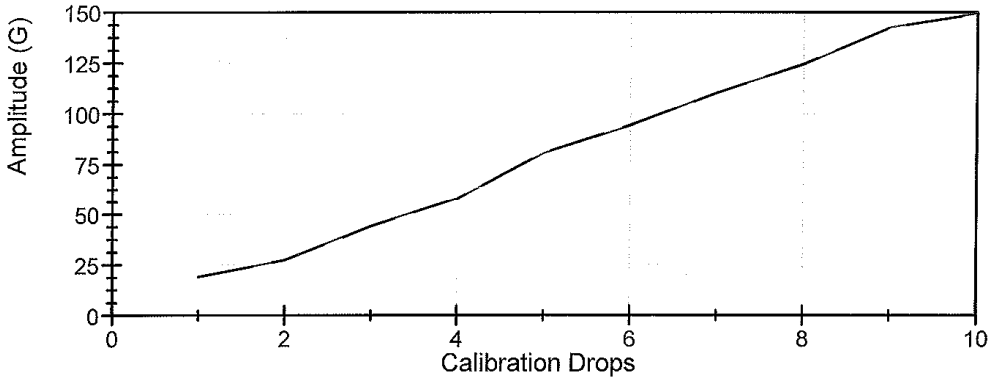
Excitation Voltage: 10 V
Error: 0.2593 %
Linearity (R-Squared): 1.0000

Temperature: 21.9 °C
Relative Humidity: 35.0 %RH
Software Version: CalDLR.vbs v2014.03.05

Approved By: Helen Kaleto

Helen A. Kaleto

Reference (g) vs Predicted (g)



All calibrations are traceable to the National Institute of Standards and Technology.
Estimated uncertainty of the measurement is ±3.816%. All certification data and equipment are on file for inspection at your request.
Best uncertainties represent expanded uncertainties expressed at
approximately the 95% confidence level using a coverage factor k=2.

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mga research corporation

Certificate of Calibration

Test Accelerometer:

Serial No.: J40834
Model No.: Endevco 7264-2000TZ
Capacity (G's): 2,000
Calibration Date: 11/5/2014
Calibrated By: Scott Arsen
Calibration Time: 15:02:26

Reference Accelerometer:

Serial No.: 95980
Model No.: PCB 352C03
Capacity (G's): 250
Calibration Date: 8/18/2014
Calibrated By: Novastar

Certificate No.: J40834_2014-11-05

		New vs Old
Sensitivity :	0.0282 mV/V/g	-0.12 %
DLR (100K Shunt):	88.35 g	0.09 %

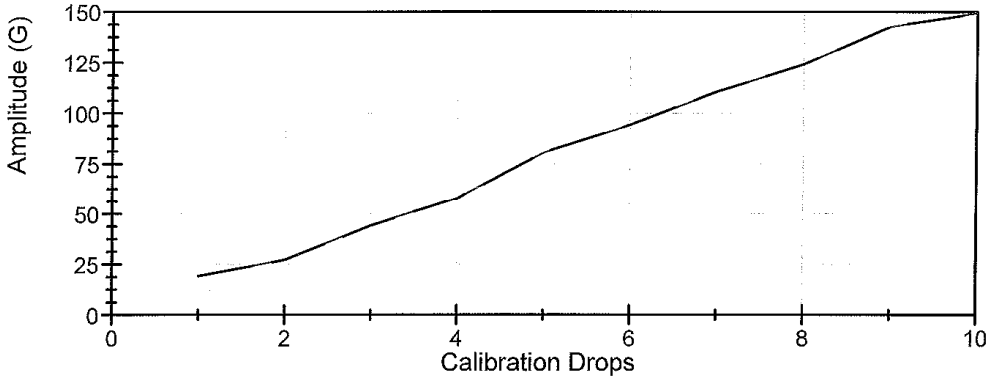
Excitation Voltage: 10 V
Error: 0.1401 %
Linearity (R-Squared): 1.0000

Temperature: 21.9 °C
Relative Humidity: 35.0 %RH
Software Version: CalDLR.vbs v2014.03.05

Approved By: Helen Kaleto

Helen A. Kaleto

Reference (g) vs Predicted (g)



All calibrations are traceable to the National Institute of Standards and Technology.
Estimated uncertainty of the measurement is ±3.816%. All certification data and equipment are on file for inspection at your request.
Best uncertainties represent expanded uncertainties expressed at
approximately the 95% confidence level using a coverage factor k=2.

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mga research corporation

Certificate of Calibration

Test Accelerometer:

Serial No.: J40819
Model No.: Endevco 7264-2000TZ
Capacity (G's): 2,000
Calibration Date: 11/4/2014
Calibrated By: Scott Arsen
Calibration Time: 16:36:43

Reference Accelerometer:

Serial No.: 95980
Model No.: PCB 352C03
Capacity (G's): 250
Calibration Date: 8/18/2014
Calibrated By: Novastar

Certificate No.: J40819_2014-11-04

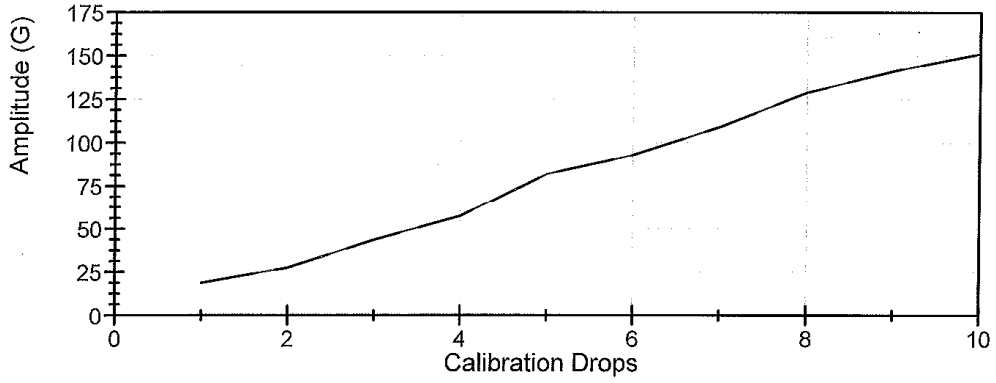
		New vs Old
Sensitivity :	0.0229 mV/V/g	-0.02 %
DLR (100K Shunt):	108.66 g	0.13 %

Excitation Voltage: 10 V
Error: 0.1301 %
Linearity (R-Squared): 1.0000

Temperature: 22.4 °C
Relative Humidity: 54.0 %RH
Software Version: CalDLR.vbs v2014.03.05

Approved By: Helen Kaleto

Reference (g) vs Predicted (g)



All calibrations are traceable to the National Institute of Standards and Technology.
Estimated uncertainty of the measurement is ±3.816%. All certification data and equipment are on file for inspection at your request.
Best uncertainties represent expanded uncertainties expressed at
approximately the 95% confidence level using a coverage factor k=2.

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Certificate of Calibration

Test Accelerometer:

Serial No.: J40883
Model No.: Endevco 7264-2000TZ
Capacity (G's): 2,000
Calibration Date: 11/5/2014
Calibrated By: Scott Arsen
Calibration Time: 15:02:26

Reference Accelerometer:

Serial No.: 95980
Model No.: PCB 352C03
Capacity (G's): 250
Calibration Date: 8/18/2014
Calibrated By: Novastar

Certificate No.: J40883_2014-11-05

		New vs Old
Sensitivity :	0.0227 mV/V/g	0.08 %
DLR (100K Shunt):	109.52 g	0.12 %

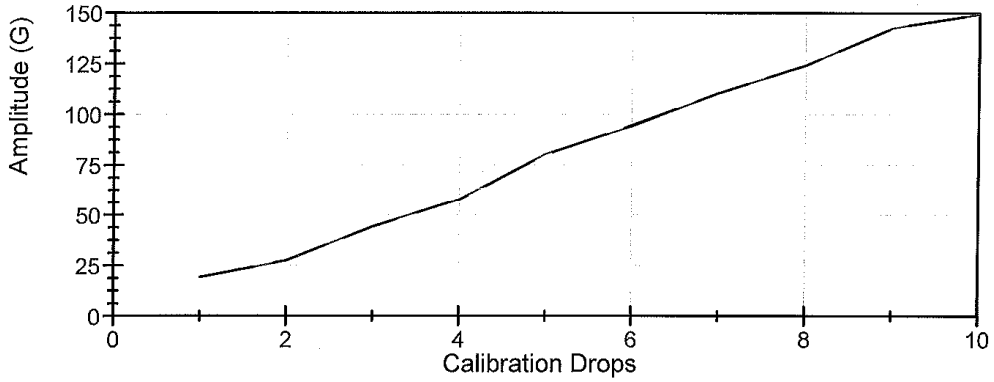
Excitation Voltage: 10 V
Error: 0.3407 %
Linearity (R-Squared): 1.0000

Temperature: 21.9 °C
Relative Humidity: 35.0 %RH
Software Version: CalDLR.vbs v2014.03.05

Approved By: Helen Kaleto

Helen A. Kaleto

Reference (g) vs Predicted (g)



All calibrations are traceable to the National Institute of Standards and Technology.
Estimated uncertainty of the measurement is ±3.816%. All certification data and equipment are on file for inspection at your request.
Best uncertainties represent expanded uncertainties expressed at
approximately the 95% confidence level using a coverage factor k=2.

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mga research corporation

Certificate of Calibration

Test Accelerometer:

Serial No.: J40863
Model No.: Endevco 7264-2000TZ
Capacity (G's): 2,000
Calibration Date: 11/5/2014
Calibrated By: Scott Arsen
Calibration Time: 15:02:26

Reference Accelerometer:

Serial No.: 95980
Model No.: PCB 352C03
Capacity (G's): 250
Calibration Date: 8/18/2014
Calibrated By: Novastar

Certificate No.: J40863_2014-11-05

		New vs Old
Sensitivity :	0.0320 mV/V/g	0.11 %
DLR (100K Shunt):	77.65 g	0.03 %

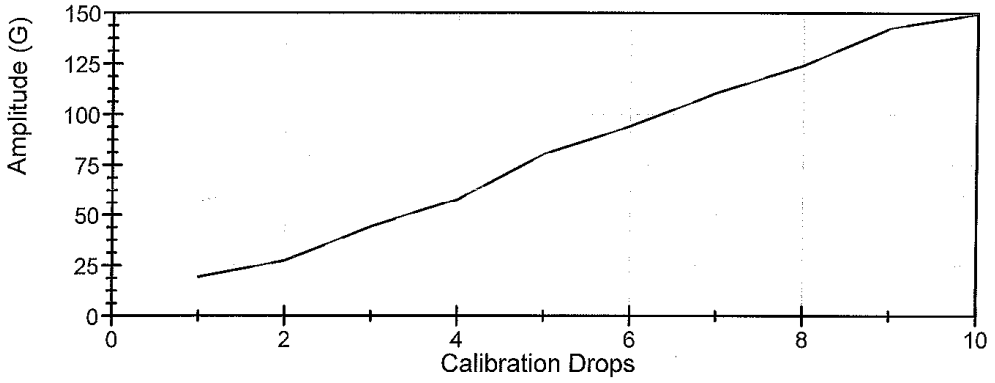
Excitation Voltage: 10 V
Error: 0.1264 %
Linearity (R-Squared): 1.0000

Temperature: 21.9 °C
Relative Humidity: 35.0 %RH
Software Version: CalDLR.vbs v2014.03.05

Approved By: Helen Kaleto

Helen A. Kaleto

Reference (g) vs Predicted (g)



All calibrations are traceable to the National Institute of Standards and Technology.
Estimated uncertainty of the measurement is ±3.816%. All certification data and equipment are on file for inspection at your request.
Best uncertainties represent expanded uncertainties expressed at
approximately the 95% confidence level using a coverage factor k=2.

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mga research corporation

Certificate of Calibration

Test Accelerometer:

Serial No.: J45309
Model No.: Endevco 7264-2000TZ
Capacity (G's): 2,000
Calibration Date: 11/5/2014
Calibrated By: Scott Arsen
Calibration Time: 15:02:26

Reference Accelerometer:

Serial No.: 95980
Model No.: PCB 352C03
Capacity (G's): 250
Calibration Date: 8/18/2014
Calibrated By: Novastar

Certificate No.: J45309_2014-11-05

		New vs Old
Sensitivity :	0.0242 mV/V/g	0.46 %
DLR (100K Shunt):	102.67 g	-0.68 %

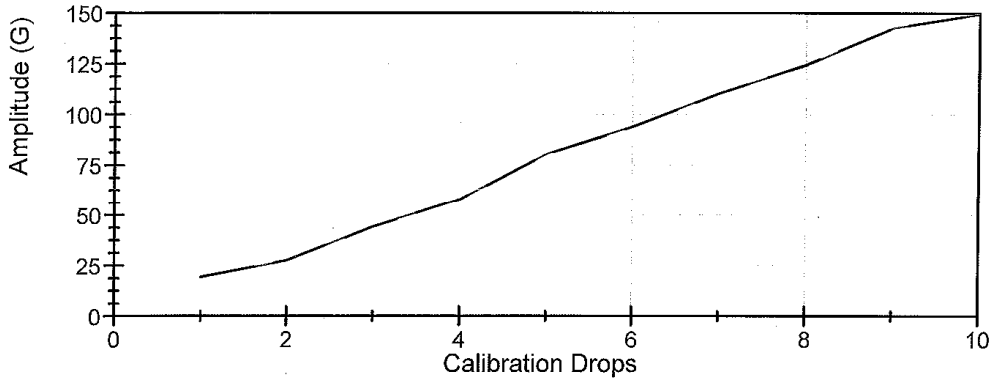
Excitation Voltage: 10 V
Error: 0.2235 %
Linearity (R-Squared): 1.0000

Temperature: 21.9 °C
Relative Humidity: 35.0 %RH
Software Version: CalDLR.vbs v2014.03.05

Approved By: Helen Kaleto

Helen A Kaleto

Reference (g) vs Predicted (g)



All calibrations are traceable to the National Institute of Standards and Technology.
Estimated uncertainty of the measurement is ±3.816%. All certification data and equipment are on file for inspection at your request.
Best uncertainties represent expanded uncertainties expressed at
approximately the 95% confidence level using a coverage factor k=2.

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DTS
41204 Bridge Street, Novi, MI 48375-1301 USA
Phone: +1 248-427-0045 • Fax: +1 248-427-0630
www.dtsweb.com

ilac-MRA ACCREDITED
Calibration CERT# 3007.01

Certificate of Calibration

Model #:	Sensor Input Module	Certificate #:	2015319LM0321
Serial #:	LM0321	Date Received:	15 March 2015
Firmware:	07E4	Date Calibrated:	19 March 2015
Procedure Name:	SIM Calibration Revision: 2.2	Next Calibration:	19 March 2016
Order Number:	RA27091	Item Received:	In Tolerance
Customer:	MGA Troy	Item Returned:	In Tolerance
	446 Executive Drive	Temperature:	77°F/25.0°C
	Troy, MI 48083	Humidity:	28 %

DTS has been audited by the American Association for Laboratory Accreditation (A2LA) and found in compliance with ISO/IEC 17025:2005. Accredited calibrations performed within the DTS Scope of Accreditation are indicated by the presence of the A2LA Logo and Certificate Number on this Certificate of Calibration.

DTS reference standards are processed and calibrated in accordance with the DTS Quality Assurance System, and traceable to the National Institute of Standards and Technology (NIST).

All calibrations have been performed using processes having a test uncertainty ratio of four or more times greater than the unit calibrated, unless otherwise noted on the report. Uncertainties have been estimated at a 95 percent confidence level (k=2). Calibration at a 4:1 TUR provides reasonable confidence that the instrument is within the manufacturer's published specifications.

The reported data is the raw recorded data and is not corrected for uncertainty or environmental effects. Any number of factors can cause a unit to drift out of tolerance at any time following its calibration.

This report only applies only to the item(s) identified above, and shall not be reproduced except in full, without the written approval of DTS. Limitations on the uses of this instrument are detailed in the manufacturer's operating instructions.

Remarks:

Standards Used

Serial #	Manufacturer	Model #	Description	Cal Date	Due Date
MY42006281	Agilent	34420A	Nano Volt, Micro-Ohm Meter, 7.5 Digit	1-Nov-2014	1-Nov-2015
MY44062354	Agilent	33220A	Function/Arbitrary Waveform Generator, 20 MHz	28-Oct-2014	28-Oct-2015
CAL005	DTS	CALSTAT	TDAS Calibration Station	24-Nov-2014	24-Nov-2015

Results

Test Description	Test Result	
	As Received	As Returned
Battery Changed	N/A	N/A
Visual Inspection	Pass	Pass
Basic Channel Functions	Pass	Pass
Calibration DAC Accuracy	Pass	Pass
Shunt Resistor Accuracy	Pass	Pass
Excitation Sources	Pass	Pass
Gain Accuracy	Pass	Pass
Frequency Response	Pass	Pass
Timebase Accuracy	Pass	Pass
T=0 Trigger Function	Pass	Pass
Time Skew	Pass	Pass
Noise Level	Pass	Pass

Calibrated By: Bob Colenso
Bob Colenso
Technical Support Engineer

Calibration Site: 41204 Bridge Street
Novi, MI 48375

DB 3/24/15

DTS

Serial #: LM0321
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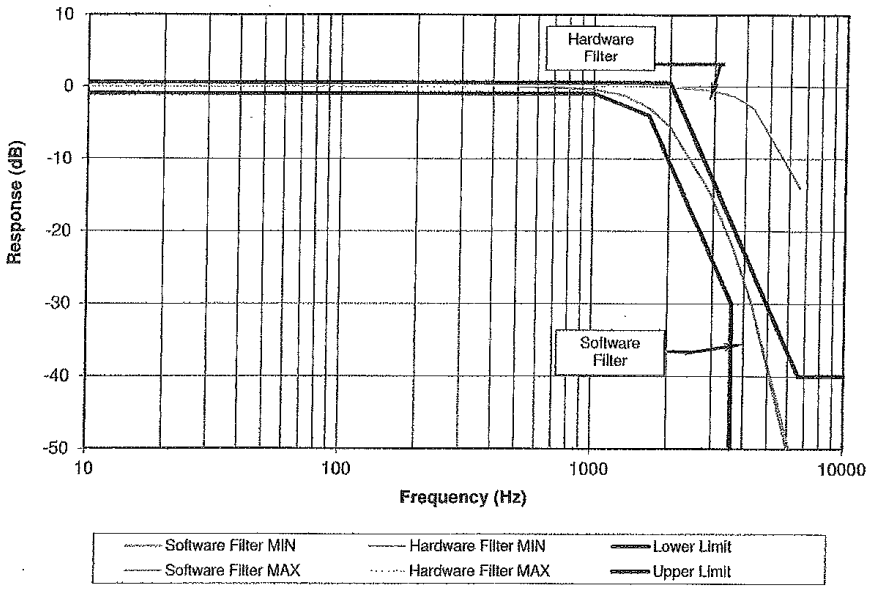
Date: 19 March 2015

Class 1000 System Response vs. SAE J211 (March 2014)
All 8 channels typically overlap due to very tight control of component tolerances.
Only the minimum and maximum response of the 8 channels are shown for clarity.



Test Description
Filter Response-Software

	Limit		As Received/Returned Std	db	Uncertainty (mV)	Pass/ Fail
Channel 1						
10Hz	0.5db	-0.75db	1.414 mV	0.000	2.1E-04	Pass
500Hz	0.5db	-0.96db	1.414 mV	-0.003	1.2E-03	Pass
1000Hz	0.5db	-1db	1.347 mV	-0.422	2.2E-03	Pass
1325Hz	0.5db	-2.69db	1.218 mV	-1.296	3.7E-03	Pass
1650Hz	0.5db	-4db	1.013 mV	-2.899	2.7E-03	Pass
2000Hz	0.5db	-10.66db	0.750 mV	-5.510	2.5E-03	Pass
2900Hz	-12.37db	-23.53db	0.265 mV	-14.558	1.8E-03	Pass
3575Hz	-19.61db	-999db	0.112 mV	-22.004	1.0E-03	Pass
4300Hz	-26db	-999db	0.044 mV	-30.066	5.0E-04	Pass
6600Hz	-40db	-999db	0.003 mV	-54.053	5.6E-04	Pass

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Test Description
Filter Response-Software

	Limit		As Received/Returned Std	db	Uncertainty (mV)	Pass/ Fail
Channel 2						
10Hz	0.5db	-0.75db	1.414 mV	0.000	2.1E-04	Pass
500Hz	0.5db	-0.96db	1.413 mV	-0.005	1.3E-03	Pass
1000Hz	0.5db	-1db	1.346 mV	-0.005	2.2E-03	Pass
1325Hz	0.5db	-2.69db	1.216 mV	-1.310	4.0E-03	Pass
1650Hz	0.5db	-4db	1.011 mV	-2.918	2.6E-03	Pass
2000Hz	0.5db	-10.66db	0.748 mV	-5.536	2.9E-03	Pass
2900Hz	-12.37db	-23.53db	0.263 mV	-14.596	2.1E-03	Pass
3575Hz	-19.61db	-999db	0.112 mV	-22.032	1.1E-03	Pass
4300Hz	-26db	-999db	0.044 mV	-30.057	6.3E-04	Pass
6600Hz	-40db	-999db	0.003 mV	-54.503	5.1E-04	Pass
Channel 3						
10Hz	0.5db	-0.75db	1.414 mV	0.000	2.1E-04	Pass
500Hz	0.5db	-0.96db	1.414 mV	-0.003	1.3E-03	Pass
1000Hz	0.5db	-1db	1.347 mV	-0.003	2.1E-03	Pass
1325Hz	0.5db	-2.69db	1.218 mV	-1.296	3.0E-03	Pass
1650Hz	0.5db	-4db	1.013 mV	-2.896	2.6E-03	Pass
2000Hz	0.5db	-10.66db	0.750 mV	-5.507	9.1E-04	Pass
2900Hz	-12.37db	-23.53db	0.265 mV	-14.559	1.6E-03	Pass
3575Hz	-19.61db	-999db	0.112 mV	-22.009	9.1E-04	Pass
4300Hz	-26db	-999db	0.044 mV	-30.082	5.9E-04	Pass
6600Hz	-40db	-999db	0.002 mV	-55.105	4.5E-04	Pass
Channel 4						
10Hz	0.5db	-0.75db	1.414 mV	0.000	1.8E-04	Pass
500Hz	0.5db	-0.96db	1.414 mV	-0.004	1.3E-03	Pass
1000Hz	0.5db	-1db	1.346 mV	-0.004	2.0E-03	Pass
1325Hz	0.5db	-2.69db	1.217 mV	-1.306	3.7E-03	Pass
1650Hz	0.5db	-4db	1.012 mV	-2.910	2.4E-03	Pass
2000Hz	0.5db	-10.66db	0.749 mV	-5.524	2.1E-03	Pass
2900Hz	-12.37db	-23.53db	0.264 mV	-14.581	1.6E-03	Pass
3575Hz	-19.61db	-999db	0.112 mV	-22.023	9.6E-04	Pass
4300Hz	-26db	-999db	0.044 mV	-30.066	5.2E-04	Pass
6600Hz	-40db	-999db	0.002 mV	-55.555	4.6E-04	Pass
Channel 5						
10Hz	0.5db	-0.75db	1.414 mV	0.000	2.2E-04	Pass
500Hz	0.5db	-0.96db	1.413 mV	-0.005	1.3E-03	Pass
1000Hz	0.5db	-1db	1.346 mV	-0.005	2.4E-03	Pass
1325Hz	0.5db	-2.69db	1.216 mV	-1.313	3.9E-03	Pass
1650Hz	0.5db	-4db	1.011 mV	-2.918	2.7E-03	Pass
2000Hz	0.5db	-10.66db	0.748 mV	-5.533	2.7E-03	Pass
2900Hz	-12.37db	-23.53db	0.264 mV	-14.594	1.9E-03	Pass
3575Hz	-19.61db	-999db	0.112 mV	-22.030	1.1E-03	Pass
4300Hz	-26db	-999db	0.044 mV	-30.051	5.9E-04	Pass
6600Hz	-40db	-999db	0.002 mV	-55.892	3.7E-04	Pass

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Test Description

Filter Response-Software

	Limit		As Received/Returned Std	db	Uncertainty (mV)	Pass/ Fail
Channel 6						
10Hz	0.5db	-0.75db	1.414 mV	0.000	2.3E-04	Pass
500Hz	0.5db	-0.96db	1.414 mV	-0.003	1.4E-03	Pass
1000Hz	0.5db	-1db	1.346 mV	-0.003	1.9E-03	Pass
1325Hz	0.5db	-2.69db	1.217 mV	-1.304	3.8E-03	Pass
1650Hz	0.5db	-4db	1.012 mV	-2.903	2.5E-03	Pass
2000Hz	0.5db	-10.66db	0.750 mV	-5.511	2.5E-03	Pass
2900Hz	-12.37db	-23.53db	0.265 mV	-14.550	1.9E-03	Pass
3575Hz	-19.61db	-999db	0.113 mV	-21.969	1.2E-03	Pass
4300Hz	-26db	-999db	0.045 mV	-29.977	6.6E-04	Pass
6600Hz	-40db	-999db	0.002 mV	-55.872	4.0E-04	Pass
Channel 7						
10Hz	0.5db	-0.75db	1.414 mV	0.000	1.8E-04	Pass
500Hz	0.5db	-0.96db	1.414 mV	-0.003	1.2E-03	Pass
1000Hz	0.5db	-1db	1.346 mV	-0.003	2.3E-03	Pass
1325Hz	0.5db	-2.69db	1.217 mV	-1.304	3.6E-03	Pass
1650Hz	0.5db	-4db	1.013 mV	-2.902	2.7E-03	Pass
2000Hz	0.5db	-10.66db	0.750 mV	-5.509	2.5E-03	Pass
2900Hz	-12.37db	-23.53db	0.265 mV	-14.550	1.7E-03	Pass
3575Hz	-19.61db	-999db	0.113 mV	-21.972	1.0E-03	Pass
4300Hz	-26db	-999db	0.045 mV	-29.990	6.1E-04	Pass
6600Hz	-40db	-999db	0.002 mV	-55.822	4.8E-04	Pass
Channel 8						
10Hz	0.5db	-0.75db	1.414 mV	0.000	2.1E-04	Pass
500Hz	0.5db	-0.96db	1.414 mV	-0.002	1.3E-03	Pass
1000Hz	0.5db	-1db	1.347 mV	-0.002	2.1E-03	Pass
1325Hz	0.5db	-2.69db	1.218 mV	-1.299	3.9E-03	Pass
1650Hz	0.5db	-4db	1.013 mV	-2.894	2.4E-03	Pass
2000Hz	0.5db	-10.66db	0.751 mV	-5.495	2.4E-03	Pass
2900Hz	-12.37db	-23.53db	0.266 mV	-14.518	1.8E-03	Pass
3575Hz	-19.61db	-999db	0.113 mV	-21.922	1.1E-03	Pass
4300Hz	-26db	-999db	0.045 mV	-29.917	7.1E-04	Pass
6600Hz	-40db	-999db	0.002 mV	-55.266	5.4E-04	Pass

Cal DAC	Lower Limit	Upper Limit	As Received/Returned UUT	Uncertainty (Vdc)	Pass/ Fail
0 Vdc	-0.0005 Vdc	0.0005 Vdc	0.0000 Vdc	6.2E-05	Pass
1.2 Vdc	1.1975 Vdc	1.2025 Vdc	1.1997 Vdc	9.1E-05	Pass
2.4 Vdc	2.3975 Vdc	2.4025 Vdc	2.3996 Vdc	1.1E-04	Pass

10V Excitation Short Circuit Recovery

Channel 1	9.8 Vdc	N/A	9.982 Vdc	1.3E-02	Pass
Channel 2	9.8 Vdc	N/A	9.978 Vdc	9.8E-03	Pass
Channel 3	9.8 Vdc	N/A	9.975 Vdc	1.1E-02	Pass
Channel 4	9.8 Vdc	N/A	9.982 Vdc	9.6E-03	Pass
Channel 5	9.8 Vdc	N/A	9.985 Vdc	1.1E-02	Pass
Channel 6	9.8 Vdc	N/A	9.982 Vdc	1.3E-02	Pass
Channel 7	9.8 Vdc	N/A	9.981 Vdc	1.0E-02	Pass
Channel 8	9.8 Vdc	N/A	9.974 Vdc	9.2E-03	Pass

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Test Description

			As Received/Returned		
	Lower Limit	**Upper Limit**	**UUT**	**Uncertainty (Vdc)**	**Pass/ Fail**
10V Excitation 154 Ohm Startup Load					
Channel 1	9.8 Vdc	N/A	9.982 Vdc	1.3E-02	Pass
Channel 2	9.8 Vdc	N/A	9.978 Vdc	1.0E-02	Pass
Channel 3	9.8 Vdc	N/A	9.975 Vdc	1.2E-02	Pass
Channel 4	9.8 Vdc	N/A	9.982 Vdc	9.7E-03	Pass
Channel 5	9.8 Vdc	N/A	9.985 Vdc	1.1E-02	Pass
Channel 6	9.8 Vdc	N/A	9.982 Vdc	1.3E-02	Pass
Channel 7	9.8 Vdc	N/A	9.981 Vdc	1.1E-02	Pass
Channel 8	9.8 Vdc	N/A	9.974 Vdc	9.7E-03	Pass
10V Excitation 350 Ohm Load Test					
Channel 1	9.95 Vdc	10.05 Vdc	9.983 Vdc	1.3E-02	Pass
Channel 2	9.95 Vdc	10.05 Vdc	9.978 Vdc	9.8E-03	Pass
Channel 3	9.95 Vdc	10.05 Vdc	9.976 Vdc	1.1E-02	Pass
Channel 4	9.95 Vdc	10.05 Vdc	9.983 Vdc	9.8E-03	Pass
Channel 5	9.95 Vdc	10.05 Vdc	9.984 Vdc	1.1E-02	Pass
Channel 6	9.95 Vdc	10.05 Vdc	9.983 Vdc	1.3E-02	Pass
Channel 7	9.95 Vdc	10.05 Vdc	9.981 Vdc	1.0E-02	Pass
Channel 8	9.95 Vdc	10.05 Vdc	9.975 Vdc	9.1E-03	Pass
10V Excitation 200 Ohm Load Test					
Channel 1	9.9 Vdc	10.1 Vdc	9.978 Vdc	1.3E-02	Pass
Channel 2	9.9 Vdc	10.1 Vdc	9.971 Vdc	1.0E-02	Pass
Channel 3	9.9 Vdc	10.1 Vdc	9.970 Vdc	1.1E-02	Pass
Channel 4	9.9 Vdc	10.1 Vdc	9.978 Vdc	1.0E-02	Pass
Channel 5	9.9 Vdc	10.1 Vdc	9.979 Vdc	1.1E-02	Pass
Channel 6	9.9 Vdc	10.1 Vdc	9.977 Vdc	1.4E-02	Pass
Channel 7	9.9 Vdc	10.1 Vdc	9.975 Vdc	1.1E-02	Pass
Channel 8	9.9 Vdc	10.1 Vdc	9.968 Vdc	9.5E-03	Pass
5V Excitation Short Circuit Recovery					
Channel 1	4.9 Vdc	N/A	4.990 Vdc	1.2E-02	Pass
Channel 2	4.9 Vdc	N/A	4.991 Vdc	9.7E-03	Pass
Channel 3	4.9 Vdc	N/A	4.988 Vdc	1.0E-02	Pass
Channel 4	4.9 Vdc	N/A	4.995 Vdc	8.3E-03	Pass
Channel 5	4.9 Vdc	N/A	4.992 Vdc	9.8E-03	Pass
Channel 6	4.9 Vdc	N/A	4.992 Vdc	1.2E-02	Pass
Channel 7	4.9 Vdc	N/A	4.996 Vdc	1.0E-02	Pass
Channel 8	4.9 Vdc	N/A	4.981 Vdc	7.6E-03	Pass
5V Excitation 100 Ohm Load					
Channel 1	4.9 Vdc	5.1 Vdc	4.974 Vdc	1.3E-02	Pass
Channel 2	4.9 Vdc	5.1 Vdc	4.975 Vdc	1.0E-02	Pass
Channel 3	4.9 Vdc	5.1 Vdc	4.972 Vdc	1.1E-02	Pass
Channel 4	4.9 Vdc	5.1 Vdc	4.977 Vdc	8.5E-03	Pass
Channel 5	4.9 Vdc	5.1 Vdc	4.979 Vdc	1.2E-02	Pass
Channel 6	4.9 Vdc	5.1 Vdc	4.974 Vdc	1.3E-02	Pass
Channel 7	4.9 Vdc	5.1 Vdc	4.981 Vdc	1.0E-02	Pass
Channel 8	4.9 Vdc	5.1 Vdc	4.959 Vdc	8.9E-03	Pass

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Test Description

			As Received/Returned		
	Lower Limit	Upper Limit	UUT	Uncertainty (Vdc)	Pass/ Fail
5V Excitation 350 Ohm Load Test					
Channel 1	4.95 Vdc	5.05 Vdc	4.990 Vdc	1.2E-02	Pass
Channel 2	4.95 Vdc	5.05 Vdc	4.991 Vdc	9.7E-03	Pass
Channel 3	4.95 Vdc	5.05 Vdc	4.988 Vdc	1.0E-02	Pass
Channel 4	4.95 Vdc	5.05 Vdc	4.994 Vdc	8.3E-03	Pass
Channel 5	4.95 Vdc	5.05 Vdc	4.992 Vdc	9.9E-03	Pass
Channel 6	4.95 Vdc	5.05 Vdc	4.992 Vdc	1.2E-02	Pass
Channel 7	4.95 Vdc	5.05 Vdc	4.996 Vdc	1.0E-02	Pass
Channel 8	4.95 Vdc	5.05 Vdc	4.981 Vdc	7.6E-03	Pass

Gain Response

Gain of 5: 1000mV			As Received/Returned			
	Limit	Std	UUT	Deviation	Uncertainty	Pass/
Channel 1		(mV)	(mV)	(%)	(mV)	Fail
-70%	+/-0.5%	-699.71	-700.21	-0.050	2.7E-01	Pass
-35%	+/-0.5%	-349.84	-350.12	-0.028	1.9E-01	Pass
35%	+/-0.5%	349.70	349.88	0.017	2.0E-01	Pass
70%	+/-0.5%	699.57	699.78	0.021	2.4E-01	Pass
Channel 2						
-70%	+/-0.5%	-699.71	-700.19	-0.048	2.1E-01	Pass
-35%	+/-0.5%	-349.84	-350.02	-0.018	1.6E-01	Pass
35%	+/-0.5%	349.70	349.96	0.026	1.7E-01	Pass
70%	+/-0.5%	699.57	699.83	0.025	2.1E-01	Pass
Channel 3						
-70%	+/-0.5%	-699.71	-700.12	-0.041	2.5E-01	Pass
-35%	+/-0.5%	-349.84	-350.01	-0.018	1.7E-01	Pass
35%	+/-0.5%	349.70	349.80	0.010	2.0E-01	Pass
70%	+/-0.5%	699.57	699.78	0.021	2.3E-01	Pass
Channel 4						
-70%	+/-0.5%	-699.71	-700.23	-0.051	2.2E-01	Pass
-35%	+/-0.5%	-349.84	-350.10	-0.026	1.9E-01	Pass
35%	+/-0.5%	349.70	349.92	0.021	1.8E-01	Pass
70%	+/-0.5%	699.57	699.80	0.023	2.9E-01	Pass
Channel 5						
-70%	+/-0.5%	-699.71	-700.14	-0.043	2.7E-01	Pass
-35%	+/-0.5%	-349.84	-350.03	-0.019	2.1E-01	Pass
35%	+/-0.5%	349.70	349.84	0.014	2.1E-01	Pass
70%	+/-0.5%	699.57	699.81	0.024	2.4E-01	Pass
Channel 6						
-70%	+/-0.5%	-699.71	-700.14	-0.043	2.2E-01	Pass
-35%	+/-0.5%	-349.84	-350.01	-0.018	1.3E-01	Pass
35%	+/-0.5%	349.70	349.83	0.013	2.2E-01	Pass
70%	+/-0.5%	699.57	699.81	0.024	2.4E-01	Pass
Channel 7						
-70%	+/-0.5%	-699.71	-700.19	-0.048	2.0E-01	Pass
-35%	+/-0.5%	-349.84	-350.07	-0.023	1.6E-01	Pass
35%	+/-0.5%	349.70	349.88	0.018	1.9E-01	Pass
70%	+/-0.5%	699.57	699.85	0.028	2.4E-01	Pass

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Test Description

Gain Response

Gain of 5: 1000mV		As Received/Returned				
Channel 8	Limit	Std (mV)	UUT (mV)	Deviation (%)	Uncertainty (mV)	Pass/ Fail
-70%	+/-0.5%	-699.71	-700.09	-0.037	2.0E-01	Pass
-35%	+/-0.5%	-349.84	-350.07	-0.024	1.5E-01	Pass
35%	+/-0.5%	349.70	349.86	0.016	2.0E-01	Pass
70%	+/-0.5%	699.57	699.81	0.024	2.1E-01	Pass

Gain Response

Gain of 16: 312.5mV						
Channel 1						
-70%	+/-0.5%	-218.76	-218.84	-0.026	1.1E-01	Pass
-35%	+/-0.5%	-109.46	-109.51	-0.016	8.4E-02	Pass
35%	+/-0.5%	109.30	109.31	0.004	8.8E-02	Pass
70%	+/-0.5%	218.60	218.67	0.023	9.4E-02	Pass
Channel 2						
-70%	+/-0.5%	-218.76	-218.82	-0.020	9.3E-02	Pass
-35%	+/-0.5%	-109.46	-109.49	-0.009	8.9E-02	Pass
35%	+/-0.5%	109.30	109.34	0.014	9.7E-02	Pass
70%	+/-0.5%	218.60	218.64	0.013	8.1E-02	Pass
Channel 3						
-70%	+/-0.5%	-218.76	-218.79	-0.011	7.7E-02	Pass
-35%	+/-0.5%	-109.46	-109.53	-0.021	9.5E-02	Pass
35%	+/-0.5%	109.30	109.32	0.005	8.4E-02	Pass
70%	+/-0.5%	218.60	218.64	0.014	1.0E-01	Pass
Channel 4						
-70%	+/-0.5%	-218.76	-218.85	-0.029	1.3E-01	Pass
-35%	+/-0.5%	-109.46	-109.50	-0.012	1.1E-01	Pass
35%	+/-0.5%	109.30	109.33	0.011	1.1E-01	Pass
70%	+/-0.5%	218.60	218.62	0.007	1.4E-01	Pass
Channel 5						
-70%	+/-0.5%	-218.76	-218.77	-0.005	1.0E-01	Pass
-35%	+/-0.5%	-109.46	-109.48	-0.006	1.1E-01	Pass
35%	+/-0.5%	109.30	109.30	0.002	8.9E-02	Pass
70%	+/-0.5%	218.60	218.59	-0.002	1.1E-01	Pass
Channel 6						
-70%	+/-0.5%	-218.76	-218.80	-0.015	1.1E-01	Pass
-35%	+/-0.5%	-109.46	-109.49	-0.009	9.4E-02	Pass
35%	+/-0.5%	109.30	109.34	0.012	8.2E-02	Pass
70%	+/-0.5%	218.60	218.60	0.002	9.1E-02	Pass
Channel 7						
-70%	+/-0.5%	-218.76	-218.80	-0.014	9.8E-02	Pass
-35%	+/-0.5%	-109.46	-109.52	-0.020	9.6E-02	Pass
35%	+/-0.5%	109.30	109.31	0.003	1.0E-01	Pass
70%	+/-0.5%	218.60	218.66	0.019	9.3E-02	Pass
Channel 8						
-70%	+/-0.5%	-218.76	-218.78	-0.007	9.9E-02	Pass
-35%	+/-0.5%	-109.46	-109.48	-0.008	1.0E-01	Pass
35%	+/-0.5%	109.30	109.28	-0.007	1.1E-01	Pass
70%	+/-0.5%	218.60	218.60	0.001	1.1E-01	Pass

DTS

Serial #: LM0321
Order #: RA27091
Date: 19 March 2015

Test Description

Gain Response

Gain of 32: 156.25mV

		As Received/Returned				
	Limit	Std	UUT	Deviation	Uncertainty	Pass/
Channel 1		(mV)	(mV)	(%)	(mV)	Fail
-70%	+/-0.5%	-109.46	-109.55	-0.056	4.7E-02	Pass
-35%	+/-0.5%	-54.71	-54.74	-0.019	2.1E-02	Pass
35%	+/-0.5%	54.57	54.59	0.011	3.9E-02	Pass
70%	+/-0.5%	109.29	109.36	0.044	3.5E-02	Pass
Channel 2						
-70%	+/-0.5%	-109.46	-109.56	-0.065	3.8E-02	Pass
-35%	+/-0.5%	-54.71	-54.74	-0.020	1.7E-02	Pass
35%	+/-0.5%	54.57	54.59	0.009	3.6E-02	Pass
70%	+/-0.5%	109.29	109.36	0.043	3.1E-02	Pass
Channel 3						
-70%	+/-0.5%	-109.46	-109.55	-0.059	4.5E-02	Pass
-35%	+/-0.5%	-54.71	-54.74	-0.022	2.1E-02	Pass
35%	+/-0.5%	54.57	54.60	0.015	3.5E-02	Pass
70%	+/-0.5%	109.29	109.35	0.041	3.1E-02	Pass
Channel 4						
-70%	+/-0.5%	-109.46	-109.56	-0.061	4.5E-02	Pass
-35%	+/-0.5%	-54.71	-54.74	-0.025	2.4E-02	Pass
35%	+/-0.5%	54.57	54.60	0.014	3.7E-02	Pass
70%	+/-0.5%	109.29	109.35	0.040	3.3E-02	Pass
Channel 5						
-70%	+/-0.5%	-109.46	-109.54	-0.052	4.7E-02	Pass
-35%	+/-0.5%	-54.71	-54.73	-0.012	2.2E-02	Pass
35%	+/-0.5%	54.57	54.60	0.014	3.7E-02	Pass
70%	+/-0.5%	109.29	109.34	0.037	3.8E-02	Pass
Channel 6						
-70%	+/-0.5%	-109.46	-109.54	-0.054	4.4E-02	Pass
-35%	+/-0.5%	-54.71	-54.73	-0.018	2.0E-02	Pass
35%	+/-0.5%	54.57	54.60	0.014	3.8E-02	Pass
70%	+/-0.5%	109.29	109.35	0.039	3.3E-02	Pass
Channel 7						
-70%	+/-0.5%	-109.46	-109.54	-0.051	4.6E-02	Pass
-35%	+/-0.5%	-54.71	-54.73	-0.013	2.0E-02	Pass
35%	+/-0.5%	54.57	54.59	0.012	3.7E-02	Pass
70%	+/-0.5%	109.29	109.35	0.038	3.3E-02	Pass
Channel 8						
-70%	+/-0.5%	-109.46	-109.54	-0.050	4.9E-02	Pass
-35%	+/-0.5%	-54.71	-54.73	-0.013	2.1E-02	Pass
35%	+/-0.5%	54.57	54.59	0.009	4.0E-02	Pass
70%	+/-0.5%	109.29	109.34	0.032	3.3E-02	Pass

Gain Response

Gain of 128: 39.0625mV

Channel 1						
-70%	+/-0.5%	-27.355	-27.417	-0.158	3.0E-02	Pass
-35%	+/-0.5%	-13.836	-13.869	-0.085	5.1E-02	Pass
35%	+/-0.5%	13.690	13.715	0.063	1.6E-02	Pass
70%	+/-0.5%	27.172	27.228	0.143	4.7E-02	Pass

DTS

Serial #: LM0321
Order #: RA27091
Date: 19 March 2015

Test Description

Gain Response		As Received/Returned				
Gain of 128: 39.0625mV		Std	UUT	Deviation	Uncertainty	Pass/
Channel 2	Limit	(mV)	(mV)	(%)	(mV)	Fail
-70%	+/-0.5%	-27.355	-27.419	-0.163	2.8E-02	Pass
-35%	+/-0.5%	-13.836	-13.870	-0.086	4.9E-02	Pass
35%	+/-0.5%	13.690	13.715	0.064	1.4E-02	Pass
70%	+/-0.5%	27.172	27.228	0.143	4.7E-02	Pass
Channel 3						
-70%	+/-0.5%	-27.355	-27.411	-0.143	2.5E-02	Pass
-35%	+/-0.5%	-13.836	-13.866	-0.076	5.1E-02	Pass
35%	+/-0.5%	13.690	13.714	0.060	1.6E-02	Pass
70%	+/-0.5%	27.172	27.225	0.138	4.5E-02	Pass
Channel 4						
-70%	+/-0.5%	-27.355	-27.418	-0.161	3.1E-02	Pass
-35%	+/-0.5%	-13.836	-13.869	-0.085	4.9E-02	Pass
35%	+/-0.5%	13.690	13.716	0.066	1.8E-02	Pass
70%	+/-0.5%	27.172	27.226	0.140	4.6E-02	Pass
Channel 5						
-70%	+/-0.5%	-27.355	-27.411	-0.143	2.6E-02	Pass
-35%	+/-0.5%	-13.836	-13.866	-0.077	5.0E-02	Pass
35%	+/-0.5%	13.690	13.710	0.050	1.5E-02	Pass
70%	+/-0.5%	27.172	27.223	0.133	4.4E-02	Pass
Channel 6						
-70%	+/-0.5%	-27.355	-27.417	-0.159	2.6E-02	Pass
-35%	+/-0.5%	-13.836	-13.866	-0.076	4.6E-02	Pass
35%	+/-0.5%	13.690	13.716	0.065	1.8E-02	Pass
70%	+/-0.5%	27.172	27.227	0.141	4.6E-02	Pass
Channel 7						
-70%	+/-0.5%	-27.355	-27.416	-0.155	2.6E-02	Pass
-35%	+/-0.5%	-13.836	-13.866	-0.077	4.8E-02	Pass
35%	+/-0.5%	13.690	13.713	0.058	1.5E-02	Pass
70%	+/-0.5%	27.172	27.227	0.143	4.8E-02	Pass
Channel 8						
-70%	+/-0.5%	-27.355	-27.413	-0.148	2.4E-02	Pass
-35%	+/-0.5%	-13.836	-13.869	-0.083	5.1E-02	Pass
35%	+/-0.5%	13.690	13.714	0.062	1.5E-02	Pass
70%	+/-0.5%	27.172	27.224	0.134	4.7E-02	Pass
Gain Response						
Gain of 512: 9.765625mV						
Channel 1						
-70%	+/-1.5%	-6.846	-6.848	-0.023	1.5E-02	Pass
-35%	+/-1.5%	-3.511	-3.516	-0.045	2.8E-02	Pass
35%	+/-1.5%	3.342	3.342	-0.005	2.3E-02	Pass
70%	+/-1.5%	6.688	6.696	0.089	3.3E-02	Pass
Channel 2						
-70%	+/-1.5%	-6.846	-6.851	-0.059	1.2E-02	Pass
-35%	+/-1.5%	-3.511	-3.518	-0.066	2.9E-02	Pass
35%	+/-1.5%	3.342	3.343	0.008	2.1E-02	Pass
70%	+/-1.5%	6.688	6.700	0.122	3.5E-02	Pass

DTS

Serial #: LM0321
Order #: RA27091
Date: 19 March 2015

Test Description

Gain Response		As Received/Returned				
Gain of 512: 9.765625mV		Std	UUT	Deviation	Uncertainty	Pass/
Channel 3	Limit	(mV)	(mV)	(%)	(mV)	Fail
-70%	+/-1.5%	-6.846	-6.851	-0.051	8.6E-03	Pass
-35%	+/-1.5%	-3.511	-3.516	-0.045	3.0E-02	Pass
35%	+/-1.5%	3.342	3.343	0.006	2.0E-02	Pass
70%	+/-1.5%	6.688	6.698	0.106	2.9E-02	Pass
Channel 4						
-70%	+/-1.5%	-6.846	-6.847	-0.013	1.2E-02	Pass
-35%	+/-1.5%	-3.511	-3.515	-0.036	3.0E-02	Pass
35%	+/-1.5%	3.342	3.342	-0.003	1.9E-02	Pass
70%	+/-1.5%	6.688	6.695	0.078	3.0E-02	Pass
Channel 5						
-70%	+/-1.5%	-6.846	-6.846	-0.003	1.1E-02	Pass
-35%	+/-1.5%	-3.511	-3.514	-0.031	3.2E-02	Pass
35%	+/-1.5%	3.342	3.343	0.002	2.2E-02	Pass
70%	+/-1.5%	6.688	6.693	0.050	3.6E-02	Pass
Channel 6						
-70%	+/-1.5%	-6.846	-6.847	-0.015	1.3E-02	Pass
-35%	+/-1.5%	-3.511	-3.514	-0.029	2.6E-02	Pass
35%	+/-1.5%	3.342	3.343	0.008	1.4E-02	Pass
70%	+/-1.5%	6.688	6.695	0.073	3.5E-02	Pass
Channel 7						
-70%	+/-1.5%	-6.846	-6.847	-0.018	1.1E-02	Pass
-35%	+/-1.5%	-3.511	-3.515	-0.040	3.0E-02	Pass
35%	+/-1.5%	3.342	3.342	-0.010	2.1E-02	Pass
70%	+/-1.5%	6.688	6.696	0.084	3.4E-02	Pass
Channel 8						
-70%	+/-1.5%	-6.846	-6.844	0.012	1.4E-02	Pass
-35%	+/-1.5%	-3.511	-3.514	-0.022	2.6E-02	Pass
35%	+/-1.5%	3.342	3.342	-0.008	1.9E-02	Pass
70%	+/-1.5%	6.688	6.692	0.047	4.1E-02	Pass
Gain Response						
Gain of 2000: 2.5mV						
Channel 1						
-70%	+/-1.5%	-1.943	-1.949	-0.265	5.5E-02	Pass
-35%	+/-1.5%	-1.054	-1.057	-0.136	4.7E-02	Pass
35%	+/-1.5%	0.873	0.878	0.231	6.1E-03	Pass
70%	+/-1.5%	1.768	1.765	-0.116	9.2E-03	Pass
Channel 2						
-70%	+/-1.5%	-1.943	-1.947	-0.187	5.0E-02	Pass
-35%	+/-1.5%	-1.054	-1.057	-0.148	4.8E-02	Pass
35%	+/-1.5%	0.873	0.878	0.208	7.8E-03	Pass
70%	+/-1.5%	1.768	1.764	-0.159	1.2E-02	Pass
Channel 3						
-70%	+/-1.5%	-1.943	-1.951	-0.343	7.0E-02	Pass
-35%	+/-1.5%	-1.054	-1.059	-0.223	4.4E-02	Pass
35%	+/-1.5%	0.873	0.878	0.233	6.3E-03	Pass
70%	+/-1.5%	1.768	1.767	-0.038	6.7E-03	Pass

DTS

Serial #: LM0321
Order #: RA27091
Date: 19 March 2015

Test Description

Gain Response — As Received/Returned

Gain of 2000: 2.5mV		Std	UUT	Deviation	Uncertainty	Pass/
Channel 4	Limit	(mV)	(mV)	(%)	(mV)	Fail
-70%	+/-1.5%	-1.943	-1.947	-0.167	5.4E-02	Pass
-35%	+/-1.5%	-1.054	-1.056	-0.094	4.8E-02	Pass
35%	+/-1.5%	0.873	0.877	0.181	8.0E-03	Pass
70%	+/-1.5%	1.768	1.763	-0.185	9.0E-03	Pass
Channel 5						
-70%	+/-1.5%	-1.943	-1.948	-0.214	5.9E-02	Pass
-35%	+/-1.5%	-1.054	-1.056	-0.104	4.7E-02	Pass
35%	+/-1.5%	0.873	0.877	0.175	4.7E-03	Pass
70%	+/-1.5%	1.768	1.763	-0.211	6.1E-03	Pass
Channel 6						
-70%	+/-1.5%	-1.943	-1.946	-0.153	5.4E-02	Pass
-35%	+/-1.5%	-1.054	-1.054	-0.011	4.4E-02	Pass
35%	+/-1.5%	0.873	0.876	0.150	4.5E-03	Pass
70%	+/-1.5%	1.768	1.763	-0.212	1.1E-02	Pass
Channel 7						
-70%	+/-1.5%	-1.943	-1.946	-0.152	5.5E-02	Pass
-35%	+/-1.5%	-1.054	-1.054	-0.035	4.6E-02	Pass
35%	+/-1.5%	0.873	0.877	0.189	4.1E-03	Pass
70%	+/-1.5%	1.768	1.763	-0.198	1.1E-02	Pass
Channel 8						
-70%	+/-1.5%	-1.943	-1.948	-0.232	5.7E-02	Pass
-35%	+/-1.5%	-1.054	-1.055	-0.071	4.9E-02	Pass
35%	+/-1.5%	0.873	0.878	0.294	4.9E-03	Pass
70%	+/-1.5%	1.768	1.764	-0.142	1.1E-02	Pass

End of Report

Calibration Certificate

Part Description: Platinum

Certification Date: 2014-11-21

Serial#: P08-05-10-26072

Single Point - (Max-Min)/2 Specification: P08-05 0.03mm (0.0012")

Certificate#: P8051026072-11212014-908A

Volumetric (Max Deviation) Specification: P08-05 +/-0.043mm (+/-0.0017")

Temperature: See attached data

Measurement Standards Traceability

Kinematic Scale Bar - Short	Asset Number: TQ1364	Calibration Due: 2/28/2015	*SI Traceability: 9a45660e-7067-4a68-a6a8-057bc59ccd3f
Kinematic Scale Bar - Long	Asset Number: TQ1378	Calibration Due: 2/28/2015	*SI Traceability: d121cd34-f79b-46a5-afbb-a77addb18404
Thermometer	Asset Number: TQ1510	Calibration Due: 7/24/2015	*SI Traceability: 6581681
Calibration Probe	Asset Number: 12658	Calibration Due: 1/7/2016	*SI Traceability: 52904
Reference Sphere	Asset Number: TQ1956	Calibration Due: 9/5/2015	*SI Traceability: 13-298-00283

The artifacts above have been calibrated with a device traceable to the International System of Units (SI) through a National Metrological Institute (NMI) or through an ISO17025 Accredited Laboratory.
Calibration was performed following procedure listed on 07MAN915. This procedure was developed in accordance with ASME B89.4.22-2004.
See attached data for measurement results

Calibration Results*

3 Single Point Articulation Tests at <=10%, 20%-80% and >=80% range.	PASSED
1 Effective diameter sphere test.	PASSED
20 Volumetric ball bar tests in 4 quadrants and 2 orientations.	PASSED

Instrument condition as received:
Not within specifications

Instrument condition outgoing:
Within specifications

FARO Technologies, Inc.
PH1:248-669-6620
FAX:248-669-8556

Approved By: Allen Minock — Cal Cert Technician Date: 2014-12-21

46998 Magellan Drive
Wixom, MI 48393
USA

FARO®

LABORATORY ACCREDITATION BUREAU ACCREDITED

Cert # L-1147.01-1 Calibration

NovaStar SOLUTIONS
Metrology Management Services

Calibration Certificate

ACCREDITED Calibration #1277.01

35200 Plymouth Rd. / Livonia, MI 48150

Certificate # Z52538:116342

GENERIC PRO 360 DIGITAL PROTRACTOR

SERIAL NUMBER:	N/A	WORK ORDER:	116342
ASSET NUMBER:	Z52538	TEST RESULT:	PASS
CUST ASSET NUMBER:	MGA00821	PERFORMED ON:	03/30/15
PROCEDURE NAME:	MIT - PRO 360 - MMC	CAL DUE DATE:	03/30/16
PROCEDURE REV:	1.0	DATA TYPE:	FOUND-LEFT
CALIBRATED BY:	Joseph Giordano	TEMPERATURE:	22.72 °C
CUSTOMER:	MGA RESEARCH 446 EXECUTIVE DRIVE TROY, MI 48083	HUMIDITY:	28 %
PRIMARY CONTACT:	SCOTT ARSEN		

This instrument has been processed and calibrated in accordance with the NovaStar Solutions Quality System Manual and is traceable to the National Institute of Standards and Technology (NIST) or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques. The NovaStar Solutions quality system is accredited ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994.

The results reported herein apply only to the calibration of the item described above. No sampling plan was used for this calibration.

The ratio of the tolerance of the instrument or parameter being calibrated to the expanded uncertainty of the standard (TUR) is greater than 4:1 unless otherwise specified. Expanded uncertainties are expressed at the approximate 95% level of confidence using a K=2. Due to any number of factors, the recommended due date on the item does not imply continuing conformance to specifications during the recommended interval. Unless otherwise stated the unit under test meets or exceeds manufacturer specifications.

For range and best measurement capability specifications for the standards used to perform this calibration, see the most recent calibration report maintained by this calibration laboratory (available upon request).

AS RECEIVED CONDITION:	IN TOLERANCE	REMARKS:	
AS RETURNED CONDITION:	IN TOLERANCE		
ACTION TAKEN:	FULL CALIBRATION		

Standards Used

Asset #	Cert #	Description	Cal Date	Due Date
1577	1577:1193650836	RAHN SUPER 100 SURFACE PLATE	02/09/2015	02/09/2016
1437	1437:1193650835	PHASE 2 220-006 ROTARY TABLE	02/13/2013	02/13/2017

QA Signature: Joe Mannix Date: 4/1/2015

4/6/2015

NovaStar SOLUTIONS
Metrology Management Services
Remit to address:

Report of Calibration

NovaStar Solutions
35200 Plymouth Rd.
Livonia, MI 48150

ACCREDITED
CALIBRATION
1277.01

GENERIC PRO 360 DIGITAL PROTRACTOR		WORK ORDER #:	116342
SERIAL NUMBER:	N/A		
ASSET NUMBER:	Z52538	TEST RESULT:	PASS
CUST. ASSET NUM:	MGA00821	PERFORMED ON:	3/30/2015
PROCEDURE NAME:	MIT - PRO 360 - MMC	CAL DUE DATE:	3/30/2016
PROCEDURE REV:	1.0	DATA TYPE:	FOUND-LEFT
CALIBRATED BY:	Joseph Giordano	TEMPERATURE:	22.72 °C
CUSTOMER:	MGA RESEARCH 446 EXECUTIVE DRIVE TROY MI 48083	HUMIDITY:	28 %
PRIMARY CONTACT:	SCOTT ARSEN		

This instrument has been processed and calibrated in accordance with the NovaStar Solutions Quality System Manual and is traceable to the National Institute of Standards and Technology (NIST), or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques. The NovaStar Solutions quality system is accredited to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994.

The results reported herein apply only to the calibration of the item described above. No sampling plan was used for this calibration.

The ratio of the tolerance of the instrument or parameter being calibrated to the expanded uncertainty of the standard (TUR) is greater than 4:1 unless otherwise specified. Expanded uncertainties are expressed at the approximate 95% level of confidence using a K=2.

Due to any number of factors, the recommended due date on the item does not imply continuing conformance to specifications during the recommended interval.
For range and best measurement capability specifications for the standards used to perform this calibration, see the most recent calibration report maintained by this calibration laboratory (available upon request).

REMARKS:

Test Results for Calibration with Certificate# : Z52538:116342

Standards Used

Asset #	Cert#	Description	Cal Date	Due Date
1437	1437:1193650835	PHASE 2 220-006 ROTARY TABLE	2/13/2013	2/13/2017
1577	1577:1193650836	RAHN SUPER 100 SURFACE PLATE	2/9/2015	2/9/2016

Test Procedure Results

Test Description	Nominal	Test Result	Lower Limit	Upper Limit	Units	Exp Uncert	Pass/Fail
LINEARITY CHECK							
0° REFERENCE	0.0	0.0	-0.1	0.1	°		Pass
5°	5.0	5.0	4.9	5.1	°	0.02° + .6R	Pass
30°	30.0	30.0	29.8	30.2	°	0.02° + .6R	Pass
60°	60.0	60.0	59.8	60.2	°	0.02° + .6R	Pass
90°	90.0	89.9	89.9	90.1	°	0.02° + .6R	Pass

Test Results for Calibration with Certificate# : Z52538:116342

Test Procedure Results

Test Description	Nominal	Test Result	Lower Limit	Upper Limit	Units	Exp Uncert	Pass/Fail
60°	60.0	60.0	59.8	60.2	°	0.02° + .6R	Pass
30°	30.0	30.0	29.8	30.2	°	0.02° + .6R	Pass
5°	5.0	5.0	4.9	5.1	°	0.02° + .6R	Pass
0°	0.0	0.0	-0.1	0.1	°		Pass
5°	5.0	5.0	4.9	5.1	°	0.02° + .6R	Pass
30°	30.0	30.0	29.8	30.2	°	0.02° + .6R	Pass
60°	60.0	59.9	59.8	60.2	°	0.02° + .6R	Pass
90°	90.0	90.0	89.9	90.1	°	0.02° + .6R	Pass
60°	60.0	60.0	59.8	60.2	°	0.02° + .6R	Pass
30°	30.0	30.0	29.8	30.2	°	0.02° + .6R	Pass
5°	5.0	5.0	4.9	5.1	°	0.02° + .6R	Pass
0°	0.0	0.0	-0.1	0.1	°		Pass
ABSOLUTE ZERO ANGLE	0.0	0.0	-0.1	0.1	°		Pass

***** End of Report *****

MICHIGAN OPERATIONS
DATE: 4/4/2013
SUPERCEDES: MGATPTMC.6

DOC. NO.: MGATP_TMC
REVISION NO.: 7
PAGE 3 OF 3

Tape Measure Calibration Certificate

Reference Steel Rule
Brand: Swanson
S/N: MEA00799
Calibration Date: 5/21/2014

Subject Tape Measure
Brand: Stanley
S/N: TEM001-10
Calibration Date: 1/27/2015

Reference in (mm)	Subject Tape Measure		Difference		Reference in (mm)	Subject Tape Measure		Difference	
	Pull	Push	Pull	Push		Pull	Push	Pull	Push
0 (0)	0	0	0	0	18 (450)	450	449	0	-1
1 (25)	25	24	0	-1	19 (475)	475	474	0	-1
2 (50)	50	49	0	-1	20 (500)	500	499	0	-1
3 (75)	75	74	0	-1	21 (525)	525	524	0	-1
4 (100)	100	99	0	-1	22 (550)	550	549	0	-1
5 (125)	125	124	0	-1	23 (575)	575	574	0	-1
6 (150)	150	149	0	-1	24 (600)	600	599	0	-1
7 (175)	175	174	0	-1	25 (625)	625	624	0	-1
8 (200)	200	199	0	-1	26 (650)	650	649	0	-1
9 (225)	225	224	0	-1	27 (675)	675	674	0	-1
10 (250)	250	249	0	-1	28 (700)	700	699	0	-1
11 (275)	275	274	0	-1	29 (725)	725	724	0	-1
12 (300)	300	299	0	-1	30 (750)	750	749	0	-1
13 (325)	325	324	0	-1	31 (775)	775	774	0	-1
14 (350)	350	349	0	-1	32 (800)	800	799	0	-1
15 (375)	375	374	0	-1	33 (825)	825	824	0	-1
16 (400)	400	399	0	-1	34 (850)	850	849	0	-1
17 (425)	425	424	0	-1	35 (875)	875	874	0	-1

If all differences are ± 1/32 of an inch (1 mm), then the tape measure is acceptable.

Pass ✓ Fail ____ Maximum Difference = -1

Date: 1/27/2015 Performed By: _____

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is ± 0.2%. All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor k=2.

NovaStar SOLUTIONS
Metrology Management Services

Calibration Certificate

ACCREDITED Calibration #1277.01

35200 Plymouth Rd. / Livonia, MI 48150

Certificate # Z73658:116132

OMEGA OM-73 TEMPERATURE/RH DATA LOGGER

SERIAL NUMBER:	0514B1305F	WORK ORDER:	116132
ASSET NUMBER:	Z73658	TEST RESULT:	PASS
CUST ASSET NUMBER:	0514B1305F	PERFORMED ON:	03/26/15
PROCEDURE NAME:	OME - OM-73 - MMC	CAL DUE DATE:	03/26/16
PROCEDURE REV:	1.0	DATA TYPE:	FOUND-LEFT
CALIBRATED BY:	JUSTIN BURDICK	TEMPERATURE:	23.01 °C
CUSTOMER:	MGA RESEARCH 446 EXECUTIVE DRIVE TROY, MI 48083	HUMIDITY:	44 %
PRIMARY CONTACT:	SCOTT ARSEN		

This instrument has been processed and calibrated in accordance with the NovaStar Solutions Quality System Manual and is traceable to the National Institute of Standards and Technology (NIST) or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques. The NovaStar Solutions quality system is accredited ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994.

The results reported herein apply only to the calibration of the item described above. No sampling plan was used for this calibration.

The ratio of the tolerance of the instrument or parameter being calibrated to the expanded uncertainty of the standard (TUR) is greater than 4:1 unless otherwise specified. Expanded uncertainties are expressed at the approximate 95% level of confidence using a K=2. Due to any number of factors, the recommended due date on the item does not imply continuing conformance to specifications during the recommended interval. Unless otherwise stated the unit under test meets or exceeds manufacturer specifications.

For range and best measurement capability specifications for the standards used to perform this calibration, see the most recent calibration report maintained by this calibration laboratory (available upon request).

This report may not be reproduced, except in full, without written approval from NovaStar Solutions.

AS RECEIVED CONDITION:	IN TOLERANCE	REMARKS:
AS RETURNED CONDITION:	IN TOLERANCE	
ACTION TAKEN:	FULL CALIBRATION	

Standards Used

Asset #	Cert #	Description	Cal Date	Due Date
002664	002664:1091515041	VERITEQ 5000A-RH/T RH/TEMPERATURE DATA LOGGER	03/16/2015	03/16/2016
1917	1917:1263999738	VAISALA M170/HMP76 INDICATOR/PROBE	12/12/2014	12/12/2015

QA Signature: [signature] Date: 3/26/2015

3/26/2015

NovaStar SOLUTIONS
Metrology Management Services
Remit to address:

Report of Calibration

NovaStar Solutions
35200 Plymouth Rd.
Livonia, MI 48150

ACCREDITED
CALIBRATION
1277.01

OMEGA OM-73 TEMPERATURE/RH DATA LOGGER

SERIAL NUMBER:	0514B1305F	WORK ORDER #:	116132
ASSET NUMBER:	Z73658		
CUST. ASSET NUM:	0514B1305F	TEST RESULT:	PASS
PROCEDURE NAME:	OME - OM-73 - MMC	PERFORMED ON:	3/26/2015
PROCEDURE REV:	1.0	CAL DUE DATE:	3/26/2016
CALIBRATED BY:	JUSTIN BURDICK	DATA TYPE:	FOUND-LEFT
CUSTOMER:	MGA RESEARCH	TEMPERATURE:	23.01 °C
	446 EXECUTIVE DRIVE	HUMIDITY:	44 %
	TROY MI 48083		
PRIMARY CONTACT:	SCOTT ARSEN		

This instrument has been processed and calibrated in accordance with the NovaStar Solutions Quality System Manual and is traceable to the National Institute of Standards and Technology (NIST), or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques. The NovaStar Solutions quality system is accredited to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994.

The results reported herein apply only to the calibration of the item described above. No sampling plan was used for this calibration.

The ratio of the tolerance of the instrument or parameter being calibrated to the expanded uncertainty of the standard (TUR) is greater than 4:1 unless otherwise specified. Expanded uncertainties are expressed at the approximate 95% level of confidence using a K=2.

Due to any number of factors, the recommended due date on the item does not imply continuing conformance to specifications during the recommended interval.
For range and best measurement capability specifications for the standards used to perform this calibration, see the most recent calibration report maintained by this calibration laboratory (available upon request).

REMARKS:

Test Results for Calibration with Certificate# : Z73658:116132

Standards Used

Asset #	Cert#	Description	Cal Date	Due Date
002664	002664:1091515041	VERITEQ 5000A-RH/T RH/TEMPERATURE DATA LOGGER	3/16/2015	3/16/2016
1917	1917:1263999738	VAISALA M170/HMP76 INDICATOR/PROBE	12/12/2014	12/12/2015

Test Procedure Results

Test Description	Nominal	Test Result	Lower Limit	Upper Limit	Units	Exp Uncert	Pass/Fail
Relative Humidity							
	13.3	15.1	11.3	15.3	%RH	2.2E+00	Pass
	46.3	46.1	44.3	48.3	%RH	2.2E+00	Pass
	69.8	70.4	67.8	71.8	%RH	2.2E+00	Pass
Temperature							
	22.2	22.5	21.7	22.7	°C	4.0E-01	Pass

***** End of Report *****

NovaStar SOLUTIONS
Metrology Management Services

Calibration Certificate

ACCREDITED Calibration #1277.01

35200 Plymouth Rd. / Livonia, MI 48150

Certificate # Z54487:107382

DETECTO AP-20 SCALE

SERIAL NUMBER:	E10807-0187	WORK ORDER:	107382
ASSET NUMBER:	Z54487	TEST RESULT:	PASS
CUST ASSET NUMBER:	MGA00783	PERFORMED ON:	10/27/14
PROCEDURE NAME:	122-040	CAL DUE DATE:	10/27/15
PROCEDURE REV:	B	DATA TYPE:	FOUND-LEFT
CALIBRATED BY:	Joseph Giordano	TEMPERATURE:	23.00 °C
CUSTOMER:	MGA RESEARCH 446 EXECUTIVE DRIVE TROY, MI 48083	HUMIDITY:	40 %
PRIMARY CONTACT:	SCOTT ARSEN		

This instrument has been processed and calibrated in accordance with the NovaStar Solutions Quality System Manual and is traceable to the National Institute of Standards and Technology (NIST) or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques. The NovaStar Solutions quality system is accredited ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994.

The results reported herein apply only to the calibration of the item described above. No sampling plan was used for this calibration.

The ratio of the tolerance of the instrument or parameter being calibrated to the expanded uncertainty of the standard (TUR) is greater than 4:1 unless otherwise specified. Expanded uncertainties are expressed at the approximate 95% level of confidence using a K=2. Due to any number of factors, the recommended due date on the item does not imply continuing conformance to specifications during the recommended interval. Unless otherwise stated the unit under test meets or exceeds manufacturer specifications.

For range and best measurement capability specifications for the standards used to perform this calibration, see the most recent calibration report maintained by this calibration laboratory (available upon request).

This report may not be reproduced, except in full, without written approval from NovaStar Solutions.

AS RECEIVED CONDITION:	IN TOLERANCE	REMARKS:
AS RETURNED CONDITION:	IN TOLERANCE	
ACTION TAKEN:	FULL CALIBRATION	

Standards Used

Asset #	Cert #	Description	Cal Date	Due Date
1081	1081:1193650835	RICE LAKE CLASS 6 18 PC WEIGHT SET	03/18/2013	03/18/2015
1633	1633:1193663229	RICE LAKE CLASS 6 17 PC WEIGHT SET	06/04/2013	12/04/2014

QA Signature: Duke Payne Date: 10/29/2014

10/31/2014

NovaStar SOLUTIONS
Metrology Managment Services

Calibration Data Sheet

35200 Plymouth Rd.
Livonia, MI 48150
734-453-8003

Inst. Type	Scale	Mfr.	Detecto	W.O.	107382
Last Cal Date	10/21/2013	Mod.	AP-20	Date	10/27/2014
Form Number	25146 Rev A	S/N	E10807-0187	Test Eng'r	JG

Note: Measurement Uncertainty = 0.008 lbs

Function	Calibration Point	Unit		As Found	Note	As Left	Low Limit	Hi Limit	Unit
Linearity	1.00 lb			1.00		1.00	0.95	1.05	lb
	5.00 lbs			5.00		5.00	4.95	5.05	lbs
	10.00 lbs			10.01		10.01	9.95	10.05	lbs
	15.00 lbs			15.01		15.01	14.95	15.05	lbs
	20.00 lbs			20.02		20.02	19.95	20.05	lbs
Shift Test	Center			10.01		10.01	10.01	10.03	lbs
@ 10lbs	Front			10.02		10.02	10.01	10.03	lbs
	Back			10.00		10.00	10.01	10.03	lbs
	Left			10.01		10.01	10.01	10.03	lbs
	Right			10.01		10.01	10.01	10.03	lbs

107382

Sterling Scale Co., Inc.
20950 Boening St.
Southfield, MI 48075

Test report for commercial device

F410/12-4
Rev. Date 7/28/08

accredited for calibration 1448.01

Customer: MGA Research ***Cert#*** 14-2713 ***Temp/Humidity:*** 0k
Location of Calibration: 2839 Elliot Ave. Troy, Mi. 48083
Calibration Date: 8/15/2014 ***Cal Due:*** Aug-15 ***Condition of Item:*** good
Equipment Make: Intercomp ***Model:*** SW Deluxe ***Serial:*** 26032389 ***Capacity:*** 8800lb x 1lb
NTEP: ***Class:*** ***COC #:*** section- 2200lb x 1lb

Applied Test Wt	*Before Adustment*	*Tolerance*	*In-Tolerance Y/N*	*After Adjustment*	*In-Tolerance Y/N*	*Unc*	
100lb	100lb	1lb	y	100lb	y	.11lb	LF
1000lb	1000lb	2lb	y	1000lb	y	.5lb	
100lb	100lb	1lb	y	100lb	y	.11lb	RF
1000lb	1000lb	2lb	y	1000lb	y	.5lb	
100lb	100lb	1lb	y	100lb	y	.11lb	LR
1000lb	1000lb	2lb	y	1000lb	y	.5lb	
100lb	100lb	1lb	y	100lb	y	.11lb	RR
1000lb	1000lb	2lb	y	1000lb	y	.5lb	

shift test
N/A
Wheel Weigh

	Platform #1	*Platform #2*	*Platform #3*
	☐ Pass	☐ Pass	☐ Pass
	☐ Fail	☐ Fail	☐ Fail

Tests performed: ☑ Repeatability ☑ Linearity ☐ Sensitivity ☑ Discrimination

Technician comments: Scale passed all tests performed

Traceable certificate for weights used: 50lb wts.- 1163,1168 1k wt.- 10002

☑ Scale Certified ☐ Scale Rejected

Sterling Scale Service Rep: Dan W

1 of 1

The above item has been calibrated using the relevant EPO or OEM procedures utilizing test weights Traceable to International Systems of Units (SI), through the Michigan Department of Agriculture.
Expanded uncertainty(k=2) confidence level of 95% as reported.
Results relate only to items listed.
The reported uncertainty is valid only for the environment in which it is determined.
Any number of factors may cause the item to drift out of calibration before recommended interval has expired for this reason Sterling Scale does not warranty calibration.
This report shall not be reproduced, except in full without approval of the laboratory
Tolerances followed are maintenance/acceptance per HB 44 or customer specific.

Dan Bentley 8/15/14