FINAL REPORT NUMBER 201UI-MGA-09-06

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

TOYOTA MOTOR MANUFACTURING, INDIANA, INC.
2009 Toyota Sienna CE FWD 7 Passenger
NHTSA No. C95107

MGA RESEARCH CORPORATION
446 Executive Drive
Troy, Michigan 48083

Test Dates: May 20-21, 2009
Report Date: May 22, 2009

FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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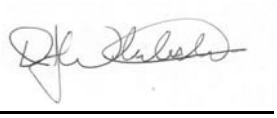
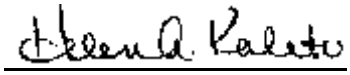
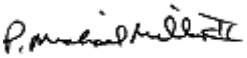
Prepared By: 

Donald J. Whiteside, Project Engineer



Helen A. Kaleto, Project Manager

Approved By: 

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Accepted By: _____

Acceptance Date: _____

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15. Supplementary Notes			
16. Abstract A compliance test series was conducted on the subject 2009 Toyota Sienna CE FWD 7 Passenger, NHTSA No. C95107, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-201U-01 for the determination of FMVSS 201 compliance. The testing was conducted at MGA Research Corporation in Troy, Michigan on May 20-21, 2009. Test failures identified were as follows: None The data recorded indicates that the 2009 Toyota Sienna CE FWD 7 Passenger tested appears to comply with the upper interior requirements of FMVSS 201.			
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1.0 PURPOSE OF COMPLIANCE TEST

The purpose of this head impact compliance test was to determine whether the subject vehicle, a 2009 Toyota Sienna CE FWD 7 Passenger, met the performance requirements of FMVSS 201, Occupant Protection in Interior Impact - Upper Interior Head Impact Protection.

Tests were conducted on May 20-21, 2009 on a 2009 Toyota Sienna CE FWD 7 Passenger, manufactured by Toyota Motor Manufacturing, Indiana, Inc.

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 July 1, 2005.

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 July 1, 2005.

2.0 COMPLIANCE TEST DATA SUMMARY

The 2009 Toyota Sienna CE FWD 7 Passenger, was equipped with A, B, O (Other), and rear-pillars, an adjustable seat belt anchorage on each B-pillar, an adjustable seat belt anchorage on the driver side O-pillar, a fixed seat belt anchorage on the rear pillar and upper roof, a grab handle located on the side rail above the front passenger side door and above the rear driver and passenger side doors, assist handles on both B-pillars, an overhead console in the front upper roof, and dual sliding doors.

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	BP2	SR2-B	SD
AP2	OP1	SR3-2	UR2@BPR
AP3	RP1	RH	UR4@OPR

The 2009 Toyota Sienna CE FWD 7 Passenger 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: 2009 Toyota Sienna CE FWD 7 Passenger

VEH. NHTSA NO.: C95107 VIN: 5TDZK23C09S262839 COLOR: Silver Pine

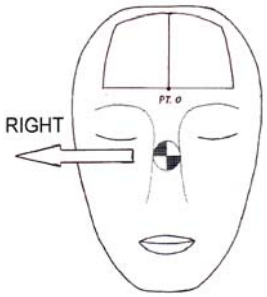
VEH. BUILD DATE: October, 2008 TEST DATES: May 20-21, 2009

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Donald J. Whiteside

TARGET	VEHICLE SIDE	HORIZONTAL ANGLE (deg)	VERTICAL ANGLE (deg)	VELOCITY (kph)	HIC(d)	FMH HIC	IMPACT ON FMH (mm)	
							Above	Left/Right
AP1	Right	110	28	19.2	562	524	26	2 Left
AP2	Left	203	45	18.9	495	436	14	1 Right
AP3	Right	157	40	19.2	579	547	19	7 Left
BP2	Left	270	3	24.1	425	342	32	12 Left
OP1	Right	90	31	24.1	794	832	18	0
RP1	Left	330	26	23.7	390	296	19	7 Left
SR2B	Left	270	46	24.0	632	618	23	3 Left
SR3-2	Left	270	45	23.8	583	552	22	3 Left
RH	Left	0	50	23.8	675	674	25	7 Left
SD	Right	90	37	24.1	510	455	33	3 Left
UR2@BPR	Right	90	38	24.0	620	601	18	1 Left
UR4@OPR	Left	270	40	24.1	485	422	27	8 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.

BP2 Left: Adjuster non-functional.

REMARKS:

The targets listed were impacted in the following order:

Right: AP3, AP1, UR2@BPR, SD, OP1

Left: RP1, RH, UR4@OPR, SR3-2, BP2, SR2B, AP2

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

RECORDED BY: Donald J. Whiteside DATE: May 21, 2009

APPROVED BY: Helen A. Kaleto

TABLE 2-2

GENERAL TEST AND VEHICLE PARAMETER DATA

VEH. MOD YR/MAKE/MODEL/BODY: 2009 Toyota Sienna CE FWD 7 Passenger

VEH. NHTSA NO.: C95107 VIN: 5TDZK23C09S262839 COLOR: Silver Pine

VEH. BUILD DATE: October, 2008 TEST DATES: May 20-21, 2009

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Donald J. Whiteside

INTERIOR TRIM INFORMATION: A, B, O (Other), and rear-pillars, an adjustable seat belt anchorage on each B-pillar, an adjustable seat belt anchorage on the driver side (O-pillar, a fixed seat belt anchorage on the rear pillar and upper roof, a grab handle located on the side rail above the front passenger side door and above the rear driver and passenger side doors, assist handles on both B-pillars, an overhead console in the front upper roof, and dual sliding doors.

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	_X_ No
Braces:	_____Yes	_X_ No

GENERAL INFORMATION:

Date Received: March 11, 2009; Odometer Reading 52 miles

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured By: Toyota Motor Manufacturing, Indiana, Inc.

Date of Manufacture: October, 2008; VIN: 5TDZK23C09S262839

GVWR: 2580 kg; GAWR FRONT: 1290 kg;

GAWR REAR: 1290 kg;

DATA FROM TIRE PLACARD:

Tire Pressure with Maximum Capacity Vehicle Load:

FRONT: 240 kPa REAR: 240 kPa

Recommended Tire Size: P215/65R16

Recommended Cold Tire Pressure:

FRONT: 240 kPa REAR: 240 kPa

Size of Tire on Test Vehicle: P215/65R16

Type of Spare Tire: T155/80R17; Space Saver: X; Standard__

VEHICLE CAPACITY DATA:

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

Number of Occupants: Front 2; Rear 5; TOTAL 7

VEHICLE CAPACITY WEIGHT:

Vehicle Capacity Weight (VCW) = 520 kg

No. of Occupants x 68 kg = 476 kg

Rated Cargo/Luggage Weight (RCLW) = 44 kg (difference)

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

Right Front =	537.5 kg	Right Rear =	396.5 kg
Left Front =	563.5 kg	Left Rear =	400.0 kg
TOTAL FRONT =	1101.0 kg	TOTAL REAR =	796.5 kg
% Total Weight =	58.0 %	% Total Weight =	42.0 %

TOTAL DELIVERED WEIGHT = 1897.5 kg

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight =	1897.5 kg
Max. Test Cargo/Luggage Weight =	44.0 kg
Target Test Weight =	1941.5 kg

WEIGHT OF TEST VEHICLE FULLY LOADED:

Right Front =	533.5 kg	Right Rear =	424.5 kg
Left Front =	557.5 kg	Left Rear =	426.0 kg
TOTAL FRONT =	1091.0 kg	TOTAL REAR =	850.5 kg
% Total Weight =	56.2 %	% Total Weight =	43.8 %

TOTAL TEST WEIGHT = 1941.5 kg

Weight of ballast secured in vehicle's cargo area = 44.0 kg

TEST VEHICLE ATTITUDE:

AS DELIVERED:
Right Front 747 mm; Left Front 746 mm;
Right Rear 762 mm; Left Rear 760 mm;
Pitch Angle at Right Door Sill = 0.2 Rear is higher
Pitch Angle at Left Door Sill = 0.2 Rear is higher
Roll Angle at Front Bumper = 0.1 Right is higher
Roll Angle at Rear Bumper = 0.0

FULLY LOADED:
Right Front 750 mm; Left Front 748 mm;
Right Rear 751 mm; Left Rear 751 mm;
Pitch Angle at Right Door Sill = 0.4 Rear is higher
Pitch Angle at Left Door Sill = 0.5 Rear is higher
Roll Angle at Front Bumper = 0.0
Roll Angle at Rear Bumper = 0.0

AS TARGETED: Right Front 855 mm; Left Front 854 mm;
Right Rear 860 mm; Left Rear 861 mm;
Pitch Angle at Right Door Sill = 0.2 Rear is higher
Pitch Angle at Left Door Sill = 0.2 Rear is higher
Roll Angle at Front Bumper = 0.0
Roll Angle at Rear Bumper = 0.0

AS TESTED ON RIGHT SIDE:
Pitch Angle at Right Door Sill = 0.2 Rear is higher
Pitch Angle at Left Door Sill = 0.2 Rear is higher
Roll Angle at Front Bumper = 0.1 Right 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 = 0.2 Rear is higher
Roll Angle at Front Bumper = 0.0
Roll Angle at Rear Bumper = 0.0

VEHICLE WHEELBASE = 3020 mm

REMARKS: The seat travel distance was measured to be 240 mm for the driver front seat and 240 mm for the passenger front seat.

RECORDED BY: Donald J. Whiteside DATE: May 18, 2009

APPROVED BY: Helen A. Kaleto

TABLE 2-3

HORIZONTAL IMPACT ANGLE RANGE FOR A AND B PILLARS

VEH. MOD YR/MAKE/MODEL/BODY: 2009 Toyota Sienna CE FWD 7 Passenger

VEH. NHTSA NO.: C95107 VIN: 5TDZK23C09S262839 COLOR: Silver Pine

VEH. BUILD DATE: October, 2008 TEST DATES: May 20-21, 2009

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Donald J. Whiteside

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 203.2º	L 248.9º
	R 105º-165º	R 110.8º	R 157.5º
B-PILLAR	L 195º-345º	L 200.1º	L 273.4º
	R 15º-165º	R 85.8º	R 160.1º

AS DETERMINED USING THE PROCEDURES SPECIFIED IN S8.13.4.1

REMARKS:

RECORDED BY: Donald J. Whiteside DATE: May 18, 2009

APPROVED BY: Helen A. Kaleto

TABLE 2-4

VERTICAL IMPACT ANGLE RANGES

VEH. MOD YR/MAKE/MODEL/BODY: 2009 Toyota Sienna CE FWD 7 Passenger

VEH. NHTSA NO.: C95107 VIN: 5TDZK23C09S262839 COLOR: Silver Pine

VEH. BUILD DATE: October, 2008 TEST DATES: May 20-21, 2009

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Donald J. Whiteside

VERTICAL IMPACT ANGLE RANGES

		VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
FRONT HEADER	FH1	L 0º-50º	L 0º	L 44º
		R 0º-50º	R 0º	R 44º
	FH2	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
SIDE RAIL	SR1	L 0º-50º	L 0º	L 38º
		R 0º-50º	R 0º	R 39º
	SR2A	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
	SR2B	L 0º-50º	L 0º	L 46º
		R 0º-50º	R 0º	R 46º
	SR3-1	L 0º-50º	L 0º	L 46º
		R 0º-50º	R 0º	R 46º
	SR3-2	L 0º-50º	L 0º	L 45º
		R 0º-50º	R 0º	R 46º
	SR3-3	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
	SR3-4	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º

		VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
REAR HEADER	RH	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
SLIDING DOOR	SD	L 0º-50º	L 0º	L 35º
		R 0º-50º	R 0º	R 37º
A-PILLAR	AP1	L -5º-50º	L -5º	L 27º
		R -5º-50º	R -5º	R 28º
	AP2	L -5º-50º	L -5º	L 45º
		R -5º-50º	R -5º	R 46º
	AP3	L -5º-50º	L -5º	L 40º
		R -5º-50º	R -5º	R 40º
B-PILLAR	BP1	L -10º-50º	L -10º	L 35º
		R -10º-50º	R -10º	R 34º
	BP2*	L 0º-50º	L 0º	L 3º
		R 0º-50º	R 0º	R 3º
	BP3*	L -10º-50º	L -10º	L -4º
		R -10º-50º	R -10º	R -4º
	BP4	L -10º-50º	L -10º	L -3º
		R -10º-50º	R -10º	R -3º
OTHER-PILLAR	OP1*	L 0º-50º	L 0º	L 0º
		R -10º-50º	L -10º	R 31º
	OP2	L -10º-50º	L -10º	L -8º
		R -10º-50º	R -10º	R -10º
REAR PILLAR	RP1	L -10º-50º	L -10º	L 26º
		R -10º-50º	R -10º	R 22º
	RP2*	L 0º-50º	L 0º	L 5º
		R 0º-50º	R 0º	R 6º
UPPER ROOF 1		0º-50º	0º	42º

	VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
UPPER ROOF 2	0º-50º	0º	38º
UPPER ROOF 3	0º-50º	0º	40º
UPPER ROOF 4	0º-50º	0º	40º
UPPER ROOF 5	0º-50º	0º	40º
UPPER ROOF 6	0º-50º	0º	40º

As determined using the Procedures specified in S8.13.4.2.

*Targets BP2 and OP1 are seat belt anchorage locations.
Target BP3 is a seat belt anchorage location treated as a pillar target with respect to the vertical angle range of Table 1, approach angle limit.

RECORDED BY: Donald J. Whiteside DATE: May 18, 2009

APPROVED BY: Helen A. Kaleto

TABLE 2-5

TARGET MEASUREMENTS

VEH. MOD YR/MAKE/MODEL/BODY: 2009 Toyota Sienna CE FWD 7 Passenger

VEH. NHTSA NO.: C95107 VIN: 5TDZK23C09S262839 COLOR: Silver Pine

VEH. BUILD DATE: October, 2008 TEST DATES: May 20-21, 2009

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Donald J. Whiteside

Measurement	Description	Left Side	Right Side
M	Seat Fore/Aft Travel (Front seats)	240 mm	240 mm
Tº	Horizontal < {CG-F1 (Left Seat) to (Right A-Pillar)}	111.1º	--
A1º	360º - Tº	248.9º	--
Wº	Horizontal < {CG-2 (Left Seat) to (Left A-Pillar)}	203.2º	--
A2º	A2º = Wº	203.2º	--
Uº	Horizontal < {CG-2 (Left Seat) to (Left B-Pillar)}	273.4º	--
B1º	B1º = Uº	273.4º	--
Vº	Horizontal < {CG-R (Left Seat) to (Left B-Pillar)}	200.1º	--
B2º	B2º = Vº	200.1º	--
Wº (right)	Horizontal < {CG-F2 (Right Seat) to (Right A-Pillar)}	--	157.5º
A1º (right)	A1º (right) = Wº (right)	--	157.5º
T º (right)	Horizontal < {CG-F1 (Right Seat) to (Left A-Pillar)}	--	249.2º
A2º (right)	360º-Tº (right)	--	110.8º
V º (right)	Horizontal < {CG-R (Right Seat) to (Right B-Pillar)}	--	160.1º
B1º (right)	B1º (right) = Vº (right)	--	160.1º
U º (right)	Horizontal < {CG-F2 (Right Seat) to (Right B-Pillar)}	--	85.8º
B2º (right)	B2º (right) = Uº (right)	--	85.8º
J	A-Pillar {(Plane 3) – (Plane 5)}	383.7 mm	384.7 mm
J/2	J ÷ 2	191.9 mm	192.4 mm
D1	Upper Roof {(Plane A) – (Plane B)}	2730.0 mm	
D1/2	D1 ÷ 2	1365.0 mm	
D2	Upper Roof {(Plane C) – (Plane D)}	1442.2 mm	

Measurement	Description	Left Side	Right Side
D2/2	D2 ÷ 2	721.1 mm	
.35D1	.35 x D1	955.5 mm	
.35D2	.35 x D2	504.8 mm	
N	B-Pillar {(BPR) – (lowest point on daylight opening forward of B-Pillar)}	507.2 mm	509.5 mm
N/2	B-Pillar {(BP3) – (lowest point on daylight opening forward of B-Pillar)}	253.6 mm	254.8 mm
N/4	B-Pillar {(BP4) – (lowest point on daylight opening forward of B-Pillar)}	126.8 mm	127.4 mm
Q	O-Pillar (Plane 13 – Plane 14)	502.5 mm	504.0 mm
Q/2	Q / 2	251.2 mm	252.0 mm
D	R-Pillar (Point 7 – Point M)	1091.0 mm	1091.0 mm
3D/7	3*D / 7	467.6 mm	467.6 mm
MM	Sliding Door (widest opening)	996.4 mm	996.7 mm
MM/2	MM / 2	498.2 mm	498.4 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	2320.0	-431.0	1480.0	2320.0	431.0	1480.0
2nd Row	3250.0	-415.0	1530.0	3250.0	415.0	1530.0
3rd Row	4035.0	-355.0	1556.0	4035.0	355.0	1556.0

SgRP Locations (vehicle coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
Front	2320.0	-431.0	1480.0	2320.0	431.0	1480.0
2nd Row	3250.0	-415.0	1530.0	3250.0	415.0	1530.0
3rd Row	4035.0	-355.0	1556.0	4035.0	355.0	1556.0

CG Locations (world coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
CGF1	2240.0	-431.0	2140.0	2240.0	431.0	2140.0
CGF2	2480.0	-431.0	2140.0	2480.0	431.0	2140.0
CGR – 2nd Row	3410.0	-415.0	2190.0	3410.0	415.0	2190.0
CGR - 3rd Row	4195.0	-355.0	2216.0	4195.0	355.0	2216.0

REFERENCE FOR VEHICLE COORDINATE SYSTEM (measured in millimeters):

Front passenger seat front outboard anchor hole (x, y, z) = 1962.0, 648.0, 1138.4

Front driver seat rear outboard anchor hole (x, y, z) = 2415.1, -670.6, 1164.8

Front driver seat front outboard anchor hole (x, y, z) = 1962.0, -648.0, 1138.4

REMARKS:

RECORDED BY: Donald J. Whiteside DATE: May 18, 2009

APPROVED BY: Helen A. Kaleto

TABLE 2-6

SUMMARY OF TARGETING RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2009 Toyota Sienna CE FWD 7 Passenger

VEH. NHTSA NO.: C95107 VIN: 5TDZK23C09S262839 COLOR: Silver Pine

VEH. BUILD DATE: October, 2008 TEST DATES: May 20-21, 2009

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Andrew Gould, Ryan Jones, Helen A. Kaleto, Donald J. Whiteside

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	1997.9	-646.4	2274.2	--	--	Yes	--	--
REL	2003.6	-659.6	2255.8	248	27	--	1	No
AP2	1902.8	-702.1	2187.1	203	45	No	--	Yes
AP3	1716.8	-731.6	2082.2	203	40	No	--	No
A-Pillar Right Side								
AP1	1997.9	643.4	2273.3	--	--	Yes	--	--
REL	2011.0	655.8	2258.8	110	28	--	1	Yes
AP2	1900.5	699.5	2184.9	157	46	No	--	No
AP3	1715.8	730.7	2081.4	157	40	No	--	Yes
B-Pillar Left Side								
BP1	2541.1	-566.5	2346.2	270	35	No	--	No
BP2	2540.1	-703.5	2155.7	270	3	No	--	Yes
BP3	2494.0	-740.4	2093.1	--	--	Yes	--	--
REL	2477.1	-747.9	2074.9	270	-4	--	1	No
BP4	2653.3	-752.0	1967.0	200	-3	No	--	No
B-Pillar Right Side								
BP1	2548.4	564.4	2345.8	90	34	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**					
BP2	2537.0	705.1	2154.7	90	3	No	--	No
BP3	2495.4	739.0	2091.9	--	--	Yes	--	--
REL	2473.1	744.0	2073.1	86	-4	--	1	No
BP4	2645.3	750.6	1964.9	160	-3	No	--	No
Other Pillar Left Side								
OP1	3633.7	-696.4	2179.1	270	0	No	--	No
OP2	3674.8	-720.0	2136.4	--	--	Yes	--	--
REL	3694.7	-713.6	2141.9	270	-8	--	1	No
Other Pillar Right Side								
OP1	3586.4	561.0	2393.3	90	31	No	--	Yes
OP2	3672.2	717.5	2141.9	90	-10	No	--	No
Rear Pillar Left Side								
RP1	4324.9	-601.5	2298.0	330	26	No	--	Yes
RP2	4449.8	-538.4	2202.4	285	5	No	--	No
Rear Pillar Right Side								
RP1	4326.8	600.9	2305.5	30	22	No	--	No
RP2	4447.3	544.0	2209.7	75	6	No	--	No
Front Header Left Side								
FH1	1927.8	-537.5	2295.2	180	44	No	--	No
FH2	1896.1	-386.8	2300.9	180	50	No	--	No
Front Header Right Side								
FH1	1927.9	539.6	2296.7	180	44	No	--	No
FH2	1898.0	391.3	2301.5	180	50	No	--	No
Side Rail Left Side								
SR1	2148.0	-613.3	2310.4	270	38	No	--	No
SR2A	2298.5	-601.0	2323.4	270	50	No	--	No
SR2B	2241.0	-598.9	2320.5	270	46	No	--	Yes
SR3-1	3060.6	-595.9	2355.8	270	46	No	--	No
SR3-2	3221.8	-598.1	2355.4	270	45	No	--	Yes

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**					
SR3-3	3812.1	-621.8	2359.5	270	50	No	--	No
SR3-4	3974.5	-619.4	2348.7	270	50	No	--	No
Side Rail Right Side								
SR1	2148.7	613.3	2311.8	90	39	No	--	No
SR2A	2298.6	598.2	2346.0	--	--	Yes	--	--
REL	2302.4	626.7	2307.4	90	50	--	2	No
SR2B	2248.8	580.9	2319.0	90	46	No	--	No
SR3-1	3053.4	596.2	2357.8	90	46	No	--	No
SR3-2	3217.6	593.4	2360.7	90	46	No	--	No
SR3-3	3804.6	618.0	2368.4	90	50	No	--	No
SR3-4	3967.0	615.9	2359.0	90	50	No	--	No
Rear Header Left Side								
RH	4399.1	-355.5	2373.9	0	50	No	--	Yes
Rear Header Right Side								
RH	4305.4	354.0	2382.2	0	50	No	--	No
Left Sliding Door								
SD	3100.8	-587.3	2377.9	--	--	Yes	--	--
REL	3102.5	-602.4	2358.7	270	35	--	1	No
Right Sliding Door								
SD	3100.5	591.1	2379.5	--	--	Yes	--	--
REL	3101.5	606.2	2361.6	90	37	--	1	Yes
Upper Roof Left Side								
UR1@SR2A	2265.5	-468.2	2383.7	270	42	No	--	No
UR3@SR3-1	3094.9	-489.2	2426.4	270	40	No	--	No
UR4@OPR	3560.2	-484.1	2436.3	270	40	No	--	Yes
UR6@RP	4125.8	-494.8	2403.6	315	40	No	--	No
Upper Roof Right Side								
UR2@BPR	2551.1	492.8	2396.8	90	38	No	--	Yes

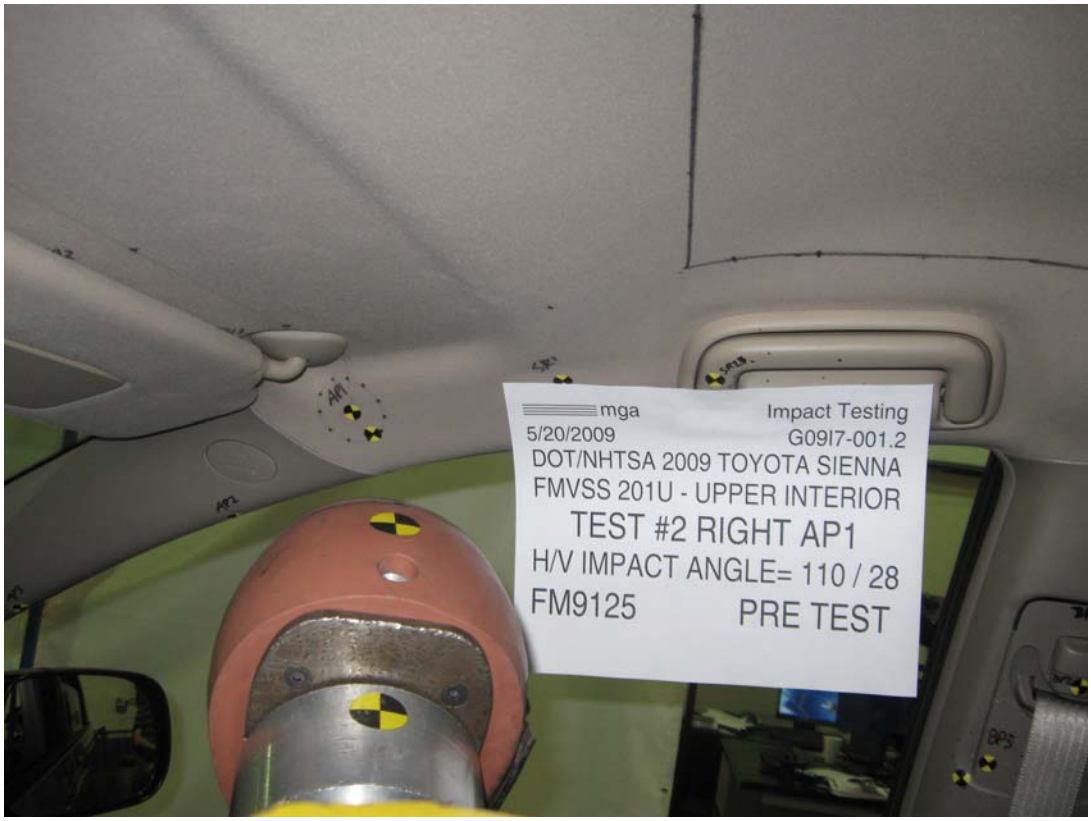
SUMMARY OF TARGETING RESULTS								
Target	**Location (mm)**			**Horizontal Angle (deg)**	**Vertical Angle (deg)**	**Relocation (Yes/No)**	**Extension (# of 25 mm Spheres)**	**Impact (Yes/No)**
	x	**y**	**z**					
UR5@SR3-4	3951.3	475.0	2431.9	90	40	No	--	No

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

RECORDED BY: Donald J. Whiteside DATE: May 18, 2009

APPROVED BY: Helen A. Kaleto

3.0 TEST DATA (Including Acceleration and Velocity Plots)

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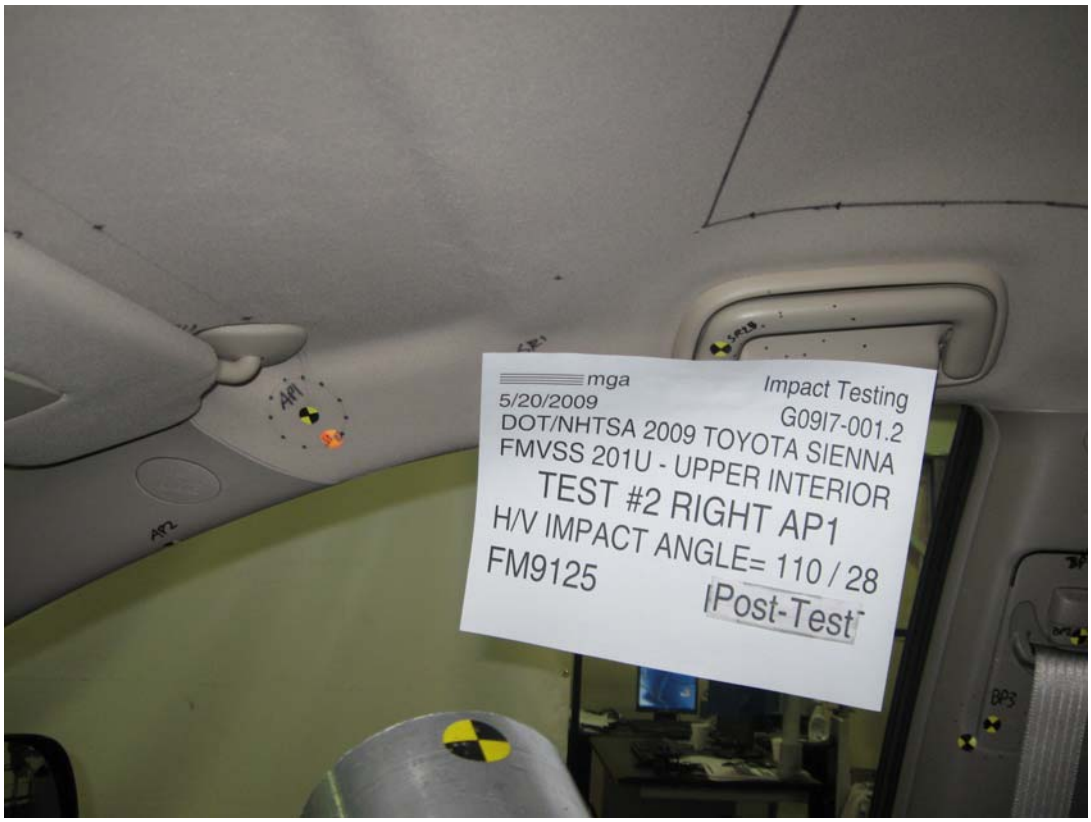
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #2 RIGHT AP1
H/V IMPACT ANGLE= 110 / 28
FM9125
Post-Test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FMVSS 201U - UPPER INTERIOR
TEST #2 RIGHT AP1
H/V IMPACT ANGLE= 110 / 28
FM9125
Post-Test


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G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #2 RIGHT AP1
H/V IMPACT ANGLE= 110 / 28
FM9125
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#2

Target (Vehicle Side): AP1Right

Temperature:21.9C

MGA Test Reference No.:FM9125

Humidity:44.0%

Approach Horizontal Angles:110º

Time of Test:12:33:08 PM

Approach Vertical Angles:28º

FMH Serial No:[037]

Additional Description:Relocations: 1

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
562	524	3.5	19.2	26	2 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-115.9	1.06	1.06
Y	6	J14103	93.7	0.85	0.85
Z	7	J35800	97.1	0.93	0.93

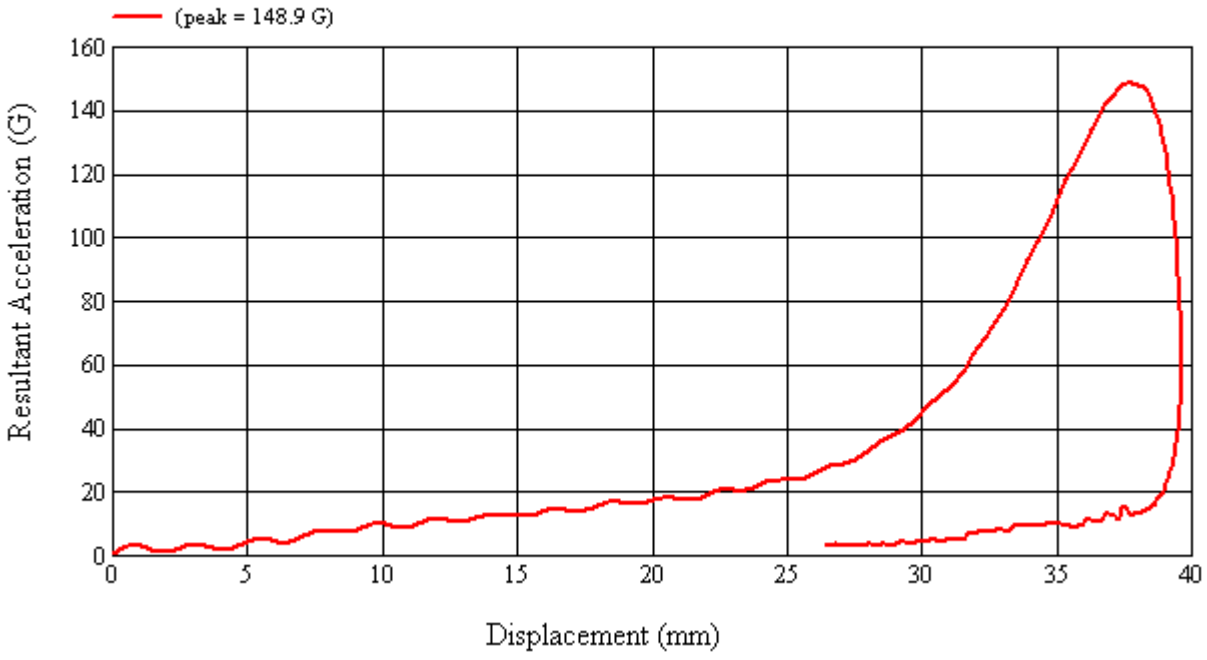
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

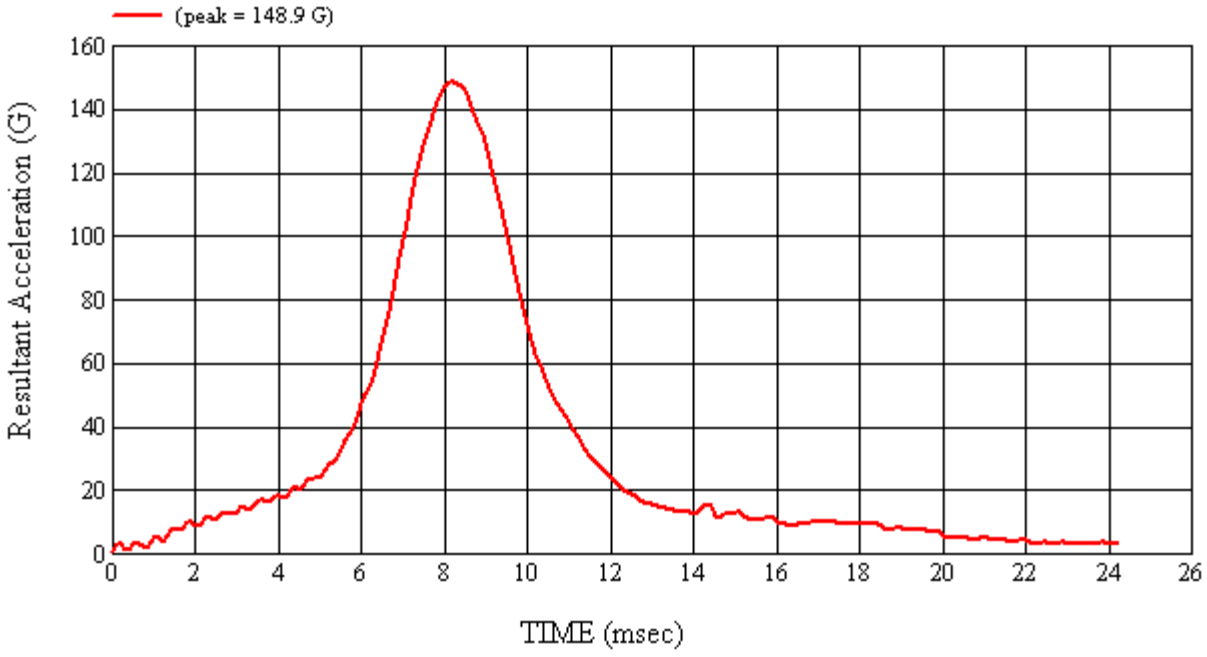
No damage observed

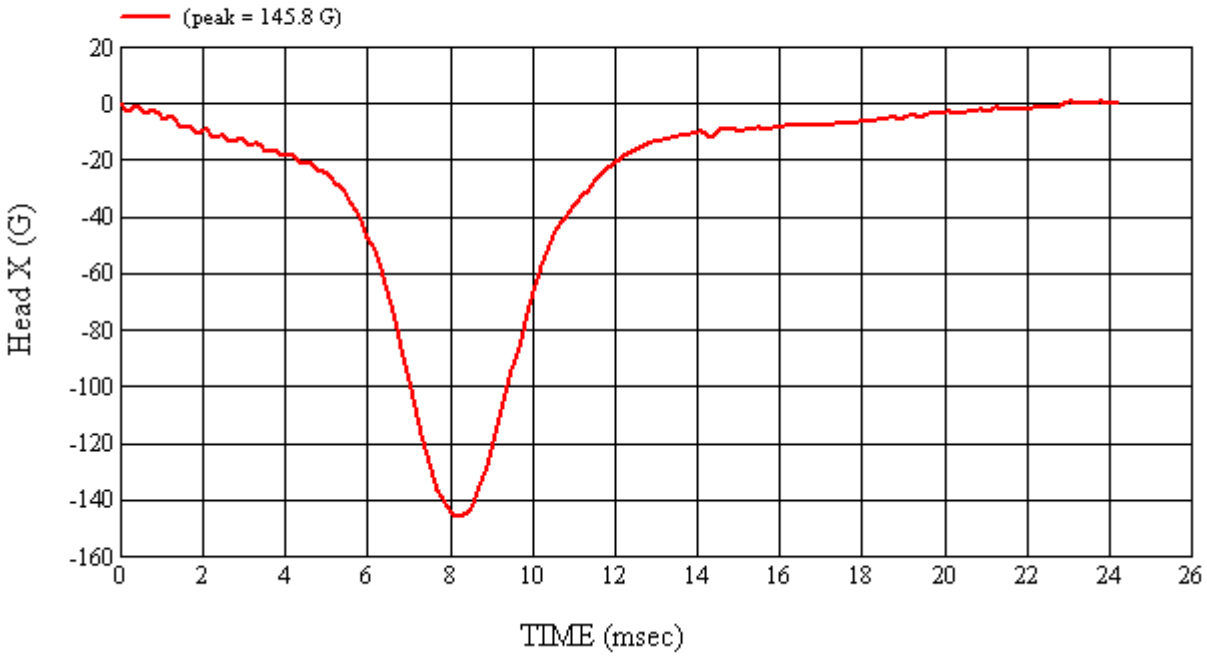
Recorded By: _____ Approved By*: _____ Date: 5/20/2009

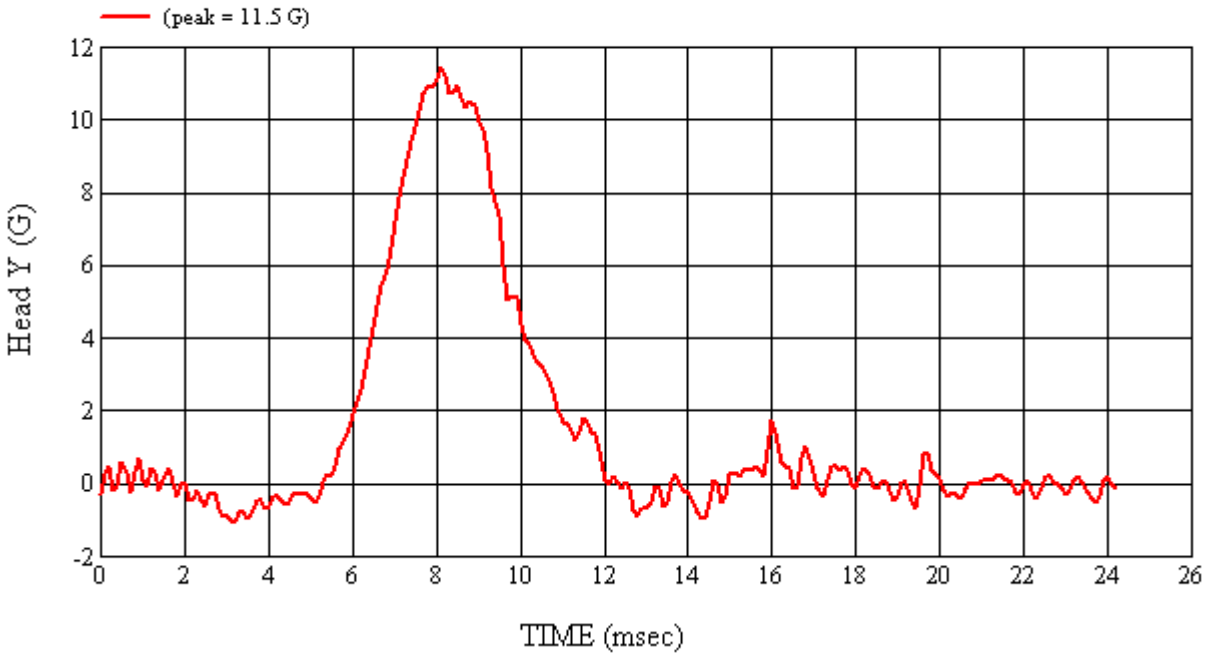
*Only necessary for NHTSA (Government) Compliance testing.

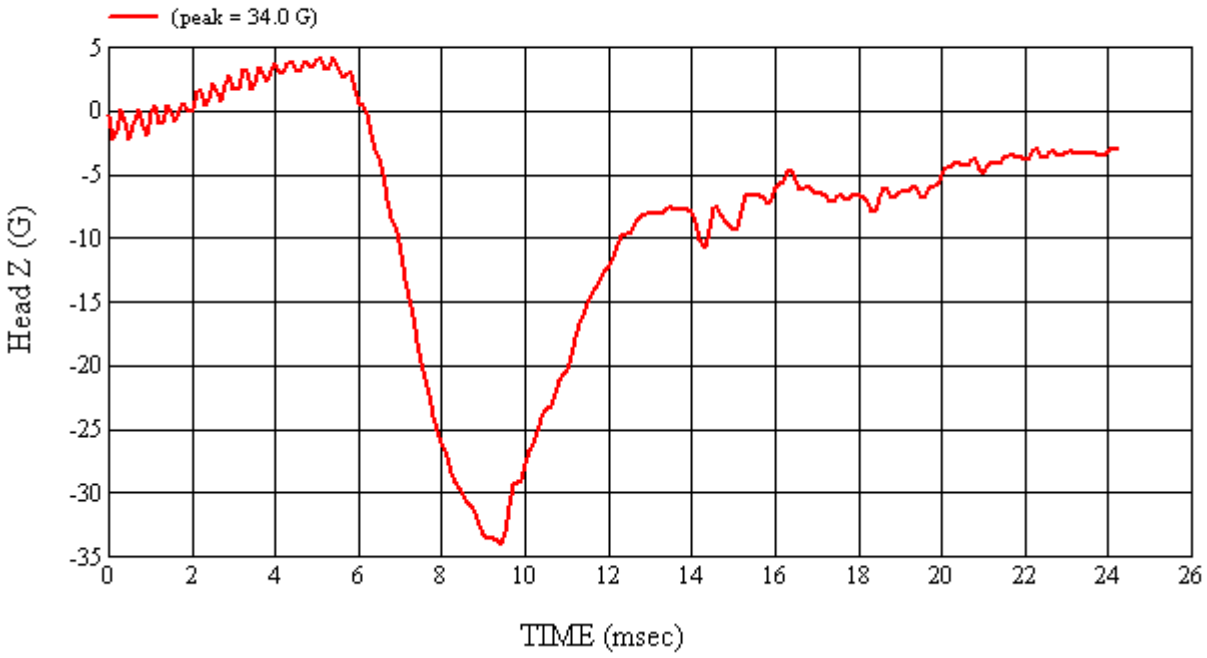
MGA Test #: FM9125 Target Location: AP1, Right Side Test Date: 5/20/2009

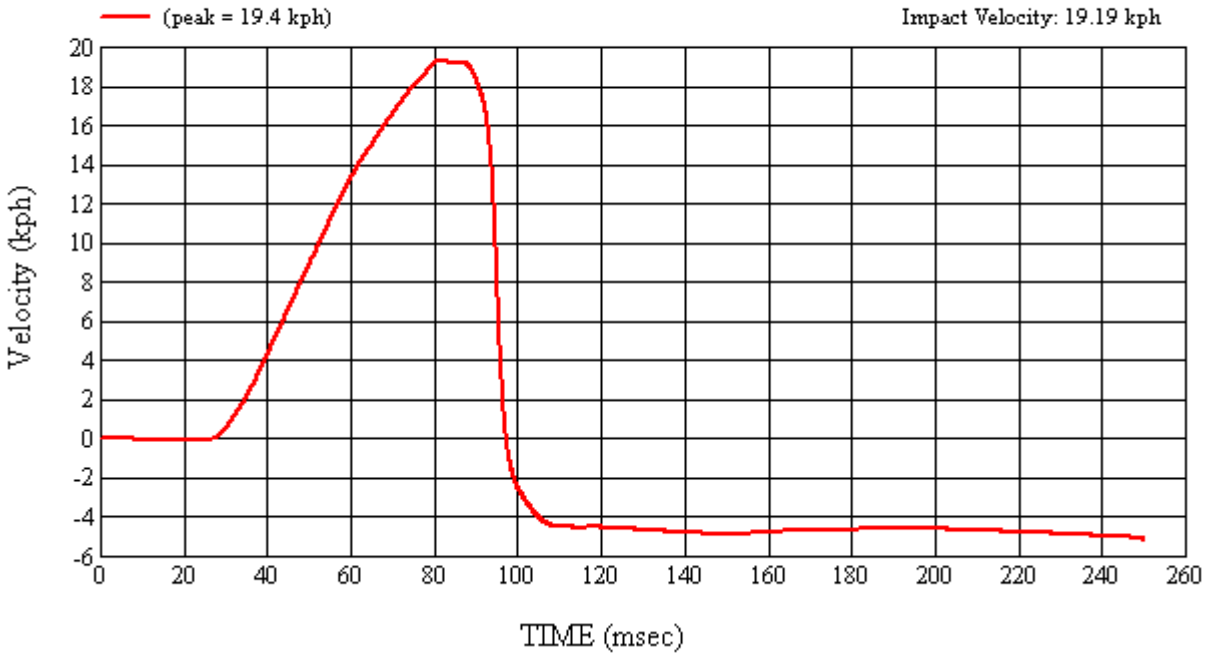


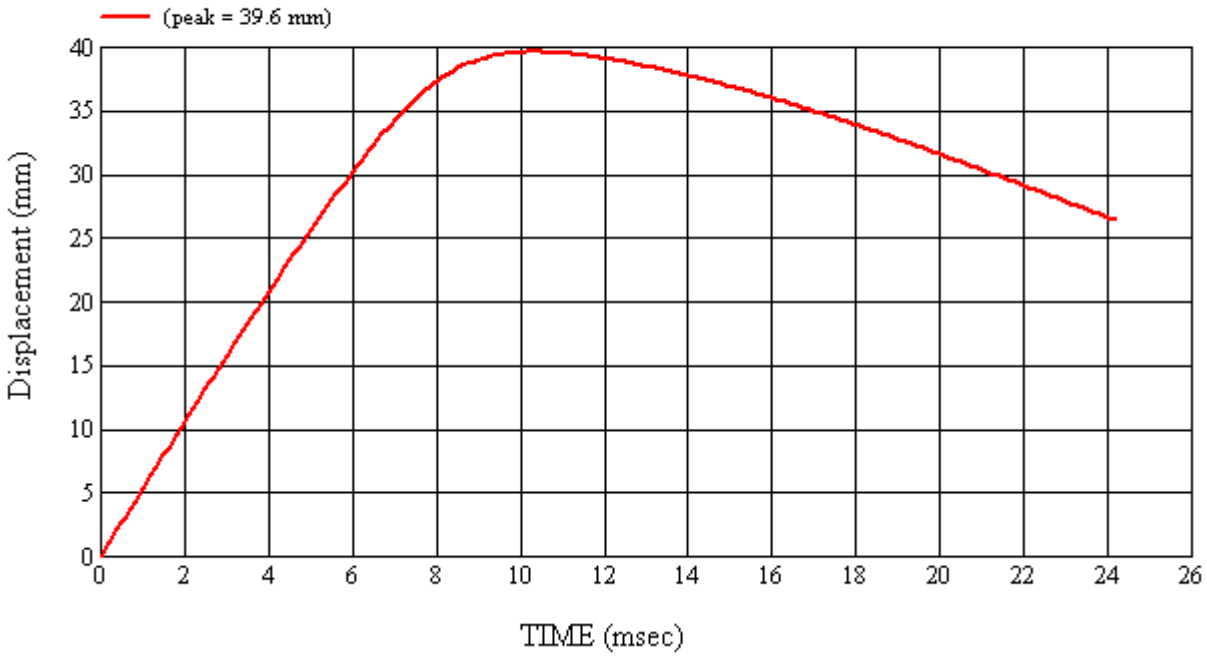



(peak = 145.8 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 11.5 G)
Head Y (G)
12
10
8
6
4
2
0
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 34.0 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 19.4 kph)
Impact Velocity: 19.19 kph
Velocity (kph)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 39.6 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)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Impact Testing
G09I7-001.2
/21/2009
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #12 LEFT AP2
H/V IMPACT ANGLE= 203 / 45
FM9135
PRE TEST


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Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #12 LEFT AP2
H/V IMPACT ANGLE= 203 / 45
FM9135
PRE TEST


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Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #12 LEFT AP2
H/V IMPACT ANGLE= 203 / 45
FM9135
Post-Test


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DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #12 LEFT AP2
H/V IMPACT ANGLE= 203 / 45
FM9135
Post-Test


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5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #12 LEFT AP2
H/V IMPACT ANGLE= 203 / 45
FM9135
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#12

Target (Vehicle Side): AP2Left

Temperature:22.4C

MGA Test Reference No.:FM9135

Humidity:47.1%

Approach Horizontal Angles:203º

Time of Test:4:08:31 PM

Approach Vertical Angles:45º

FMH Serial No:[038]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
495	436	3.8	18.9	14	1 Right

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-94	1.06	1.06
Y	6	J36197	106.3	0.85	0.85
Z	7	J36353	97.5	0.94	0.94

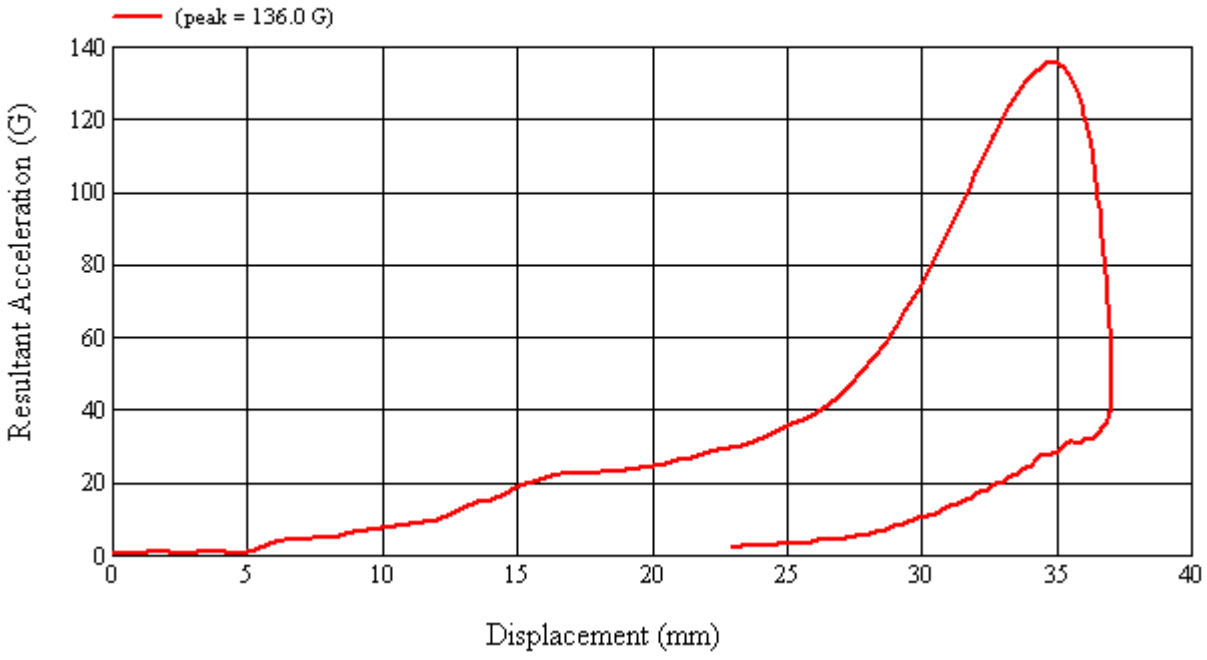
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

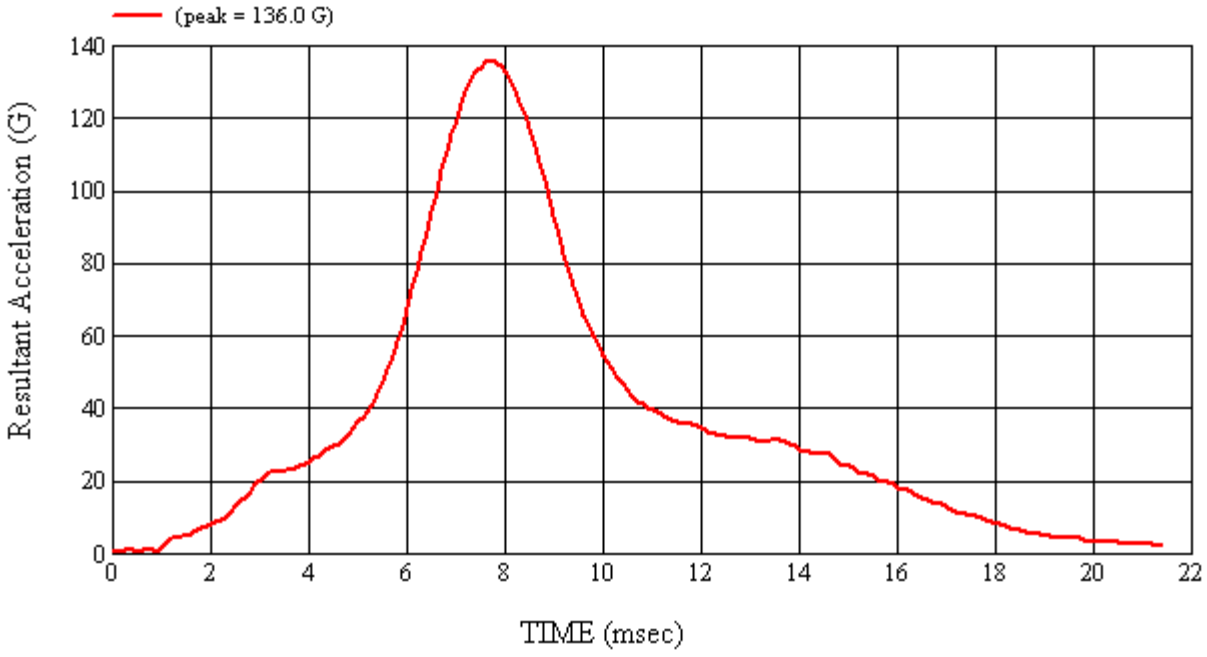
No damage observed

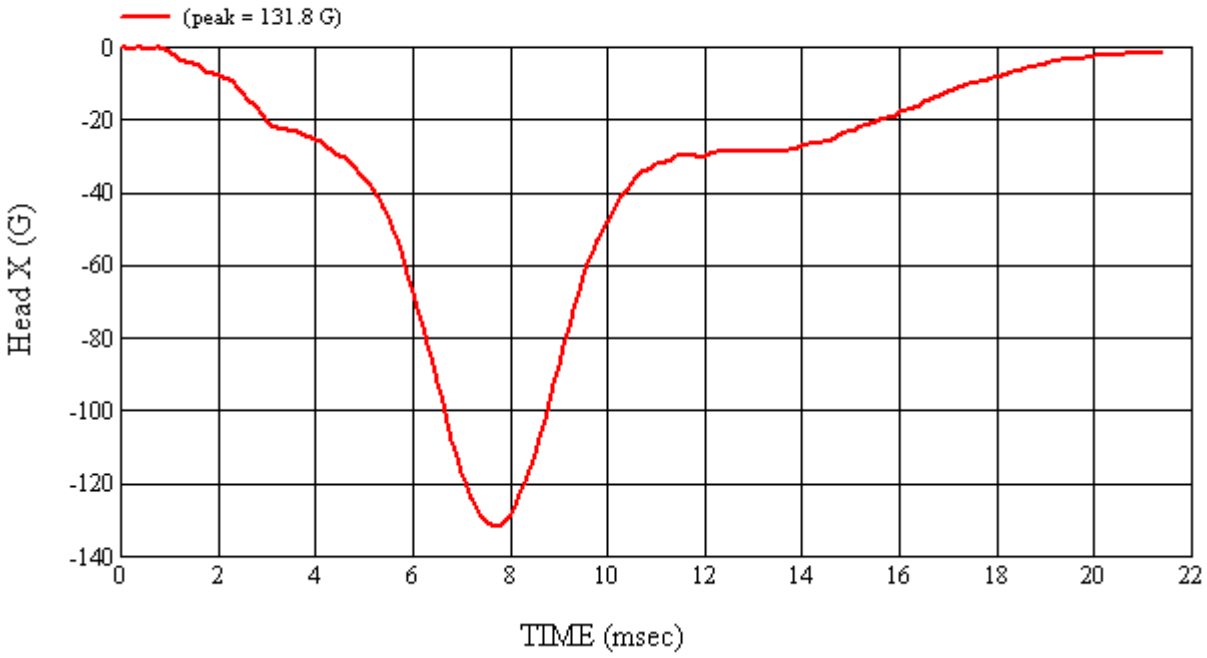
Recorded By: Andrew Gould Approved By*: Helen A. Kalafut Date: 5/21/2009

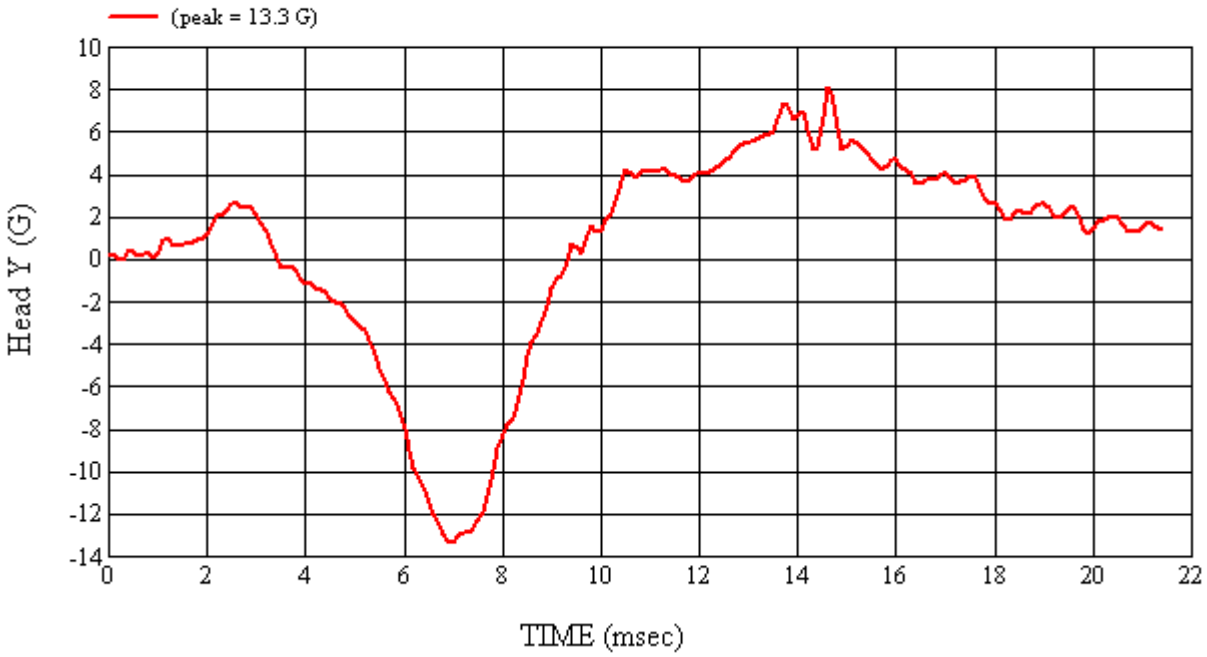
*Only necessary for NHTSA (Government) Compliance testing.

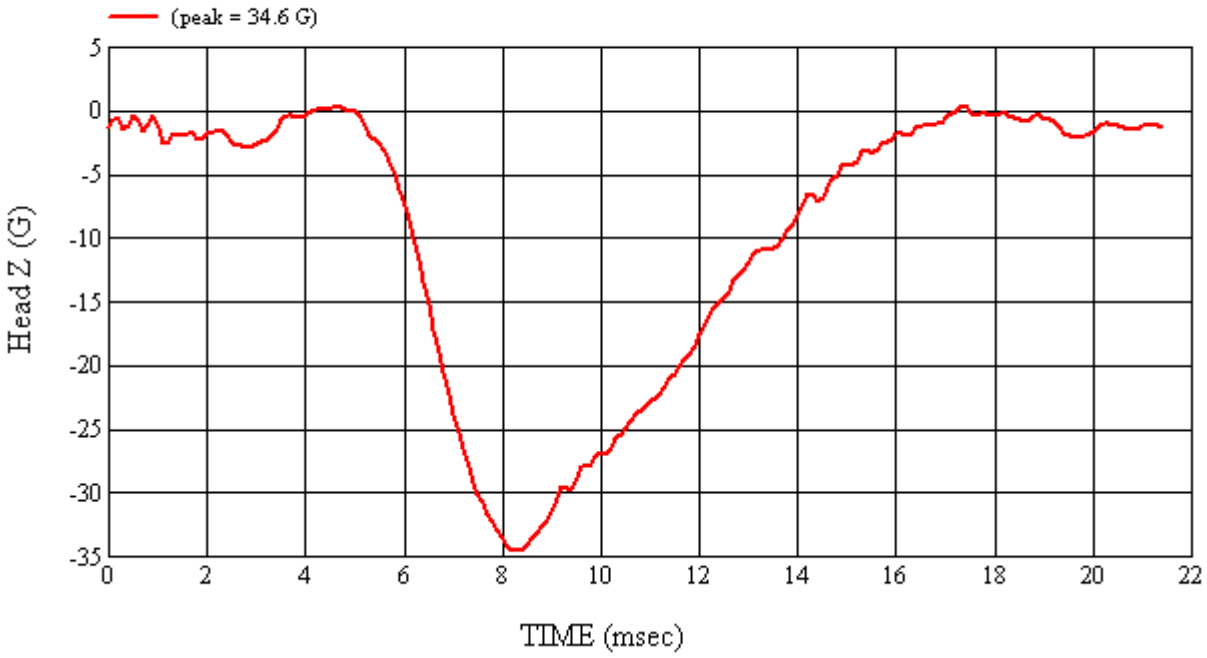
MGA Test #: FM9135 Target Location: AP2, Left Side Test Date: 5/21/2009

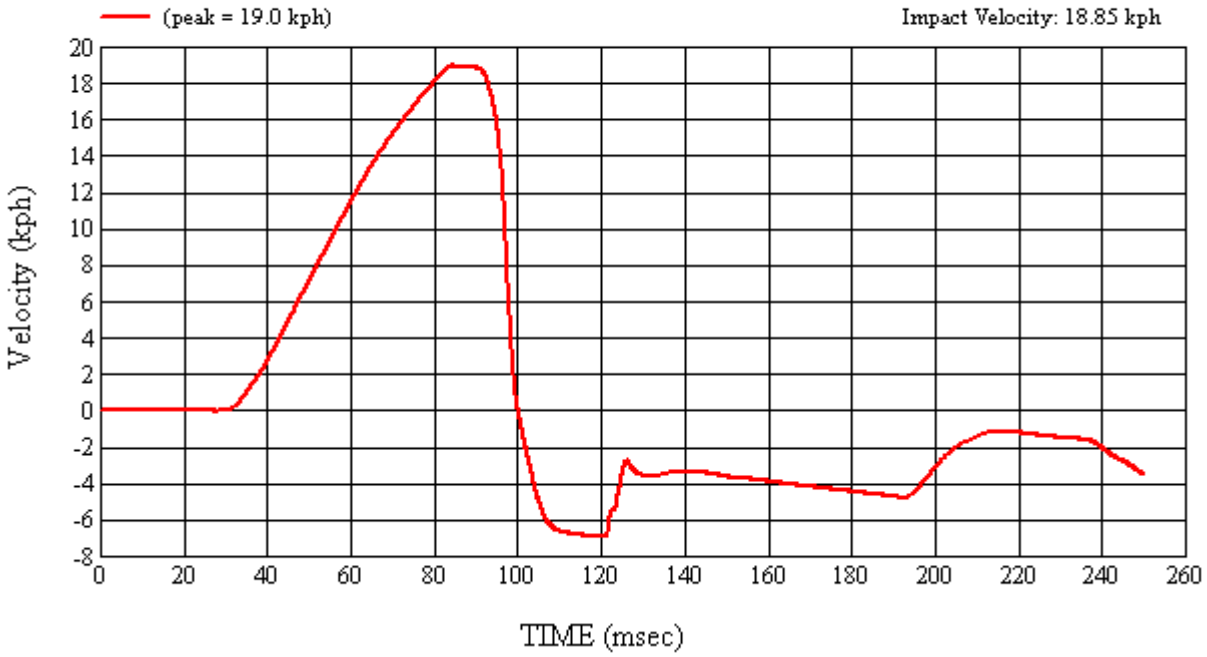


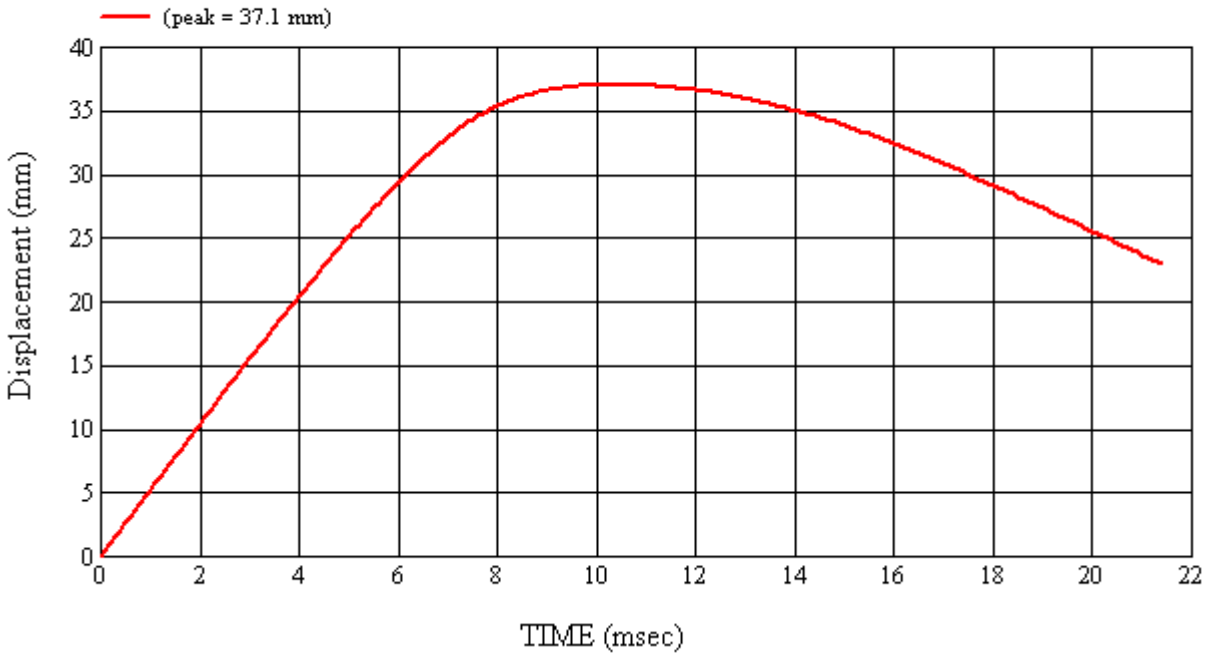



(peak = 131.8 G)
Head X (G)
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)


(peak = 13.3 G)
Head Y (G)
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)


(peak = 34.6 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)


(peak = 19.0 kph)
Impact Velocity: 18.85 kph
Velocity (kph)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 37.1 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)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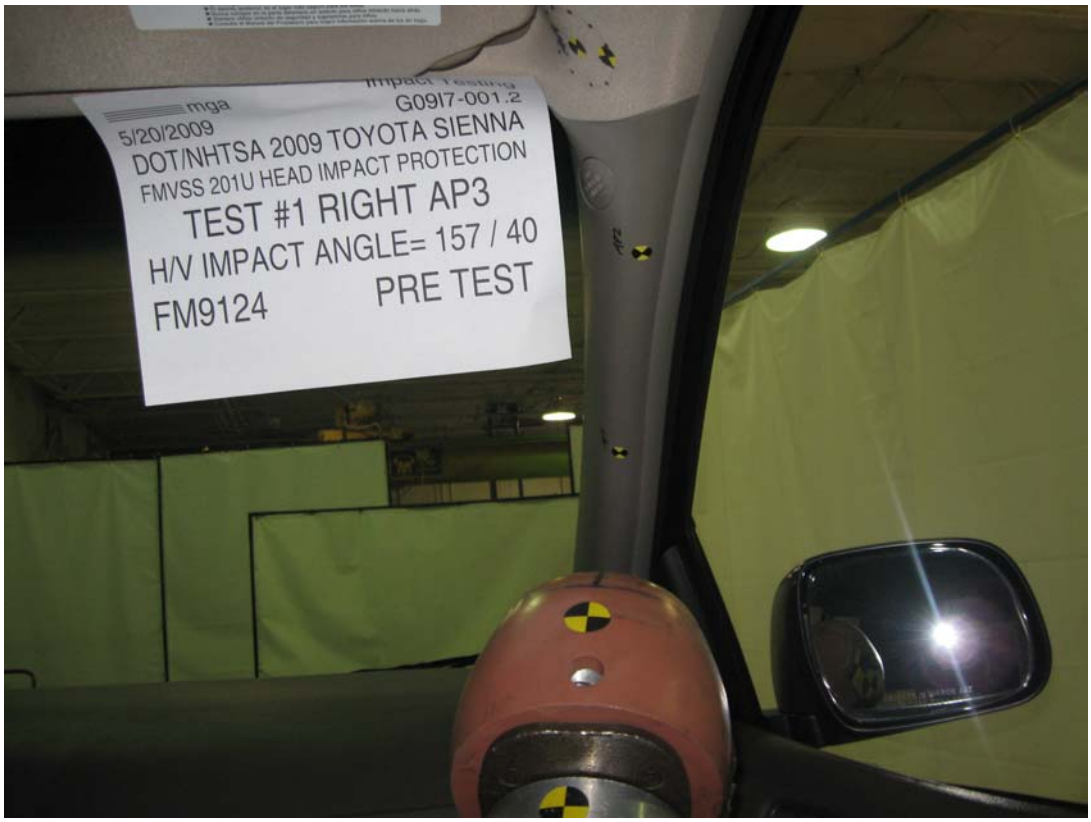
Impact Testing
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U HEAD IMPACT PROTECTION
TEST #1 RIGHT AP3
H/V IMPACT ANGLE= 157 / 40
FM9124
PRE TEST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DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U HEAD IMPACT PROTECTION
TEST #1 RIGHT AP3
H/V IMPACT ANGLE= 157 / 40
FM9124
PRE TEST


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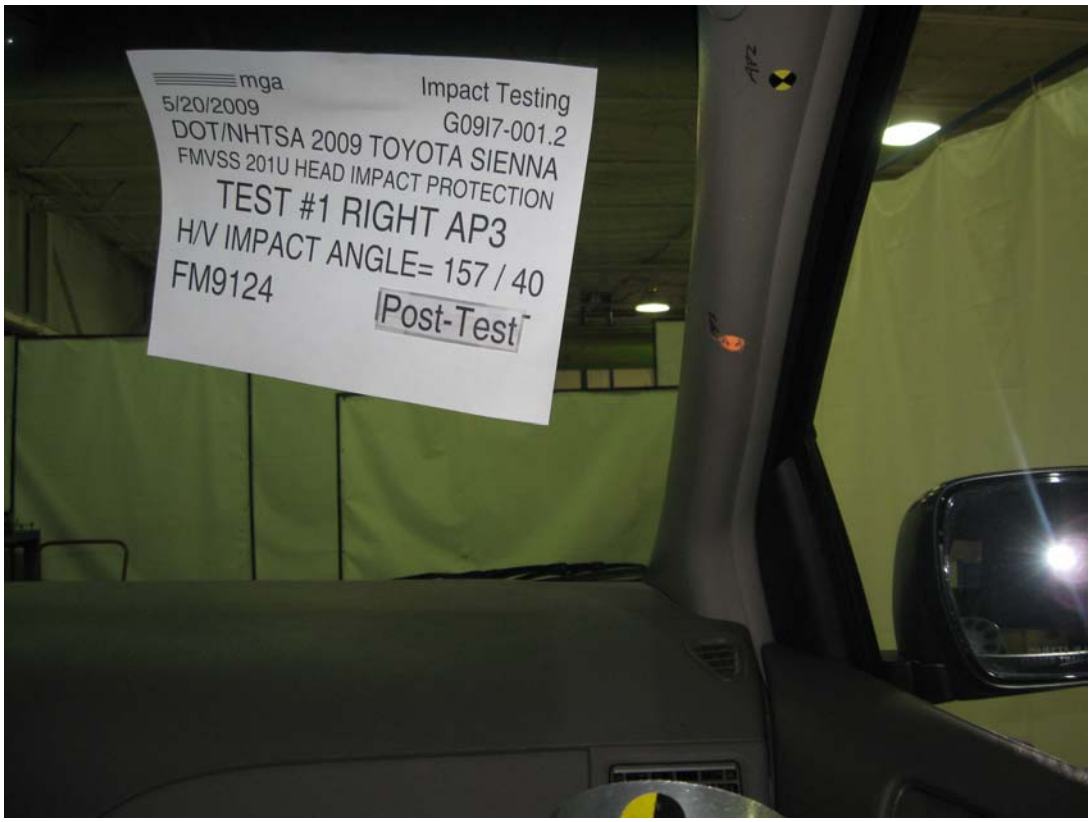
Impact Testing
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U HEAD IMPACT PROTECTION
TEST #1 RIGHT AP3
H/V IMPACT ANGLE= 157 / 40
FM9124
Post-Test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Impact Testing
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U HEAD IMPACT PROTECTION
TEST #1 RIGHT AP3
H/V IMPACT ANGLE= 157 / 40
FM9124
Post-Test


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Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U HEAD IMPACT PROTECTION
TEST #1 RIGHT AP3
H/V IMPACT ANGLE= 157 / 40
FM9124
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#1

Target (Vehicle Side): AP3Right

Temperature:21.9C

MGA Test Reference No.:FM9124

Humidity:43.9%

Approach Horizontal Angles:157º

Time of Test:12:00:07 PM

Approach Vertical Angles:40º

FMH Serial No:[035]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
579	547	4.6	19.2	19	7 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.6	1.06	1.06
Y	6	J22664	94.3	0.85	0.85
Z	7	J35924	92.8	0.93	0.94

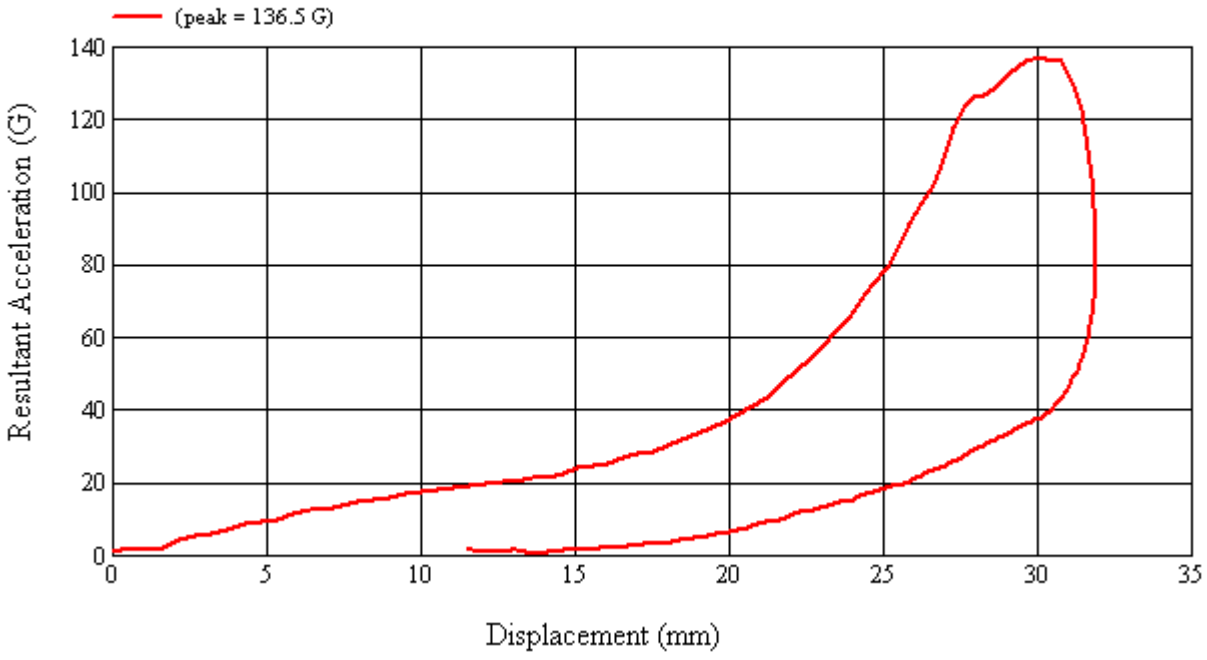
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

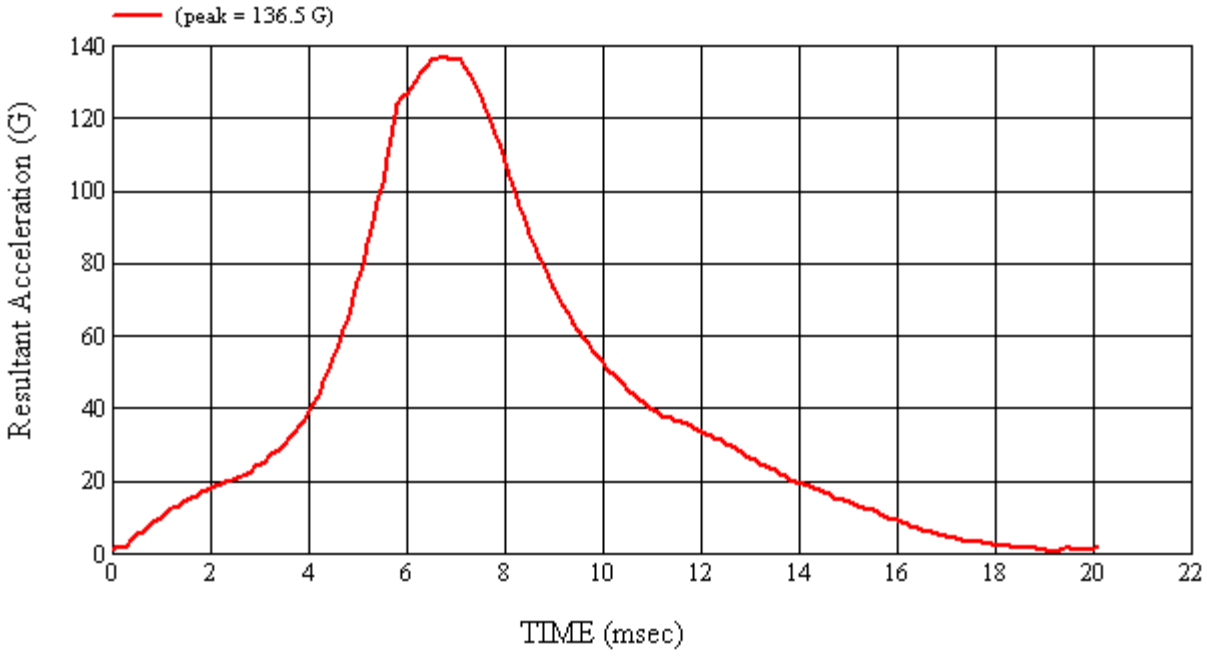
No damage observed

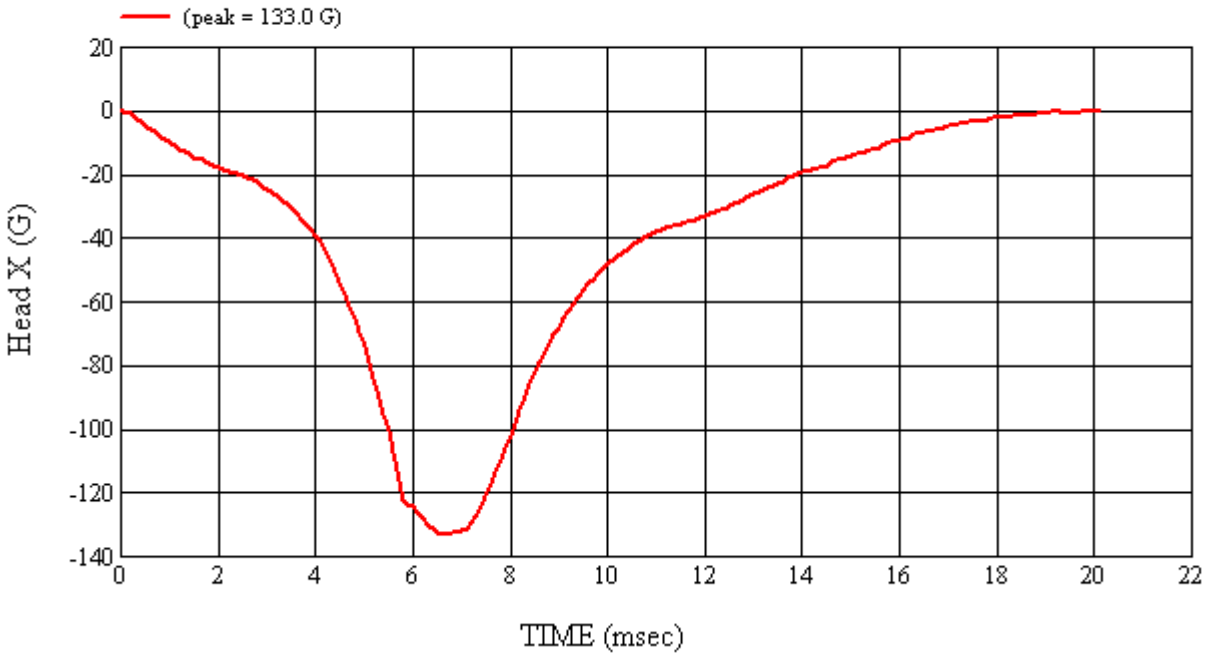
Recorded By: _____ Approved By*: _____ Date: 5/20/2009

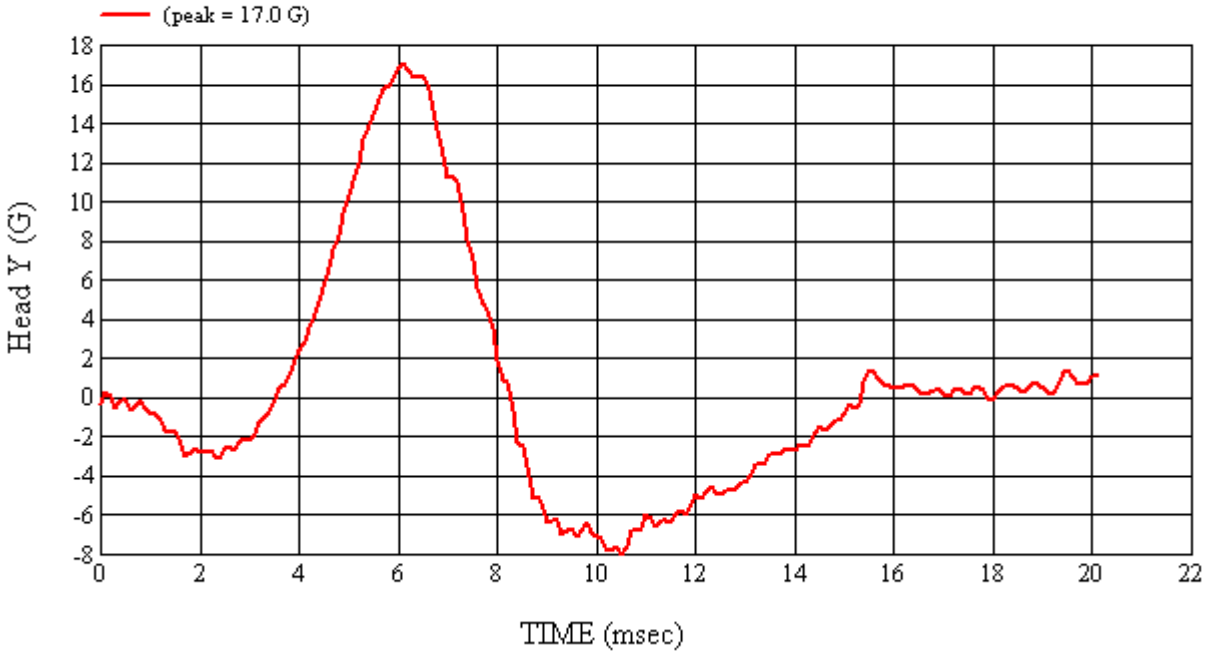
*Only necessary for NHTSA (Government) Compliance testing.

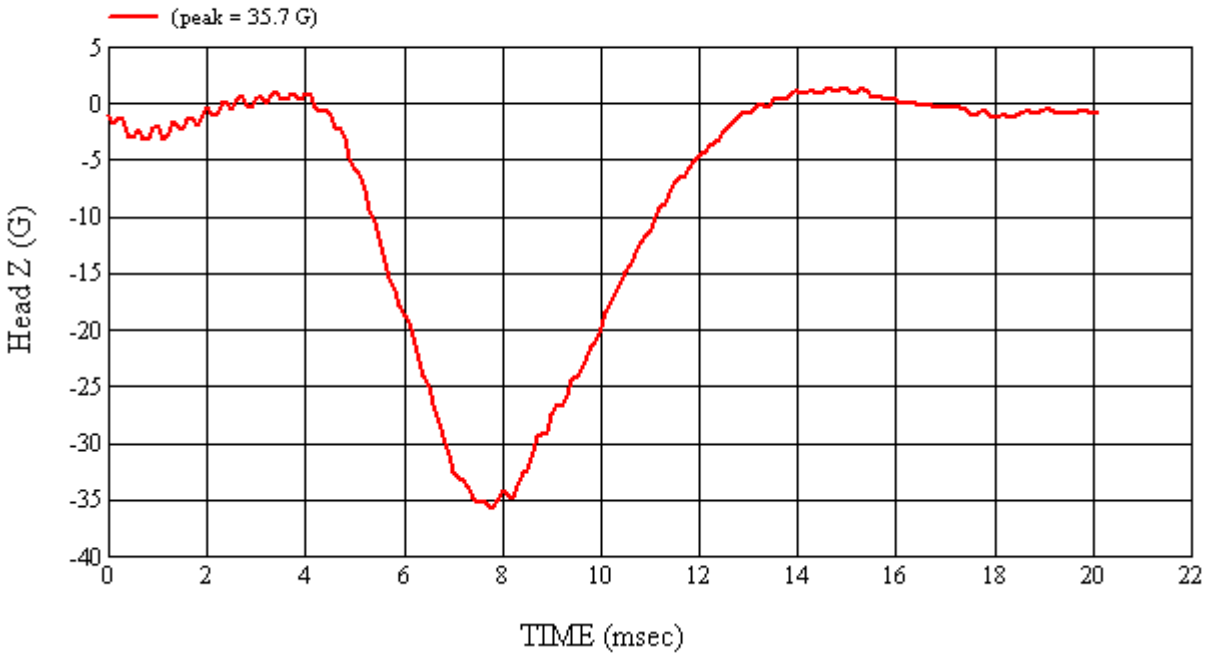
MGA Test #: FM9124 Target Location: AP3, Right Side Test Date: 5/20/2009

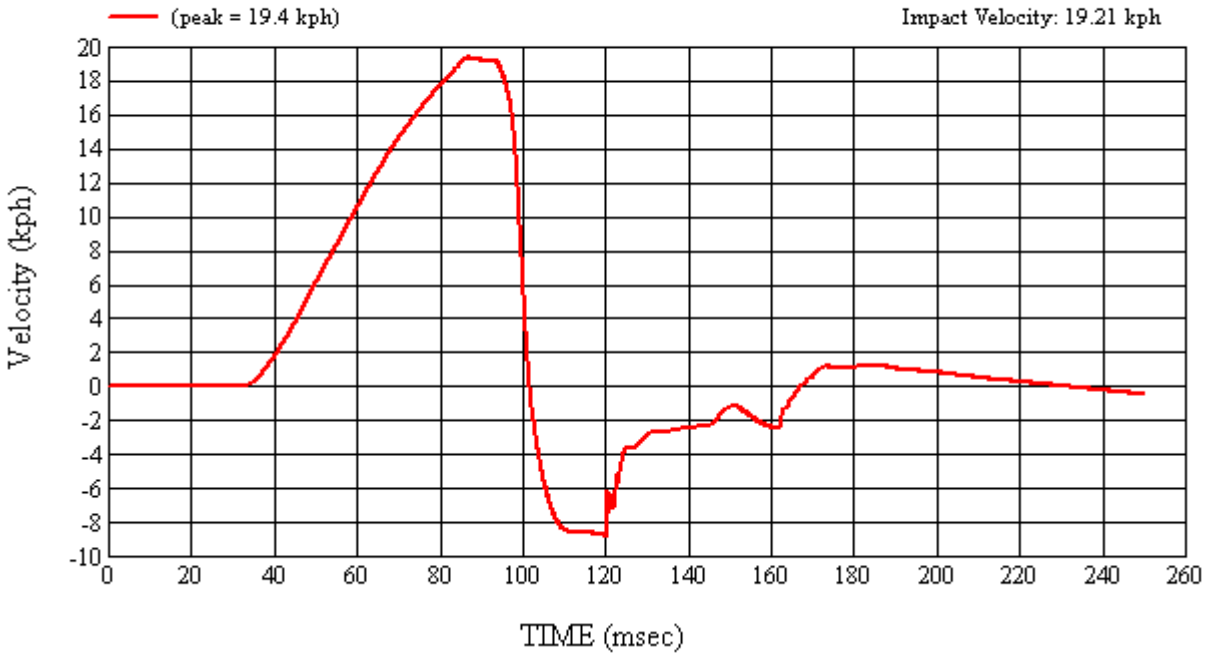


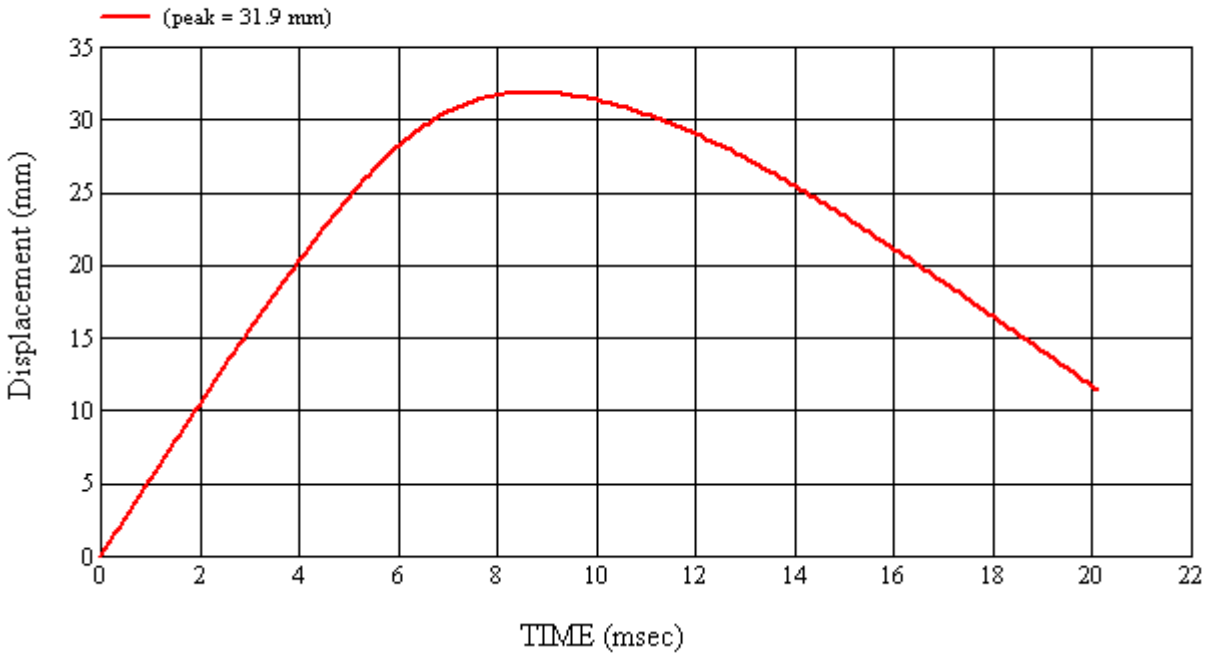



(peak = 133.0 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)

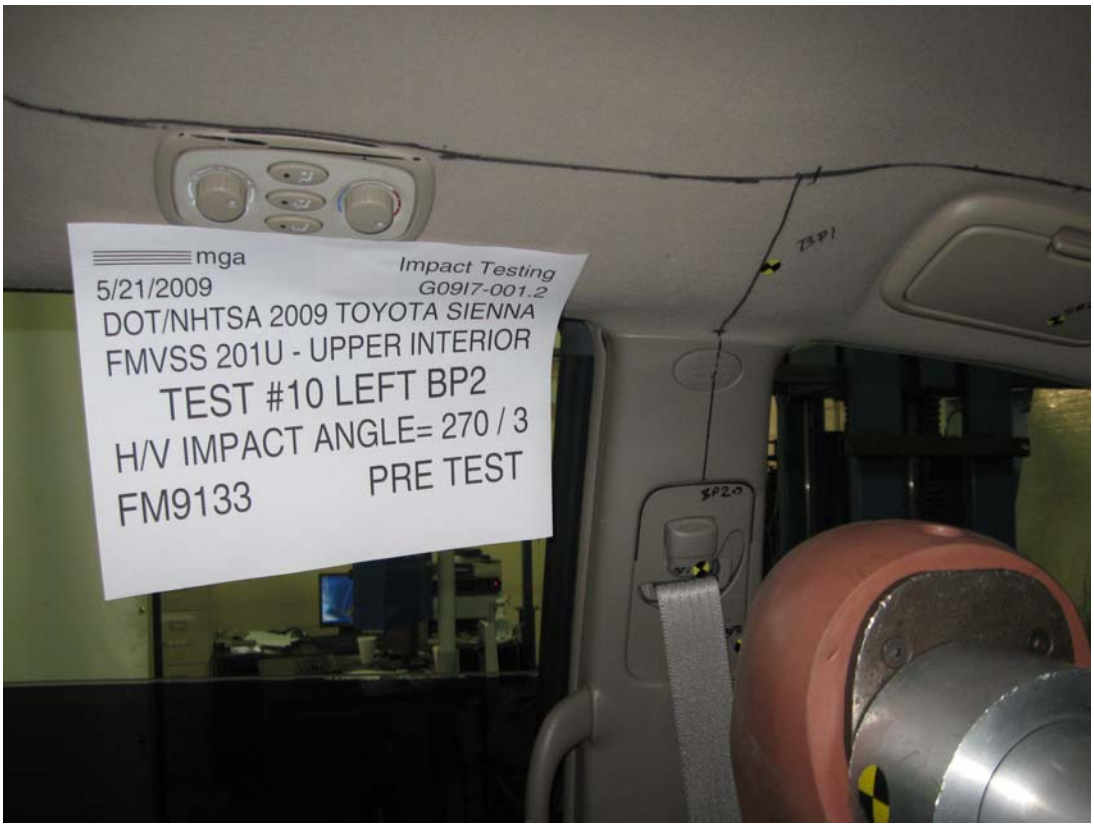

(peak = 17.0 G)
Head Y (G)
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)


(peak = 35.7 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)

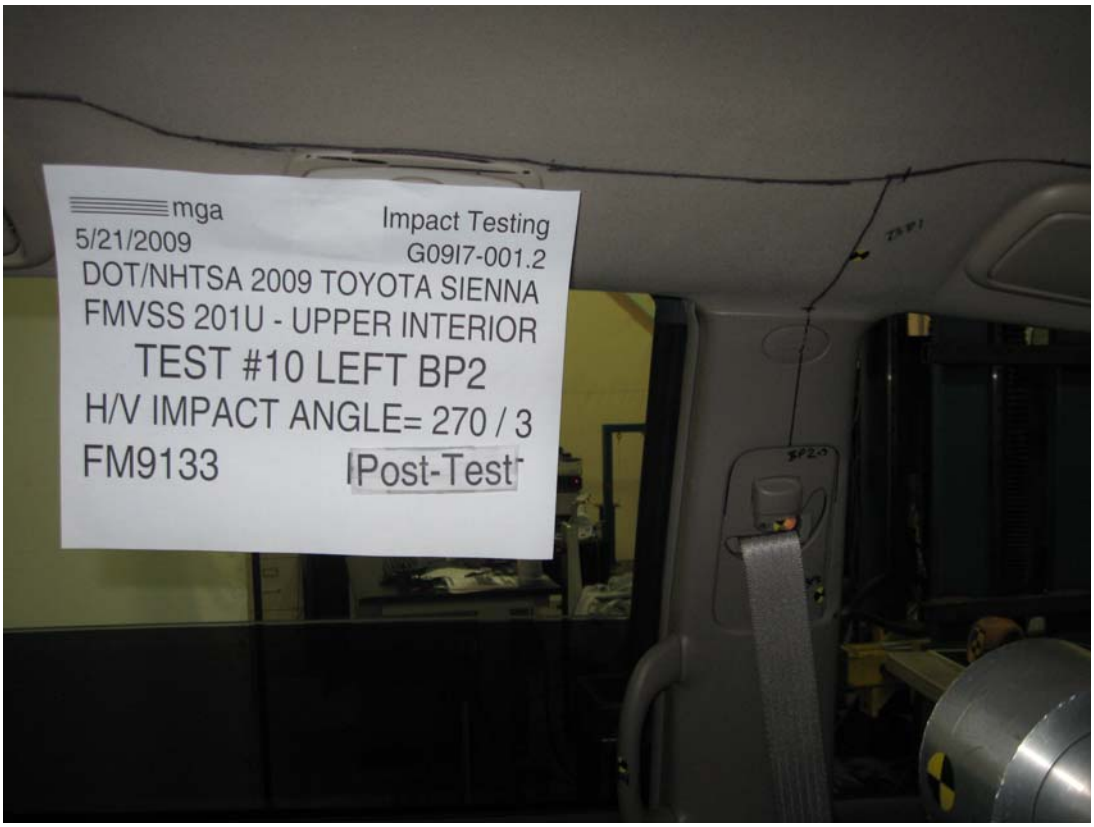

(peak = 19.4 kph)
Impact Velocity: 19.21 kph
Velocity (kph)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 31.9 mm)
Displacement (mm)
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
22
TIME (msec)


mga
5/21/2009
Impact Testing
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #10 LEFT BP2
H/V IMPACT ANGLE= 270 / 3
FM9133
PRE TEST


mga
5/21/2009
Impact Testing
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #10 LEFT BP2
H/V IMPACT ANGLE= 270 / 3
FM9133
PRE TEST


C95107
FM9133
LEFT BP2
H/V 270/3
mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #10 LEFT BP2
H/V IMPACT ANGLE= 270 / 3
FM9133
Post-Test


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #10 LEFT BP2
H/V IMPACT ANGLE= 270 / 3
FM9133
Post-Test


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #10 LEFT BP2
H/V IMPACT ANGLE= 270 / 3
FM9133
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#10

Target (Vehicle Side): BP2Left

Temperature:22.5C

MGA Test Reference No.:FM9133

Humidity:54.6%

Approach Horizontal Angles:270º

Time of Test:1:51:00 PM

Approach Vertical Angles:3º

FMH Serial No:[035]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
425	342	14.6	24.1	32	12 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.6	1.06	1.06
Y	6	J22664	94.3	0.85	0.85
Z	7	J35924	92.8	0.94	0.94

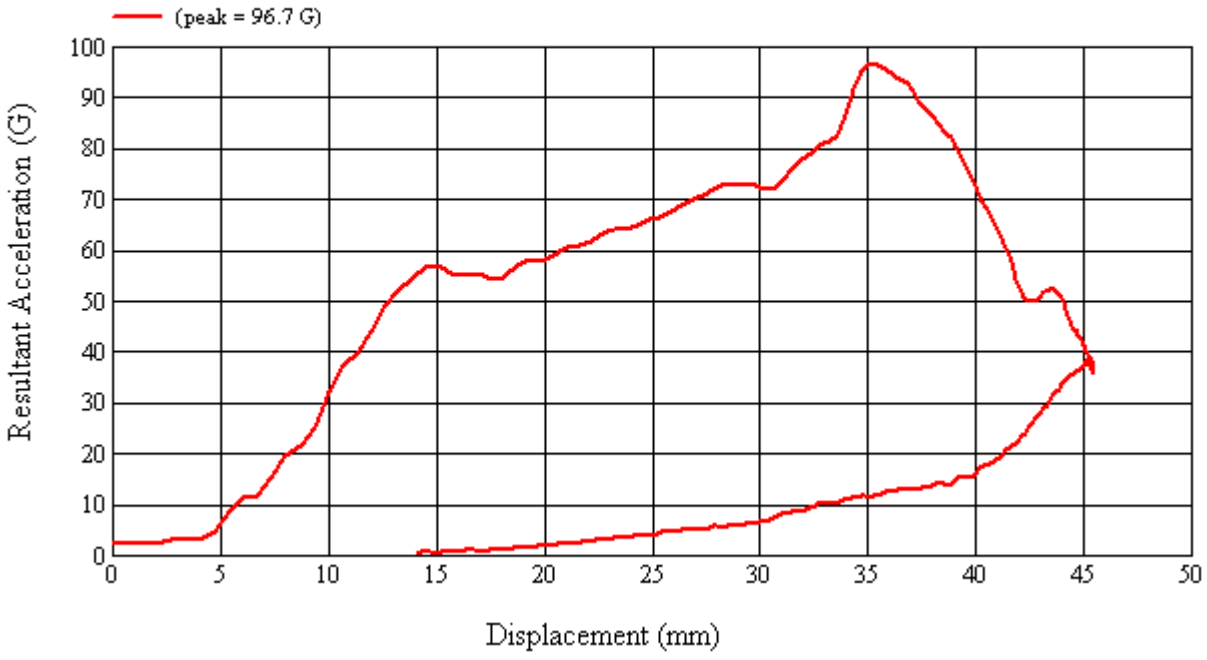
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

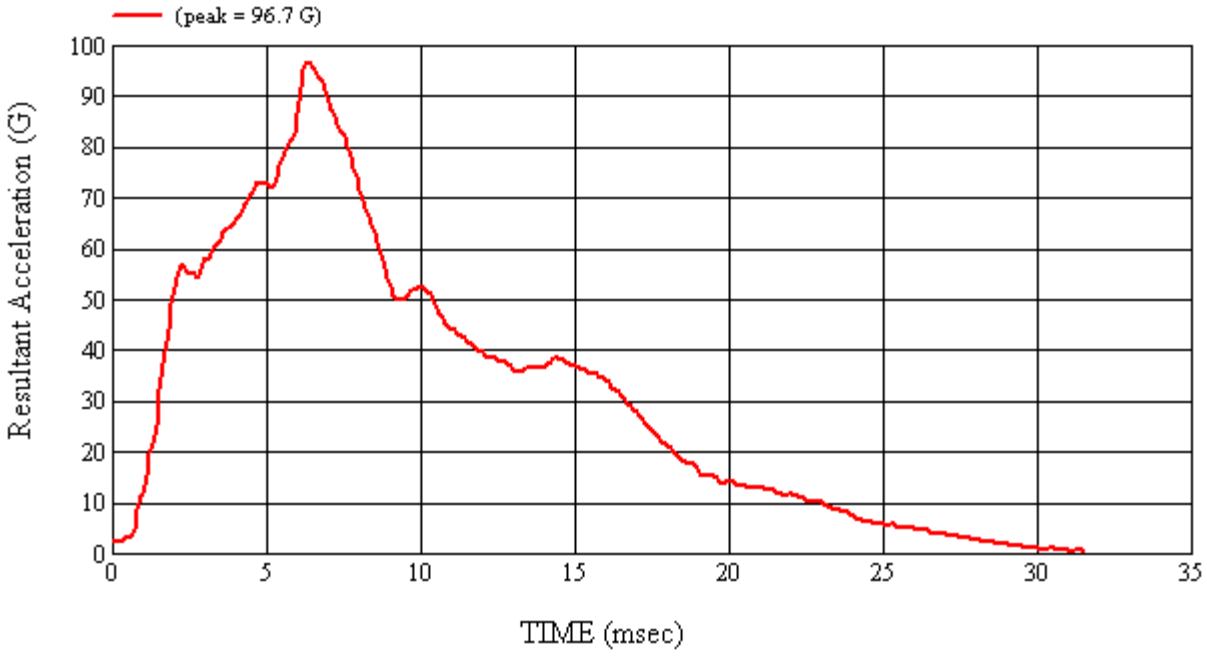
Adjuster non-functional

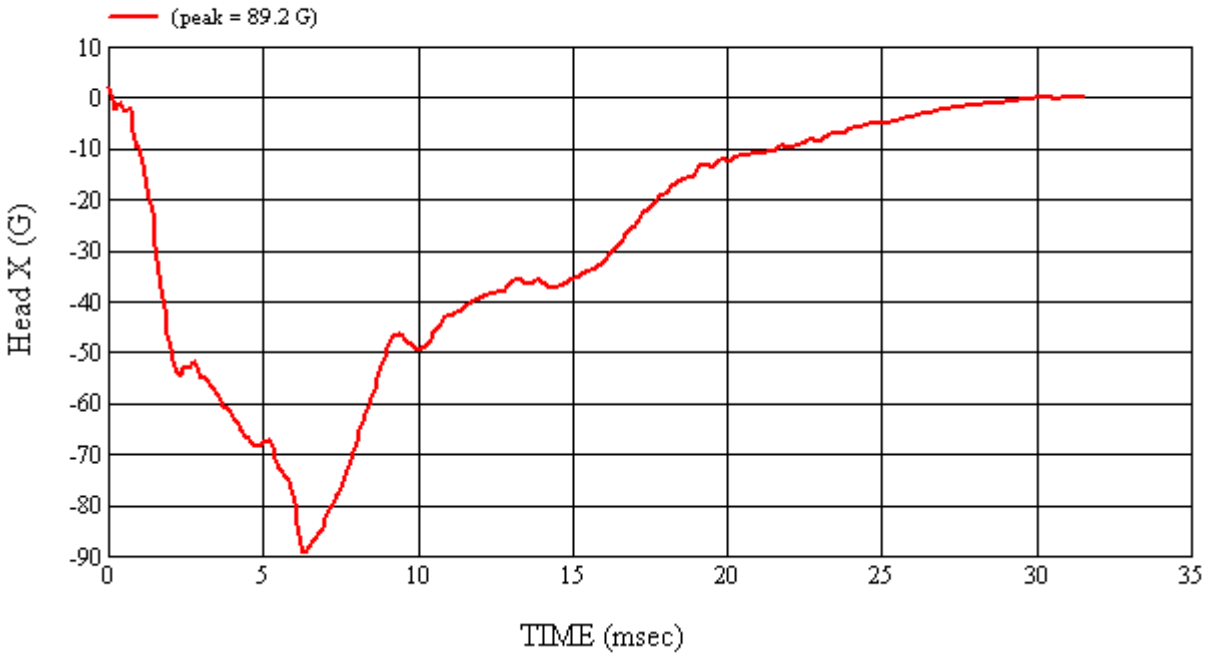
Recorded By: _____ Approved By*: _____ Date: 5/21/2009

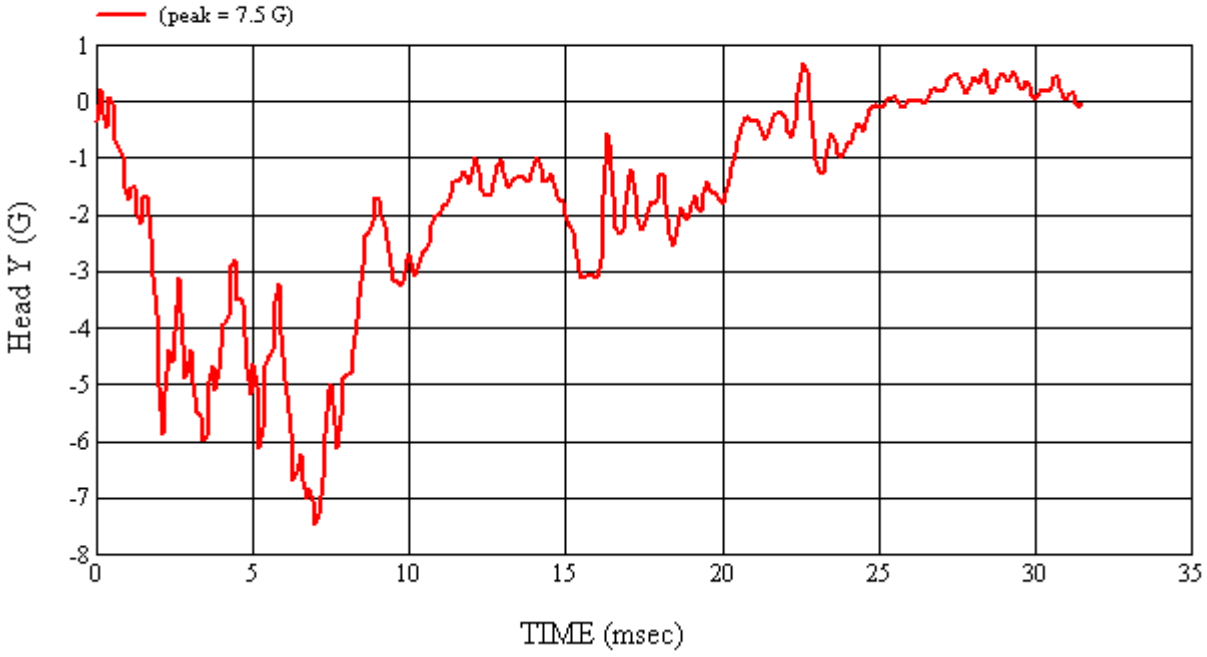
*Only necessary for NHTSA (Government) Compliance testing.

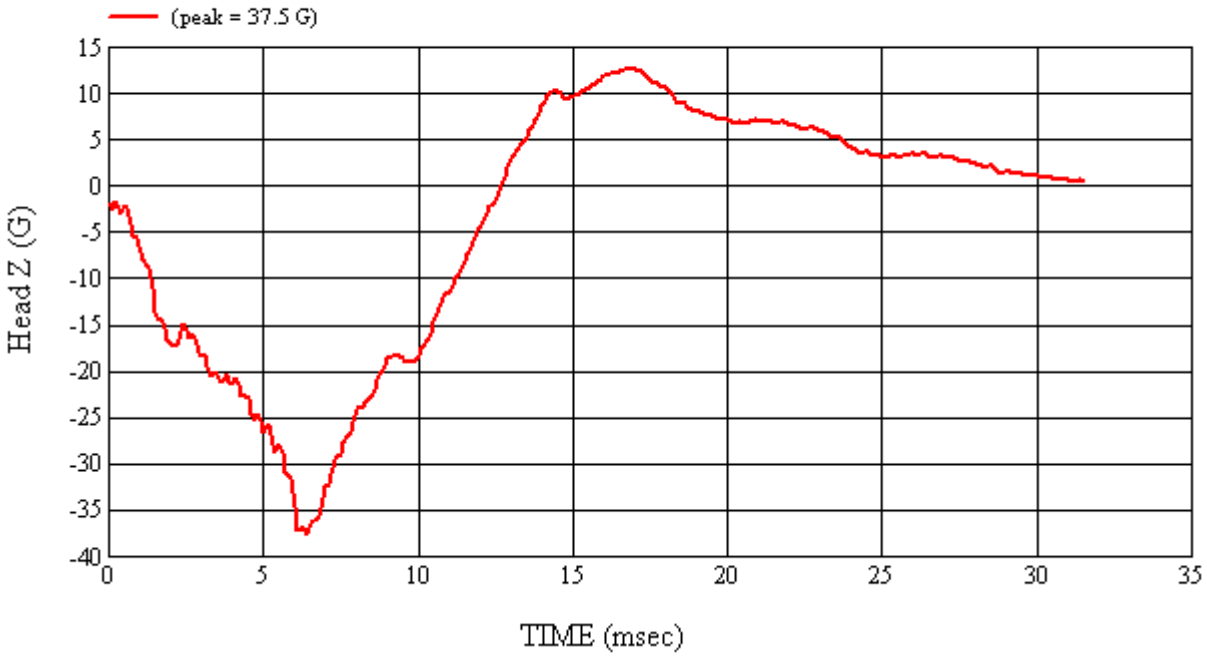
MGA Test #: FM9133 Target Location: BP2, Left Side Test Date: 5/21/2009

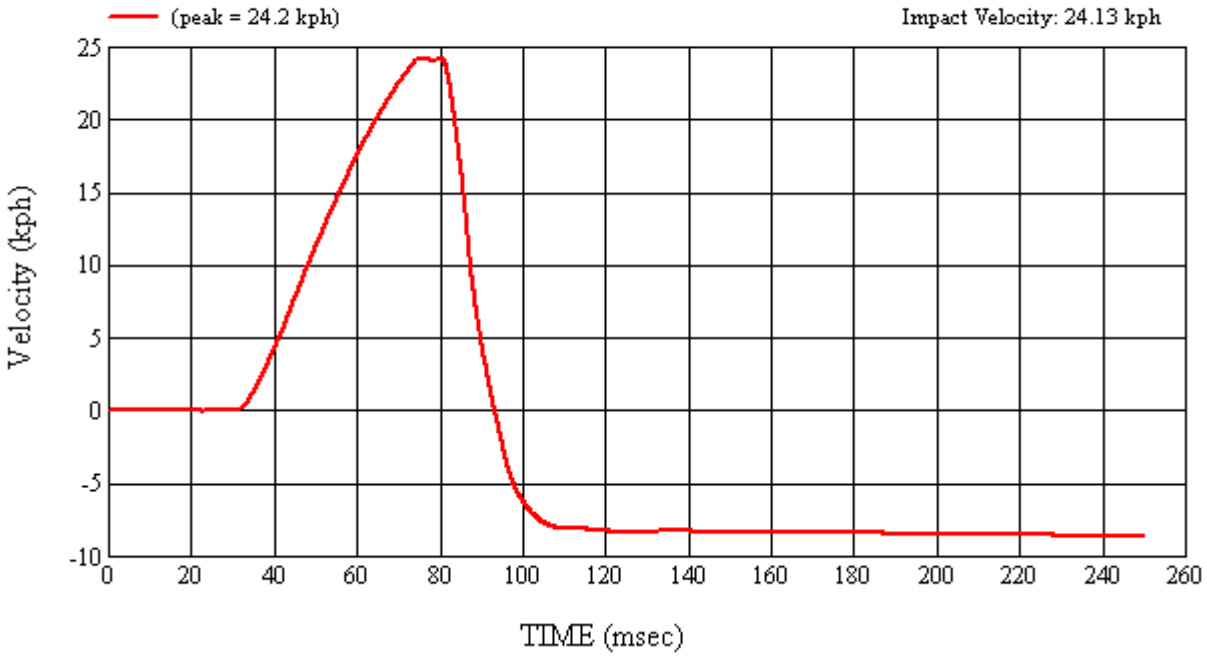


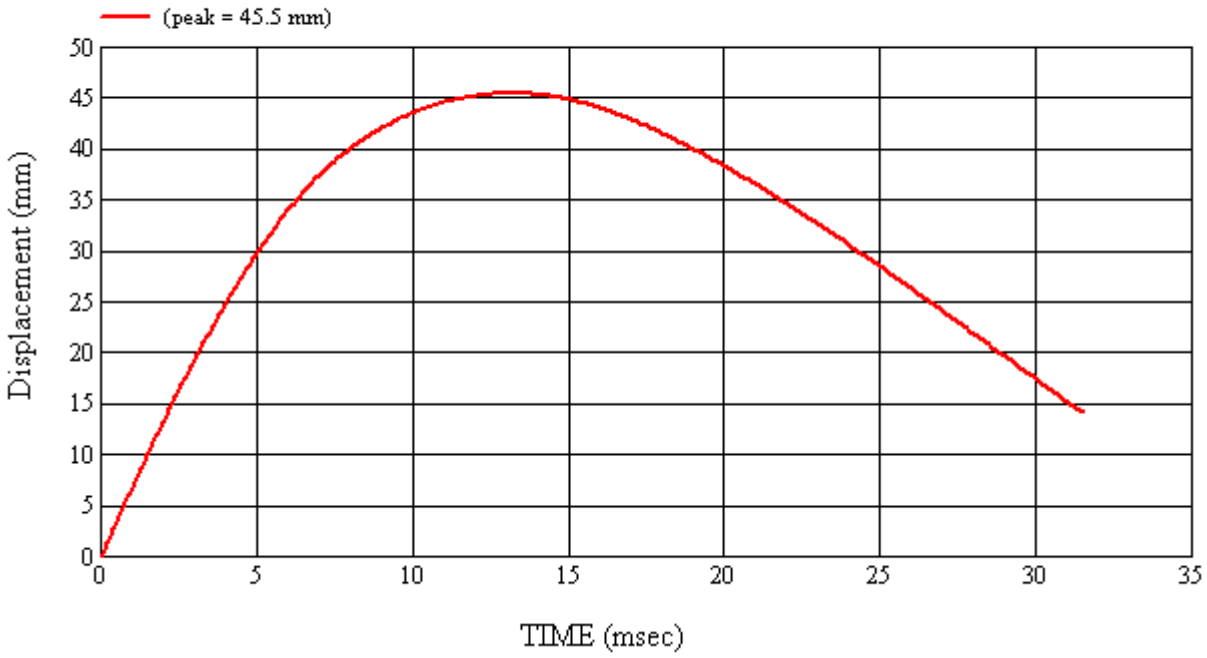



(peak = 89.2 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
5
10
15
20
25
30
35
TIME (msec)


(peak = 7.5 G)
Head Y (G)
1
0
-1
-2
-3
-4
-5
-6
-7
-8
0
5
10
15
20
25
30
35
TIME (msec)

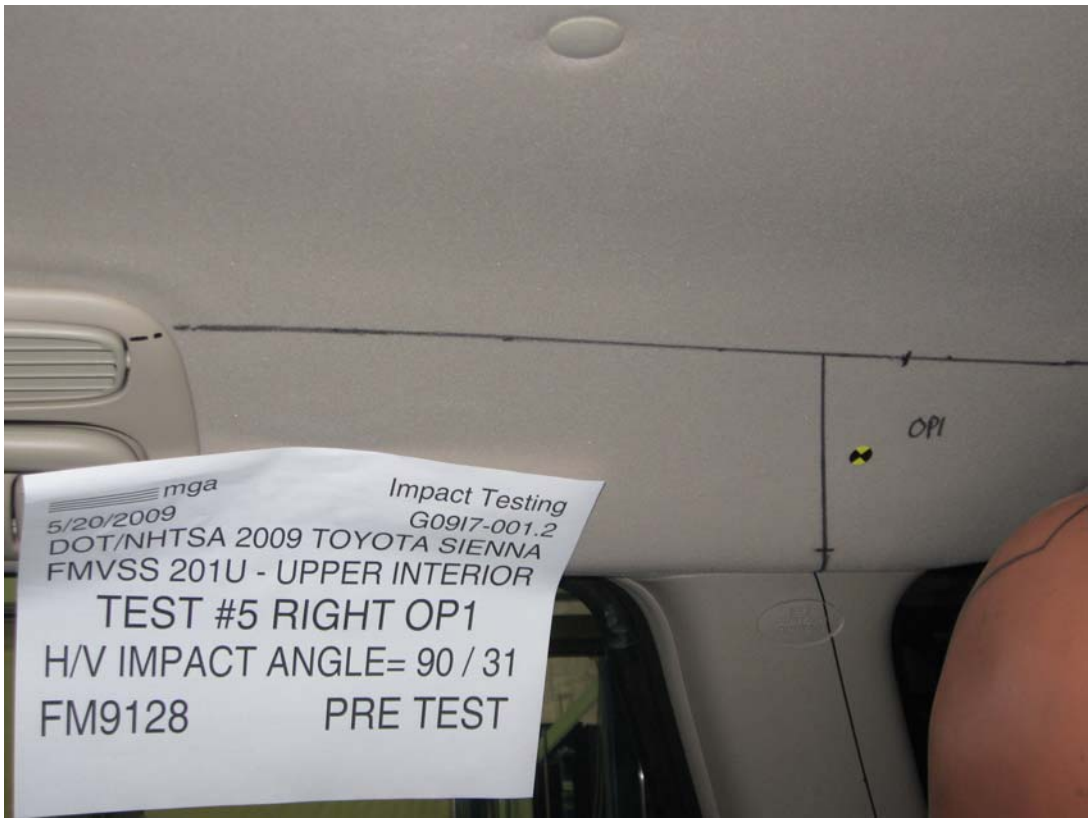

(peak = 37.5 G)
Head Z (G)
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
0
5
10
15
20
25
30
35
TIME (msec)

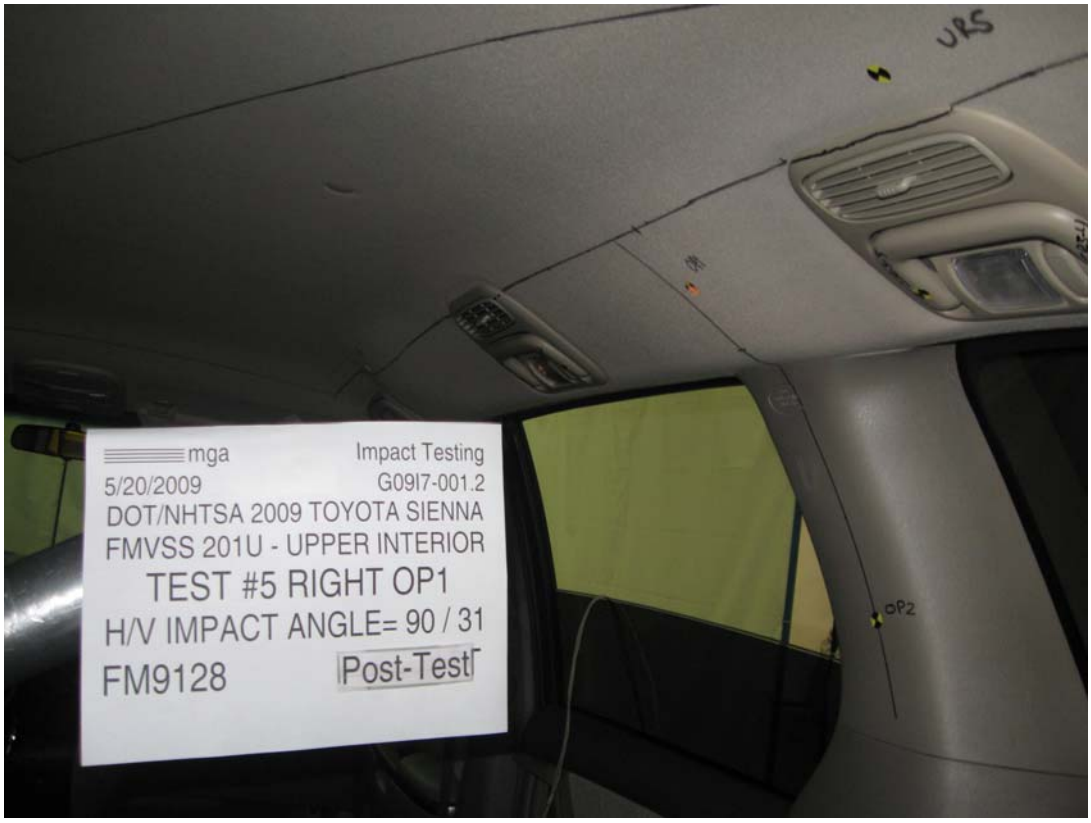

(peak = 24.2 kph)
Impact Velocity: 24.13 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)

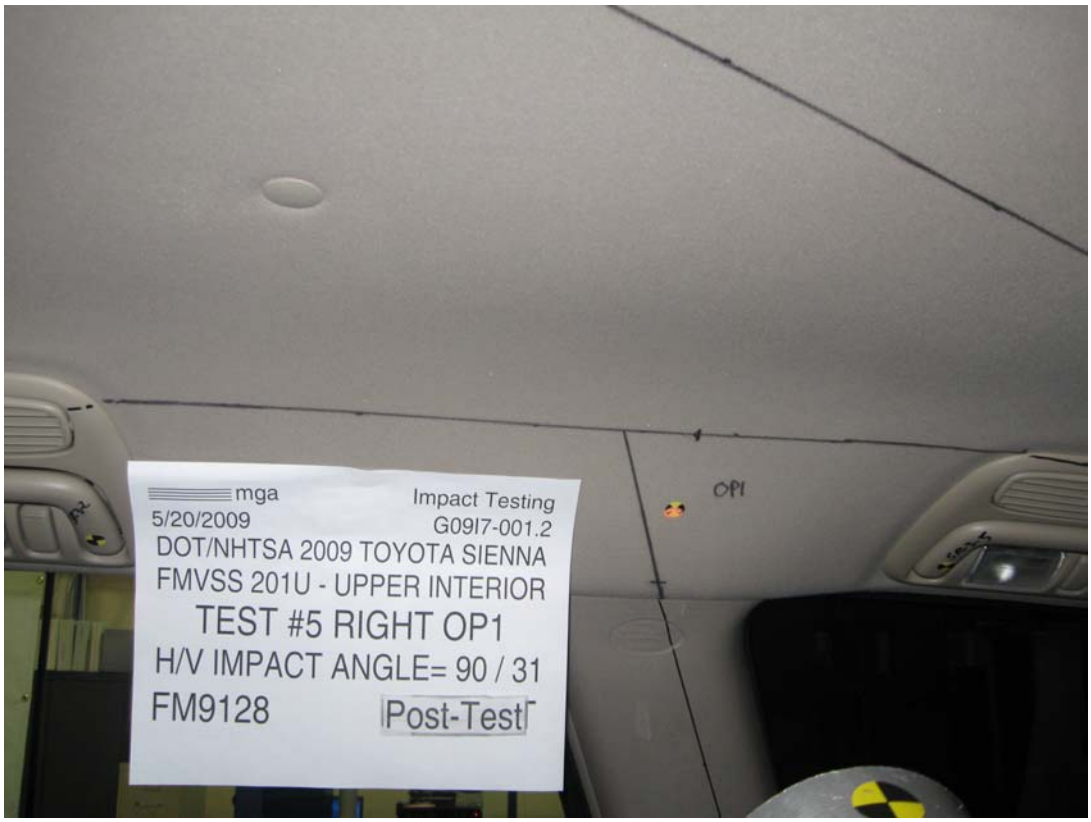

(peak = 45.5 mm)
Displacement (mm)
TIME (msec)
0
5
10
15
20
25
30
35
40
45
50

3


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #5 RIGHT OP1
H/V IMPACT ANGLE= 90 / 31
FM9128
PRE TEST
OP2


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #5 RIGHT OP1
H/V IMPACT ANGLE= 90 / 31
FM9128
PRE TEST
OP1


URS
mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #5 RIGHT OP1
H/V IMPACT ANGLE= 90 / 31
FM9128
Post-Test
OP2


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #5 RIGHT OP1
H/V IMPACT ANGLE= 90 / 31
FM9128
Post-Test
OP1


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #5 RIGHT OP1
H/V IMPACT ANGLE= 90 / 31
FM9128
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#5

Target (Vehicle Side): OP1Right

Temperature:21.9C

MGA Test Reference No.:FM9128

Humidity:43.1%

Approach Horizontal Angles:90º

Time of Test:3:55:04 PM

Approach Vertical Angles:31º

FMH Serial No:[037]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
794	832	6.7	24.1	18	0

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-115.9	1.06	1.06
Y	6	J14103	93.7	0.85	0.85
Z	7	J35800	97.1	0.93	0.93

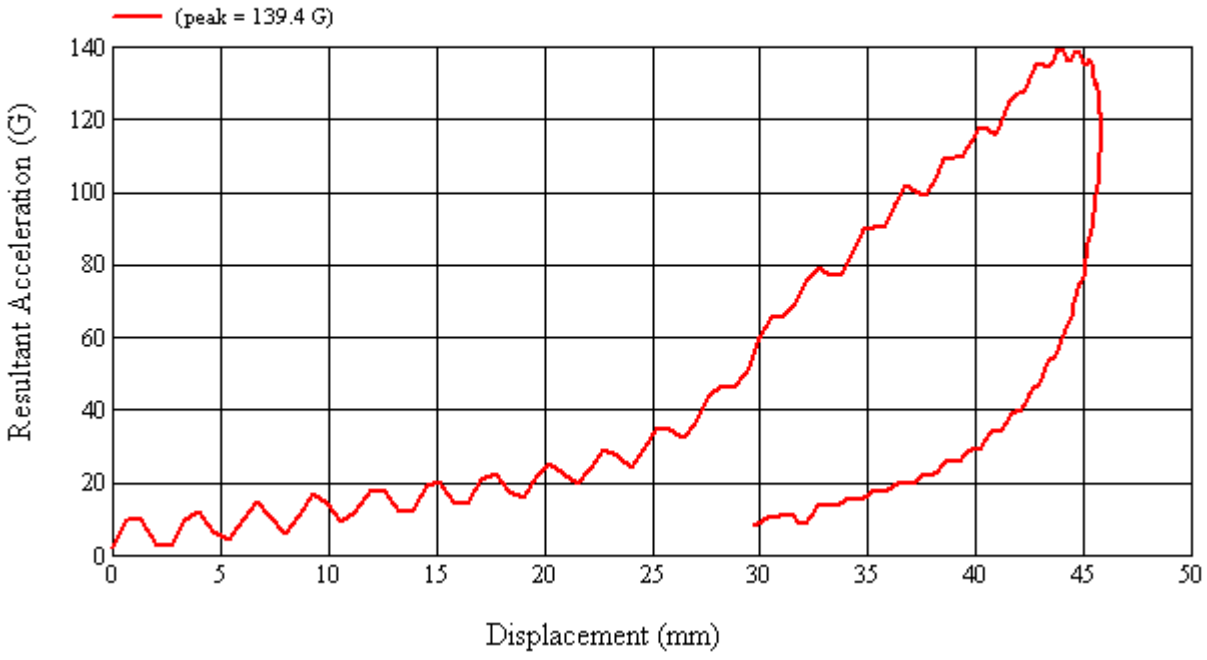
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

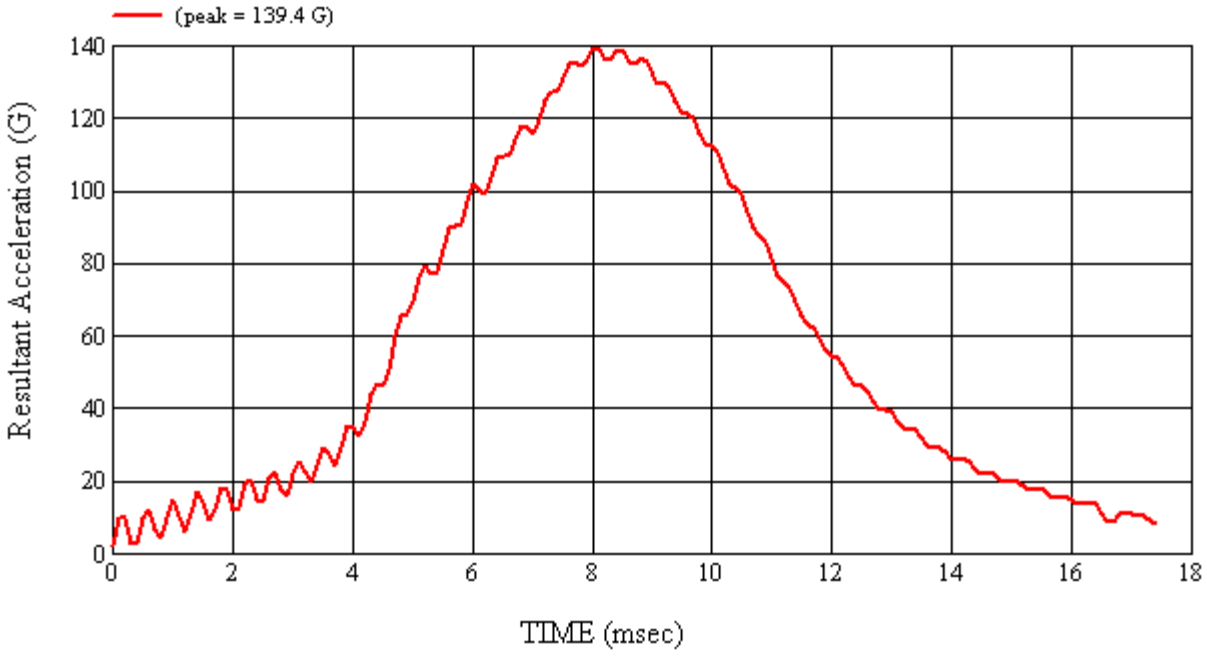
No damage observed

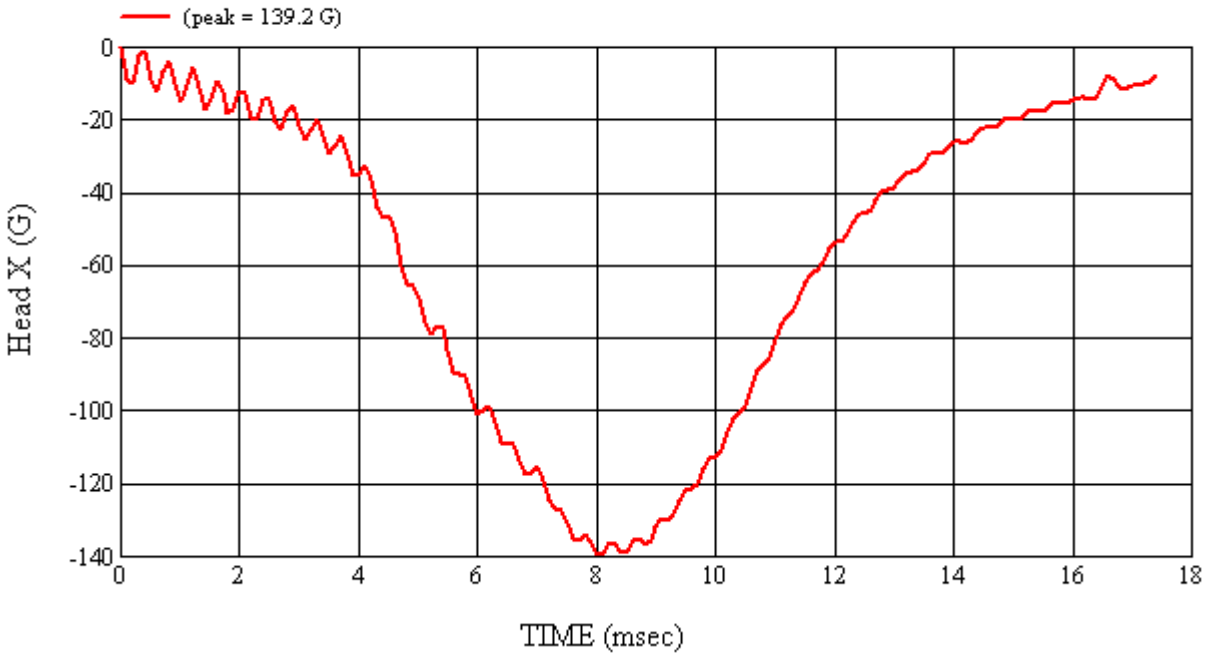
Recorded By: _____ Approved By*: _____ Date: 5/20/2009

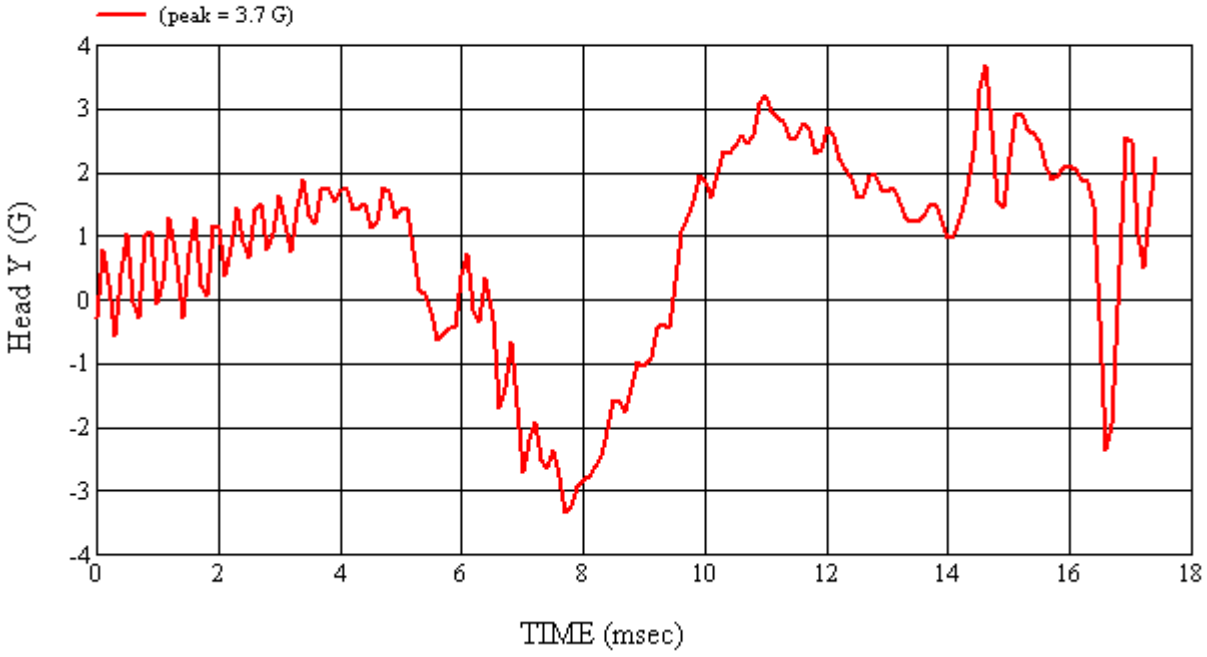
*Only necessary for NHTSA (Government) Compliance testing.

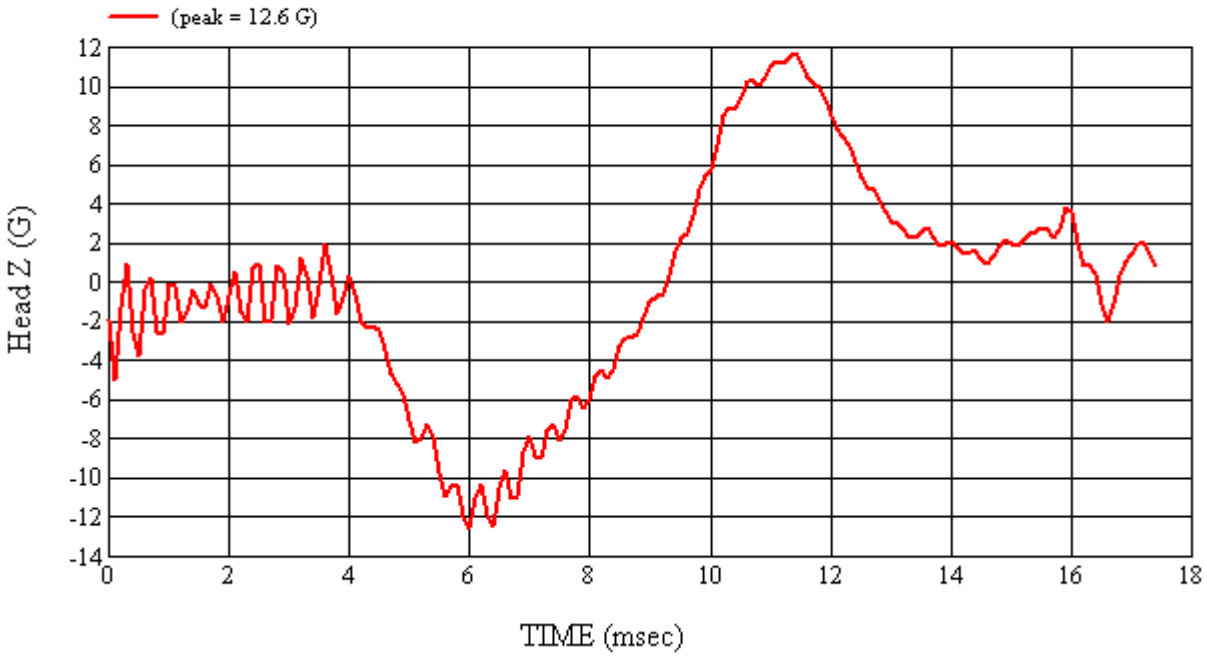
MGA Test #: FM9128 Target Location: OP1, Right Side Test Date: 5/20/2009

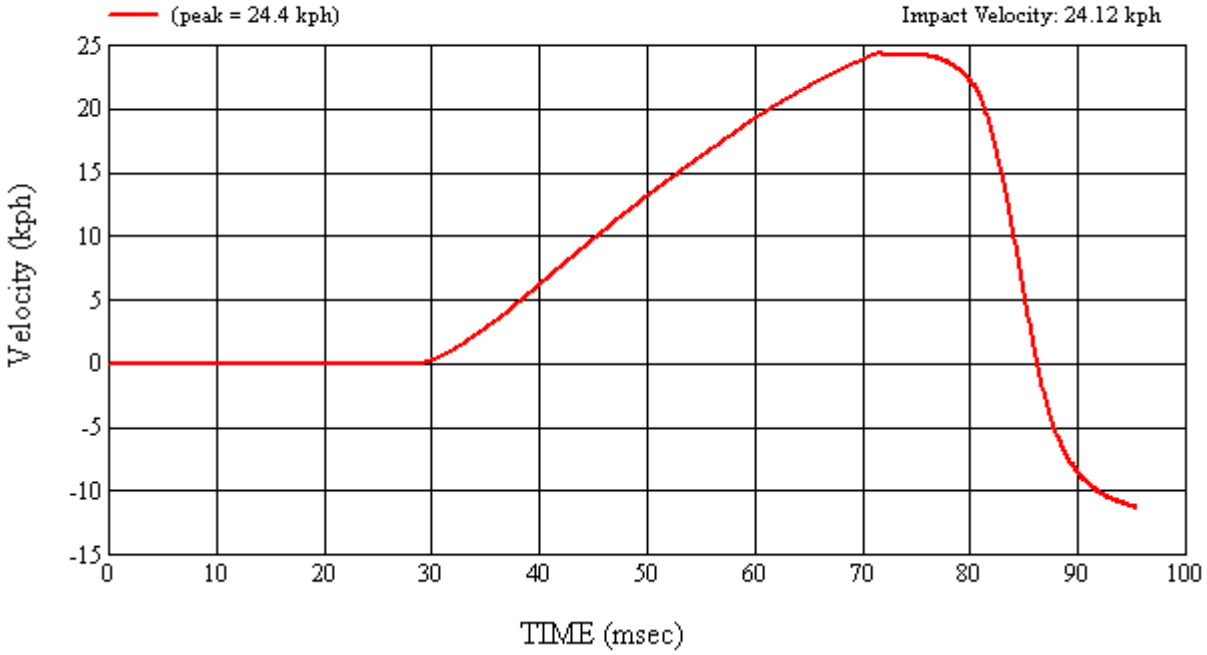


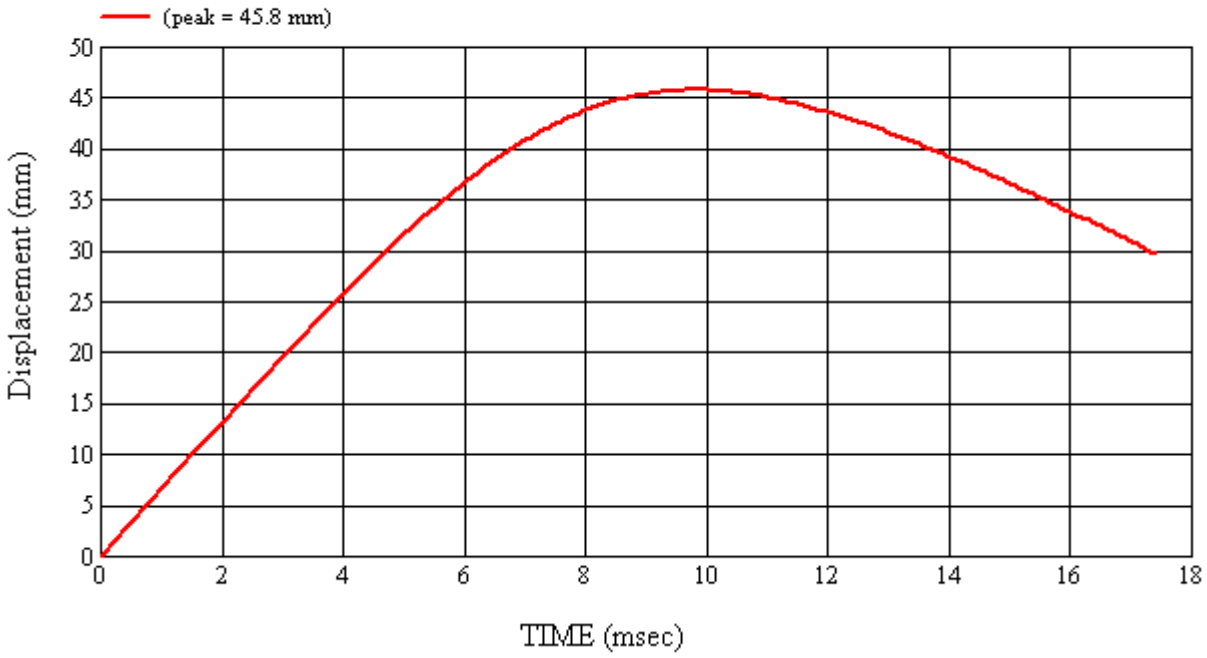



(peak = 139.2 G)
Head X (G)
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
TIME (msec)


(peak = 3.7 G)
Head Y (G)
4
3
2
1
0
-1
-2
-3
-4
0
2
4
6
8
10
12
14
16
18
TIME (msec)

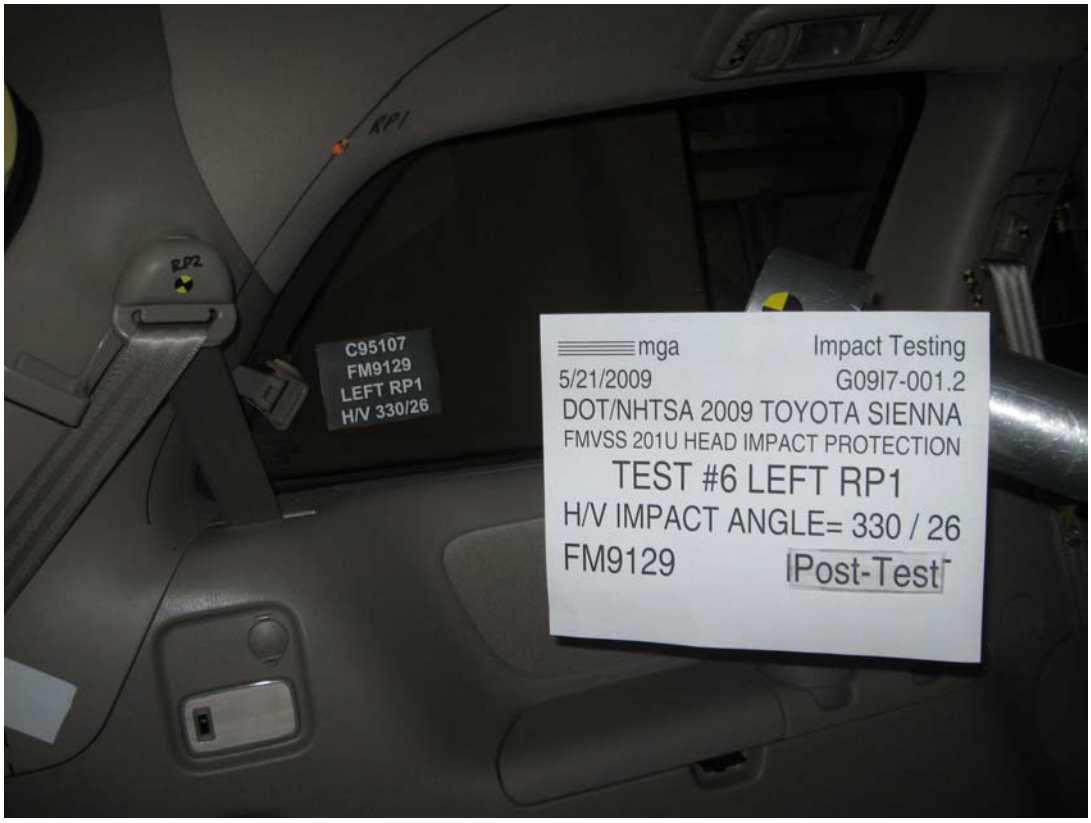

(peak = 12.6 G)
Head Z (G)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
0
2
4
6
8
10
12
14
16
18
TIME (msec)

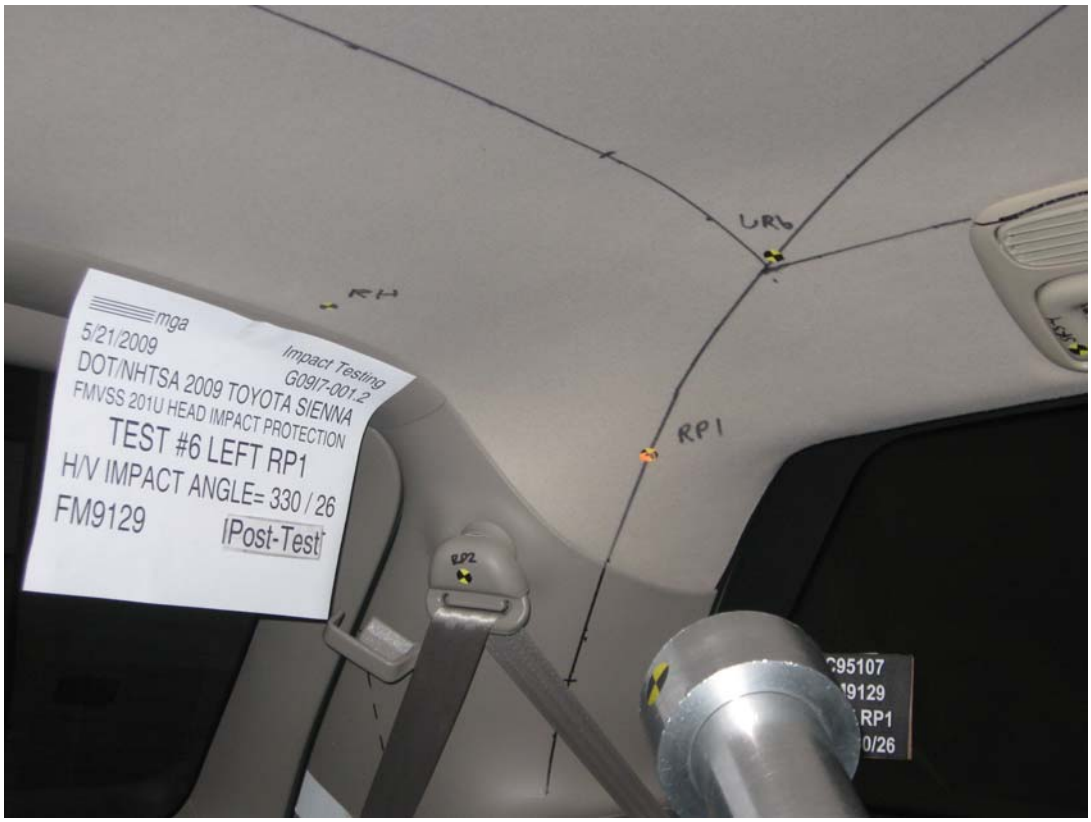

(peak = 24.4 kph)
Impact Velocity: 24.12 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
100
TIME (msec)


(peak = 45.8 mm)
Displacement (mm)
50
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
TIME (msec)


RP1
RP2
mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U HEAD IMPACT PROTECTION
TEST #6 LEFT RP1
H/V IMPACT ANGLE= 330 / 26
FM9129
PRE TEST


RP1
mga
Impact Testing
G09I7-001.2
5/21/2009
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U HEAD IMPACT PROTECTION
TEST #6 LEFT RP1
H/V IMPACT ANGLE= 330 / 26
FM9129
PRE TEST


RP1
RP2
C95107
FM9129
LEFT RP1
H/V 330/26
mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U HEAD IMPACT PROTECTION
TEST #6 LEFT RP1
H/V IMPACT ANGLE= 330 / 26
FM9129
Post-Test


UR6
RH
RP1
RP2
mga
5/21/2009
Impact Testing
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U HEAD IMPACT PROTECTION
TEST #6 LEFT RP1
H/V IMPACT ANGLE= 330 / 26
FM9129
Post-Test


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U HEAD IMPACT PROTECTION
TEST #6 LEFT RP1
H/V IMPACT ANGLE= 330 / 26
FM9129
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#6

Target (Vehicle Side): RP1Left

Temperature:22.1C

MGA Test Reference No.:FM9129

Humidity:46.9%

Approach Horizontal Angles:330º

Time of Test:9:10:19 AM

Approach Vertical Angles:26º

FMH Serial No:[038]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
390	296	14.5	23.7	19	7 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-94	1.06	1.06
Y	6	J36197	106.3	0.85	0.85
Z	7	J36353	97.5	0.93	0.94

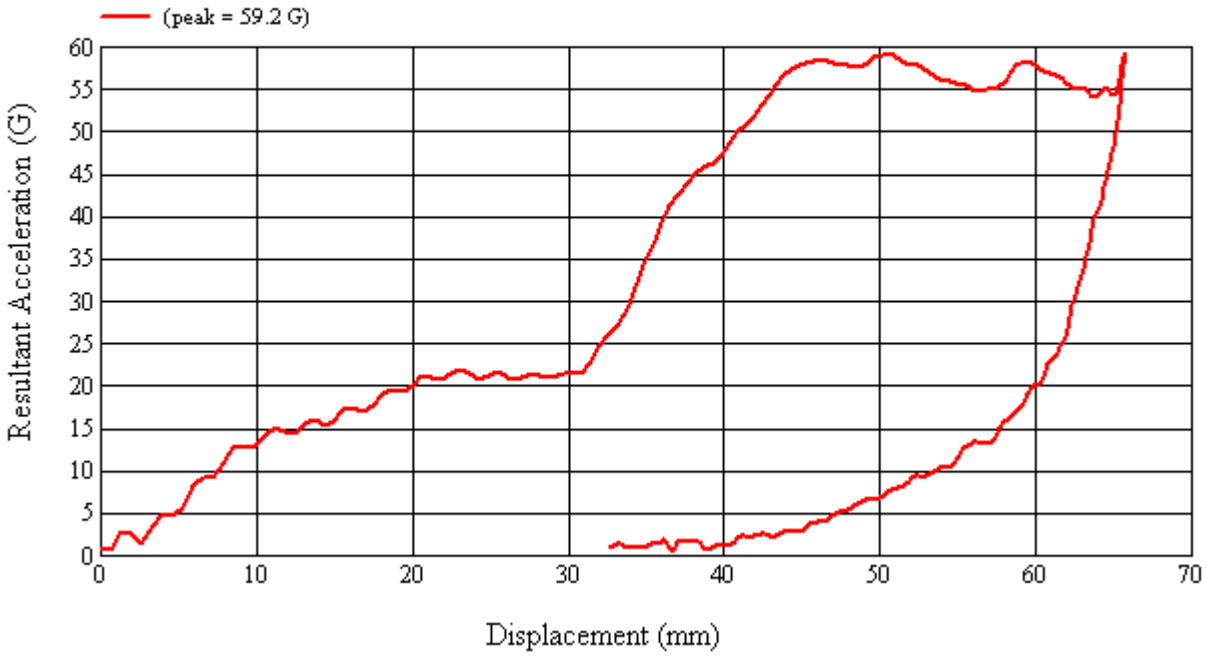
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

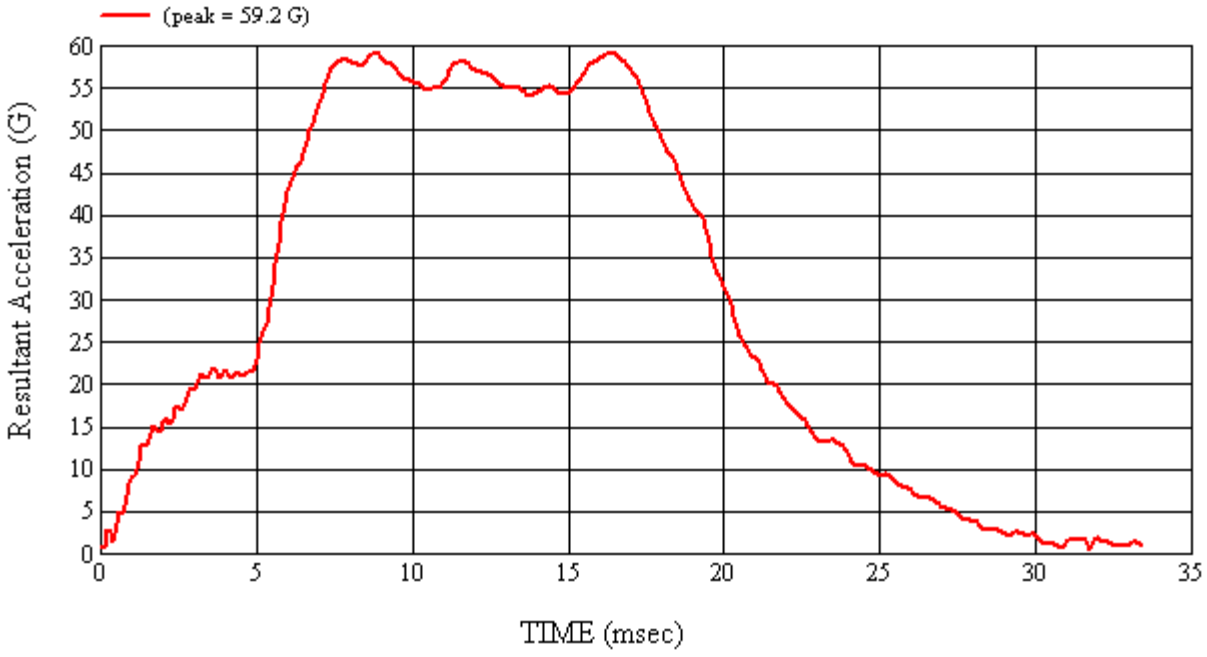
No damage observed

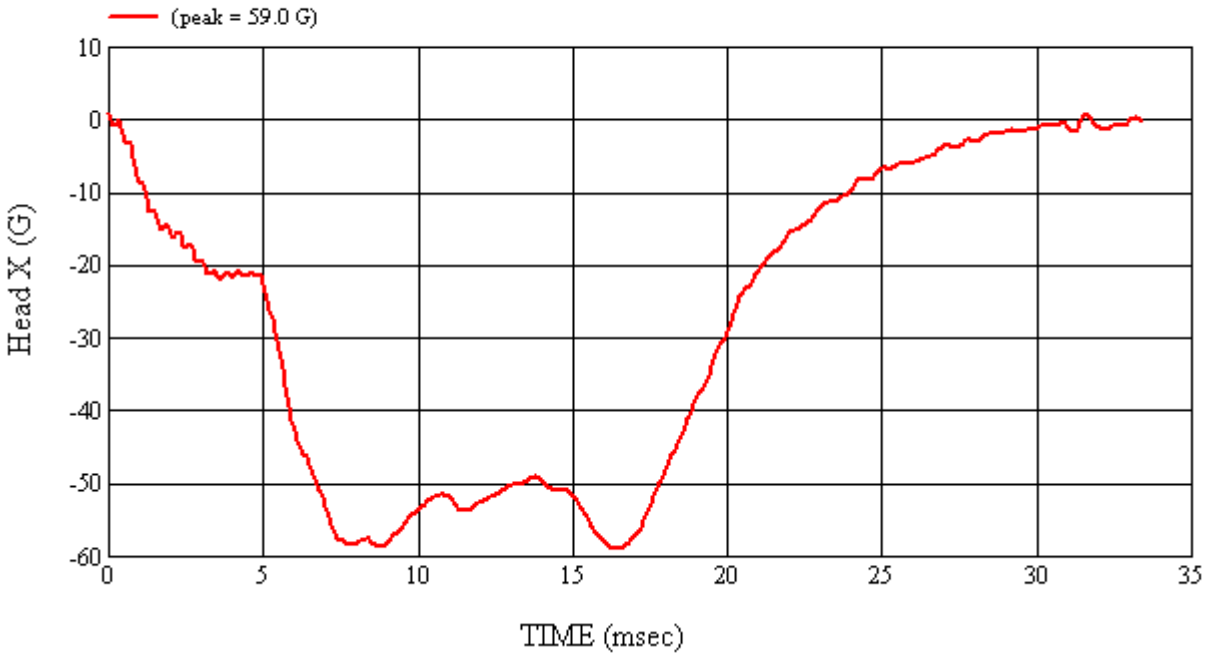
Recorded By: _____ Approved By*: _____ Date: 5/21/2009

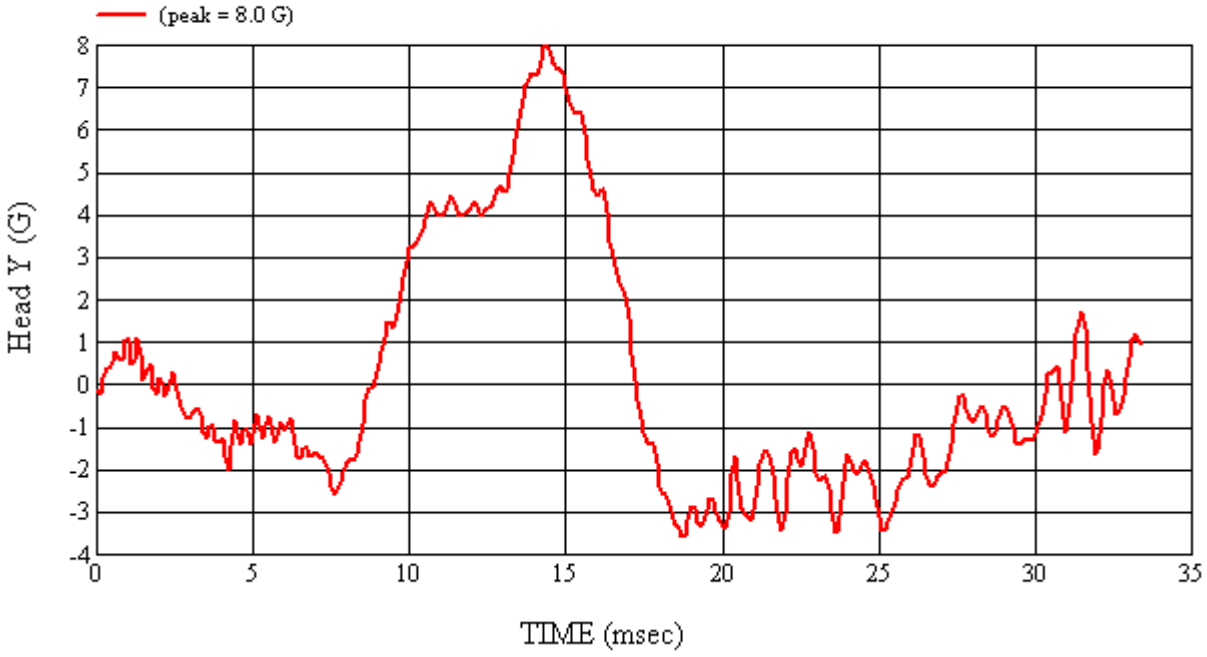
*Only necessary for NHTSA (Government) Compliance testing.

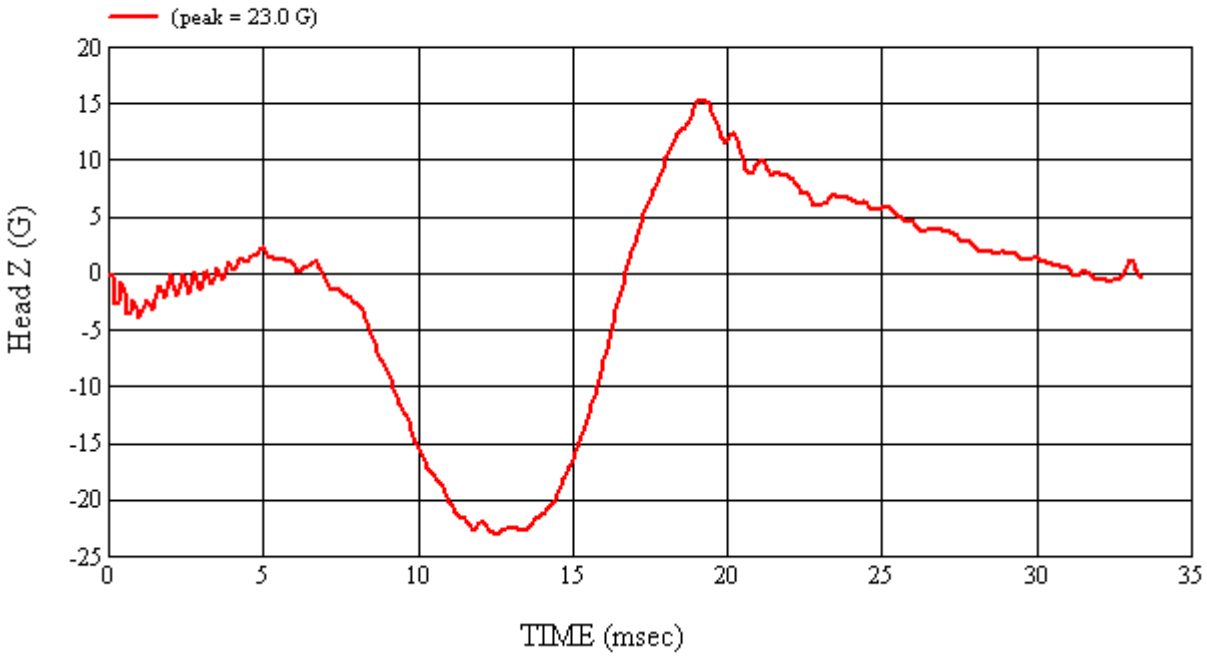
MGA Test #: FM9129 Target Location: RP1, Left Side Test Date: 5/21/2009

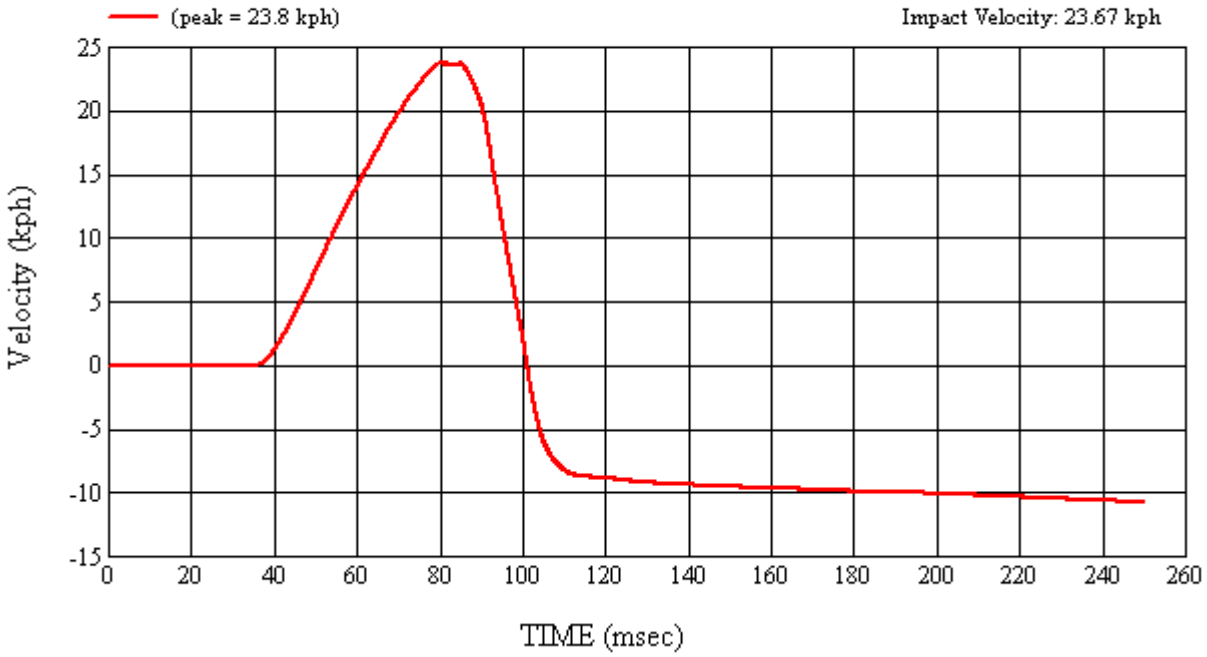


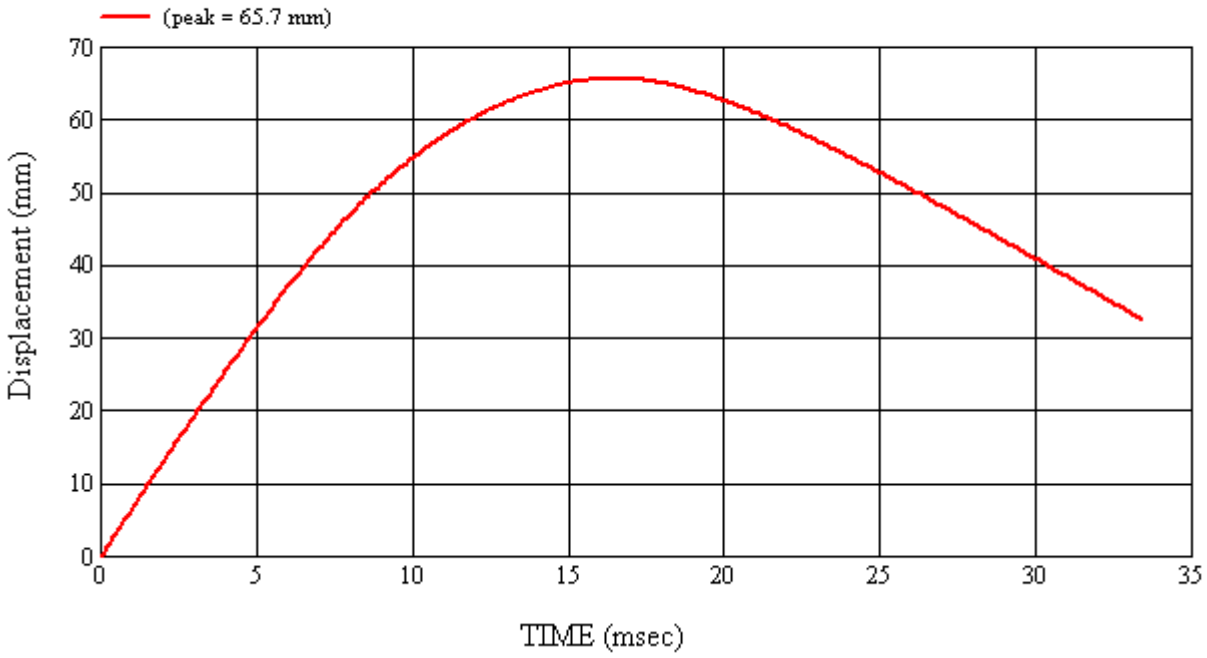



(peak = 59.0 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
0
5
10
15
20
25
30
35
TIME (msec)

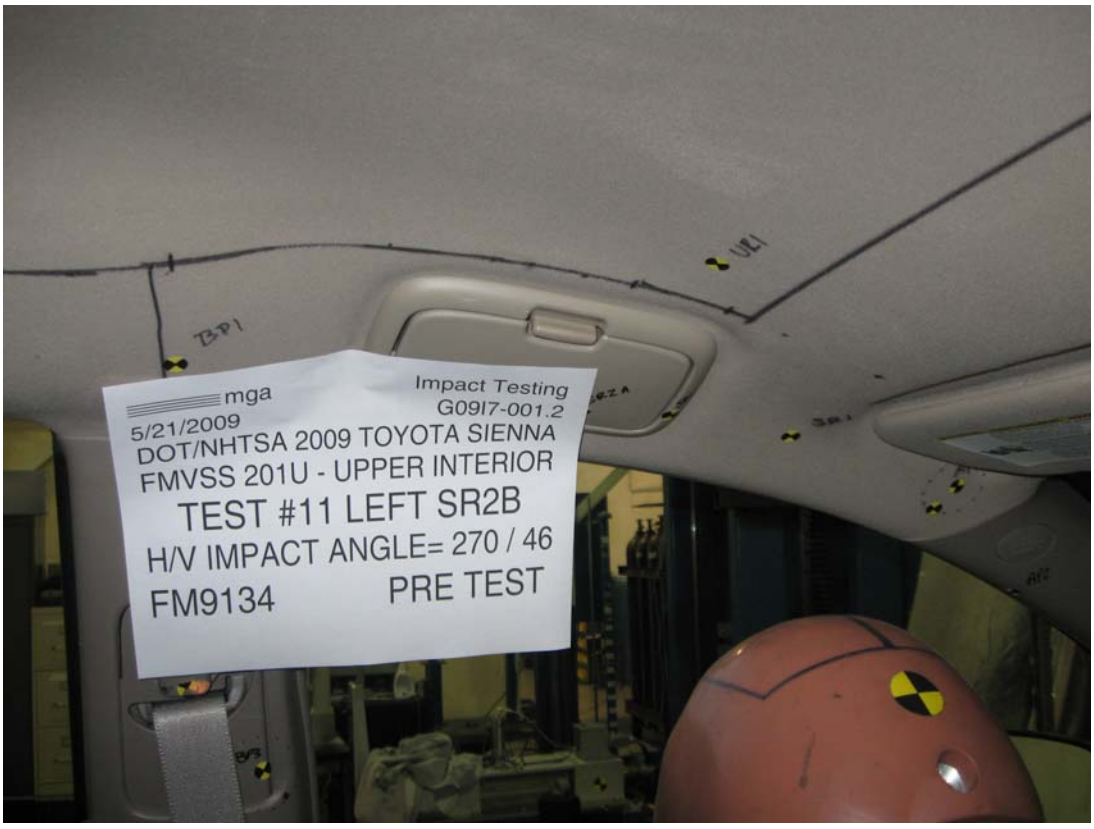

(peak = 8.0 G)
Head Y (G)
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
0
5
10
15
20
25
30
35
TIME (msec)


(peak = 23.0 G)
Head Z (G)
20
15
10
5
0
-5
-10
-15
-20
-25
0
5
10
15
20
25
30
35
TIME (msec)

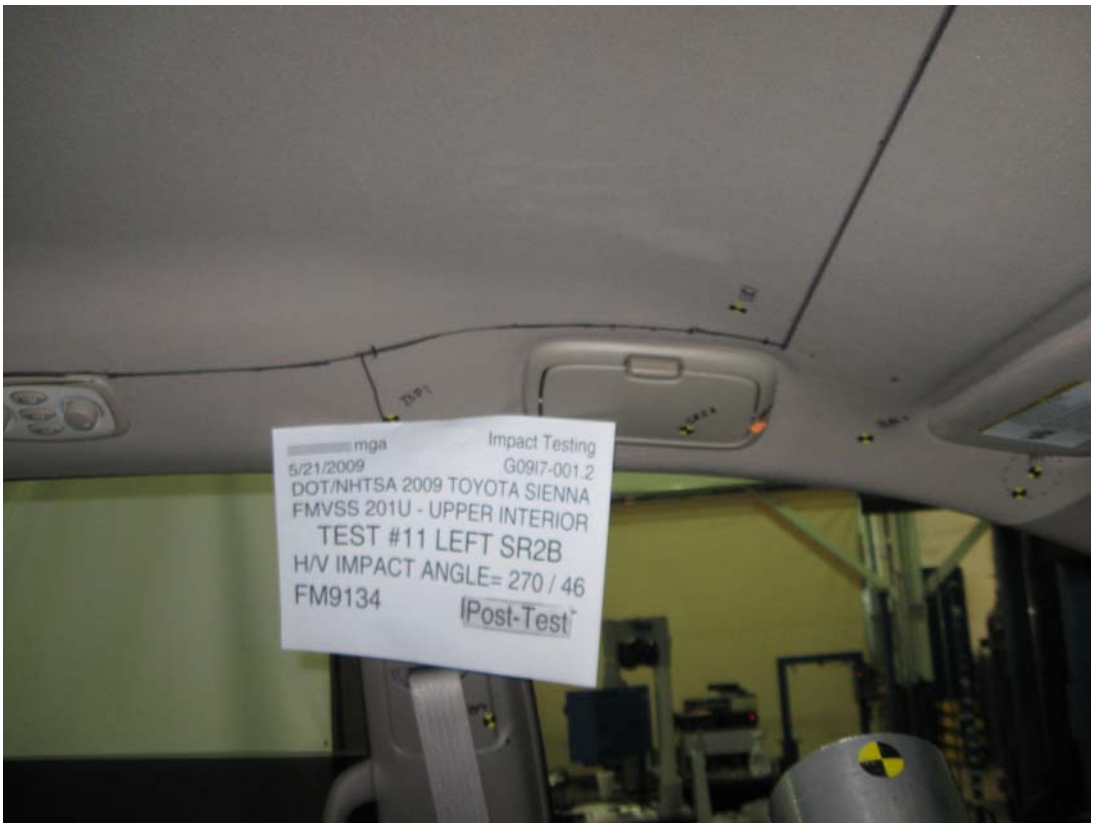

(peak = 23.8 kph)
Impact Velocity: 23.67 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 65.7 mm)
Displacement (mm)
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
TIME (msec)


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #11 LEFT SR2B
H/V IMPACT ANGLE= 270 / 46
FM9134
PRE TEST


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #11 LEFT SR2B
H/V IMPACT ANGLE= 270 / 46
FM9134
PRE TEST


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #11 LEFT SR2B
H/V IMPACT ANGLE= 270 / 46
FM9134
Post-Test


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #11 LEFT SR2B
H/V IMPACT ANGLE= 270 / 46
FM9134
Post-Test


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #11 LEFT SR2B
H/V IMPACT ANGLE= 270 / 46
FM9134
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#11

Target (Vehicle Side): SR2BLeft

Temperature:22.7C

MGA Test Reference No.:FM9134

Humidity:47.2%

Approach Horizontal Angles:270º

Time of Test:2:34:18 PM

Approach Vertical Angles:46º

FMH Serial No:[037]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
632	618	6.6	24.0	23	3 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-115.9	1.06	1.06
Y	6	J14103	93.7	0.85	0.85
Z	7	J35800	97.1	0.94	0.94

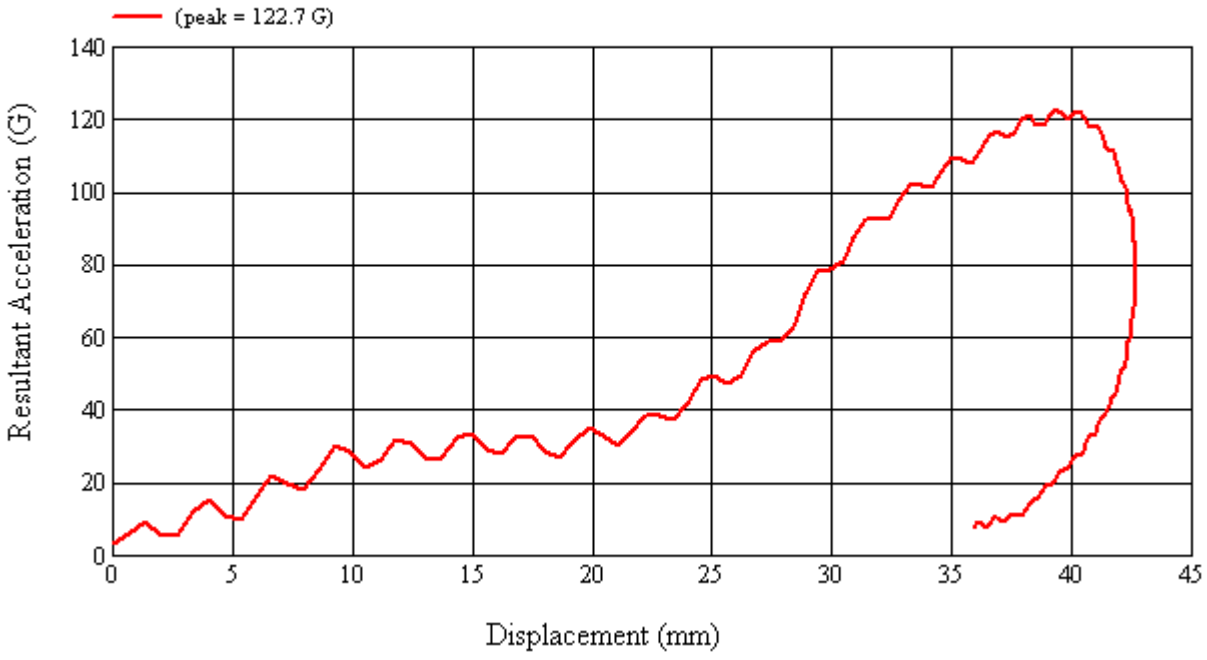
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

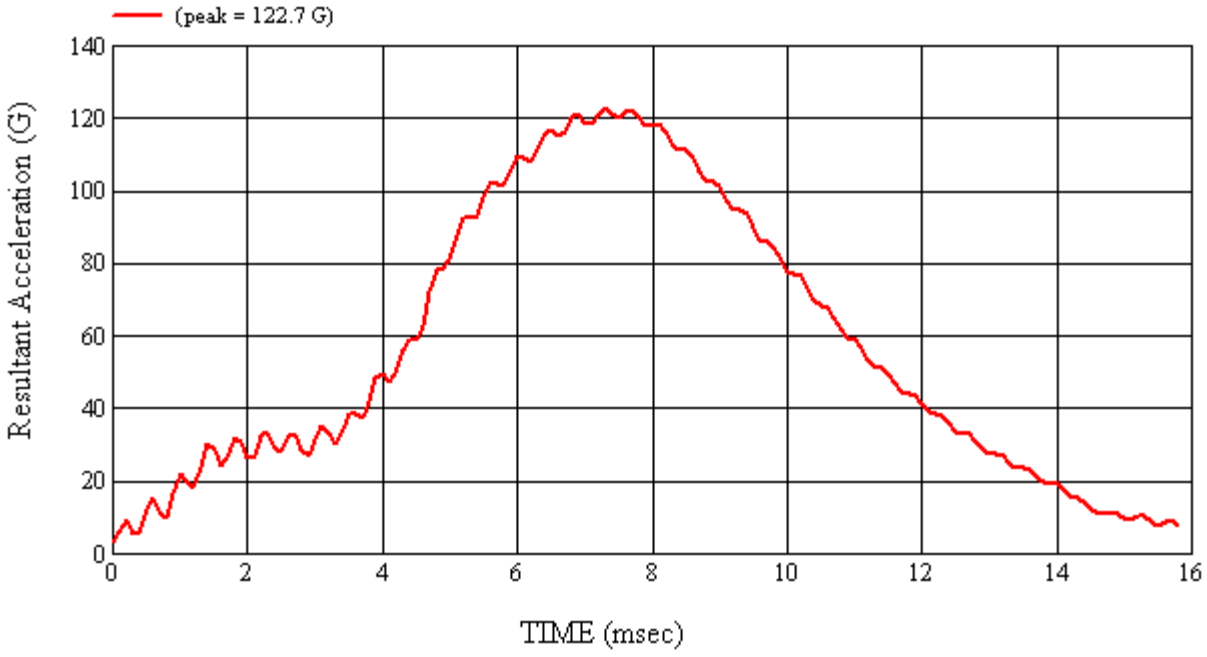
No damage observed

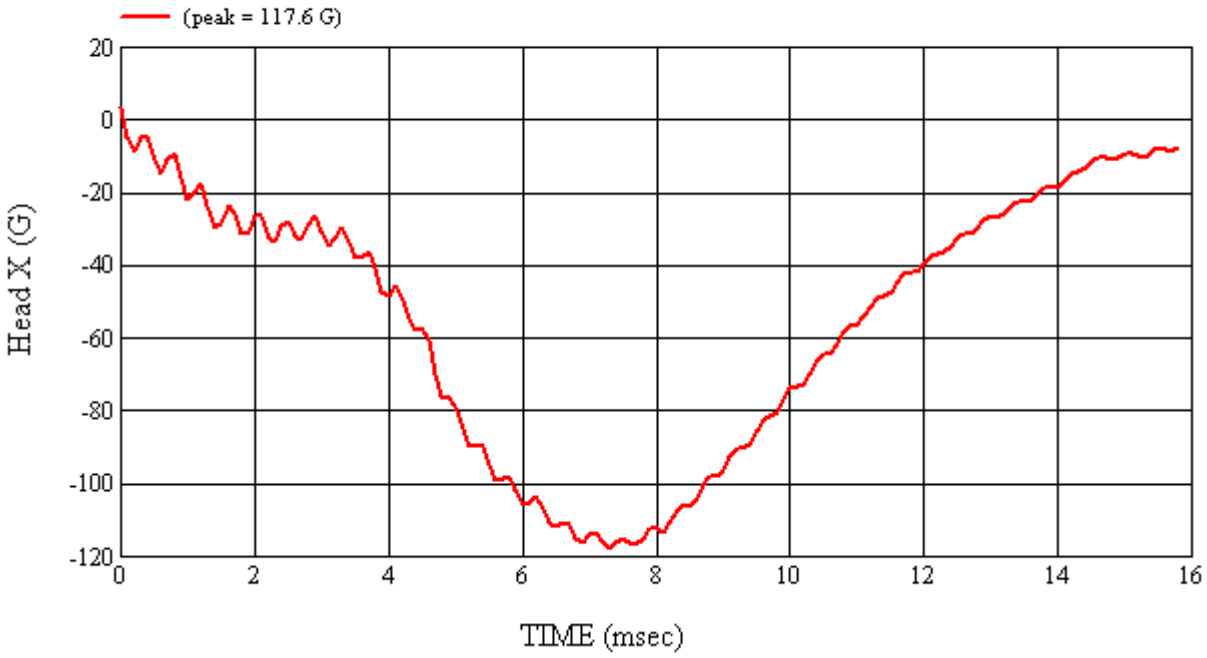
Recorded By: _____ Approved By*: _____ Date: 5/21/2009

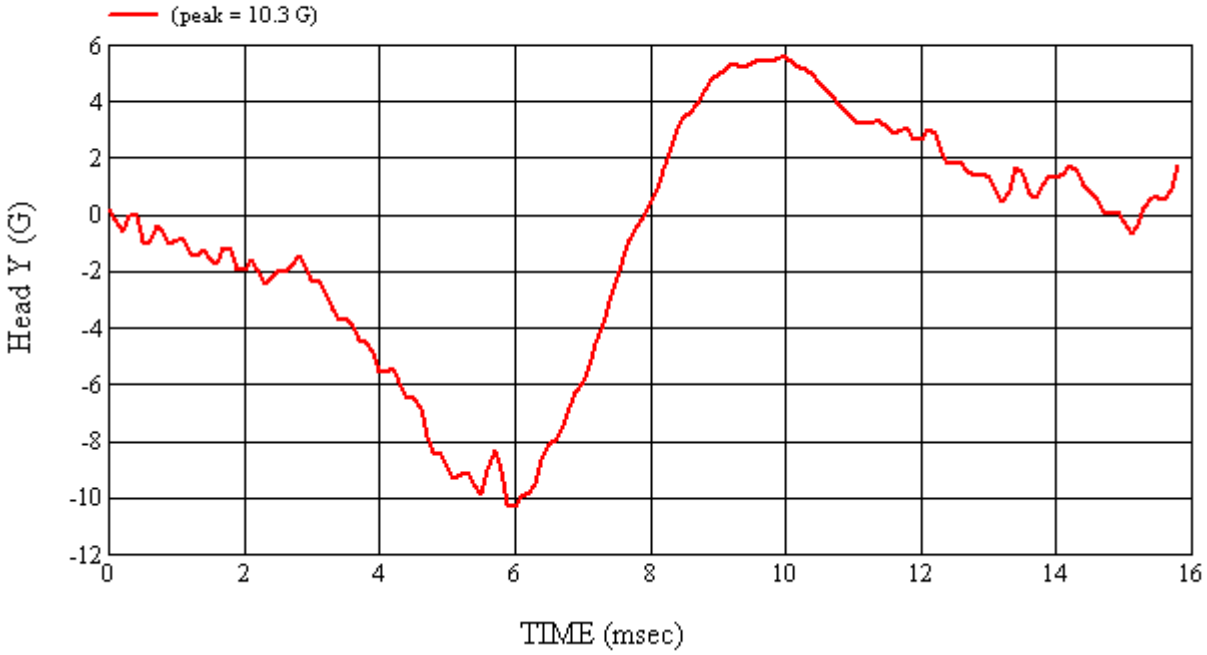
*Only necessary for NHTSA (Government) Compliance testing.

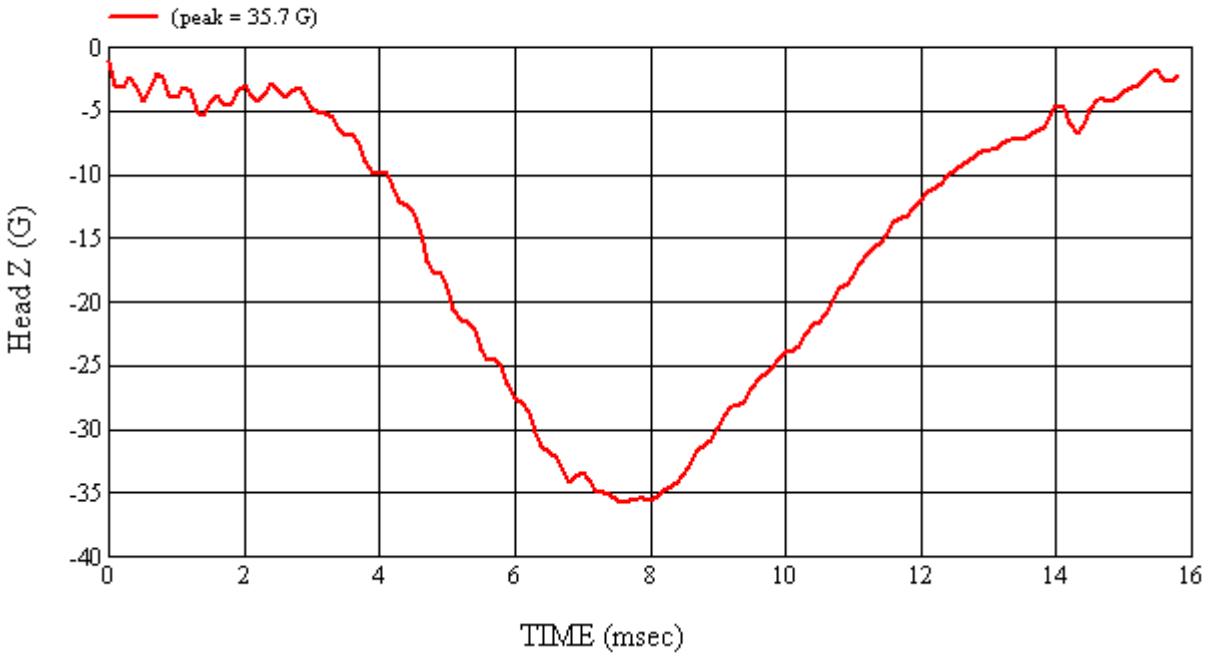
MGA Test #: FM9134 Target Location: SR2B, Left Side Test Date: 5/21/2009

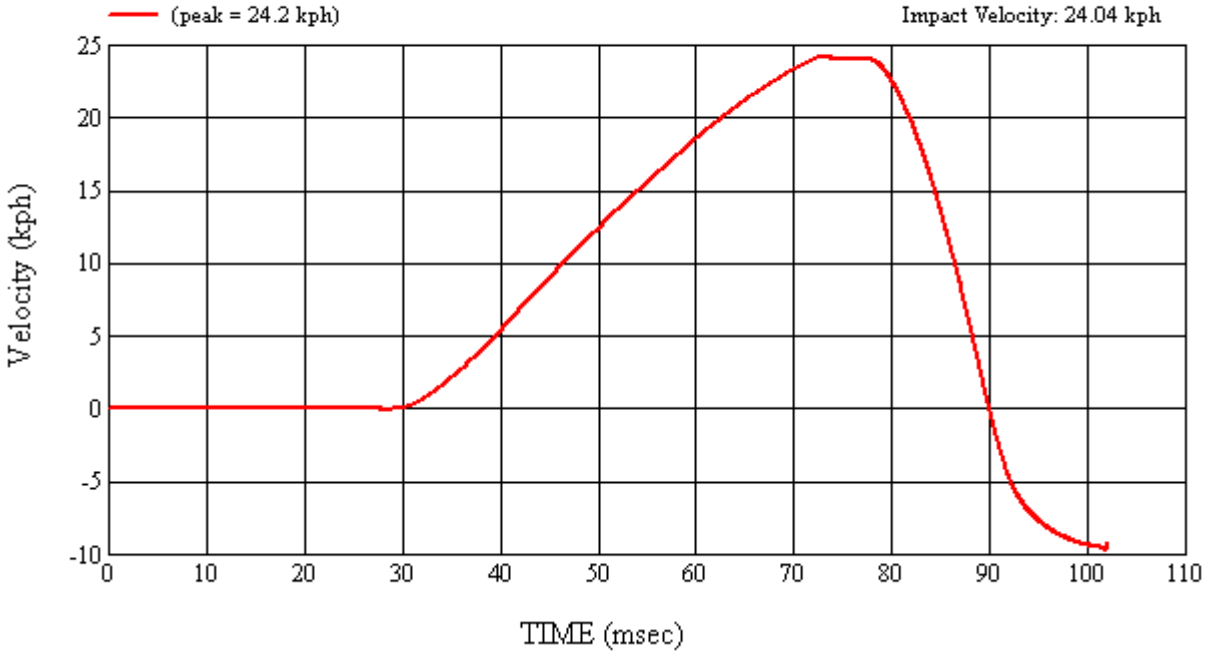


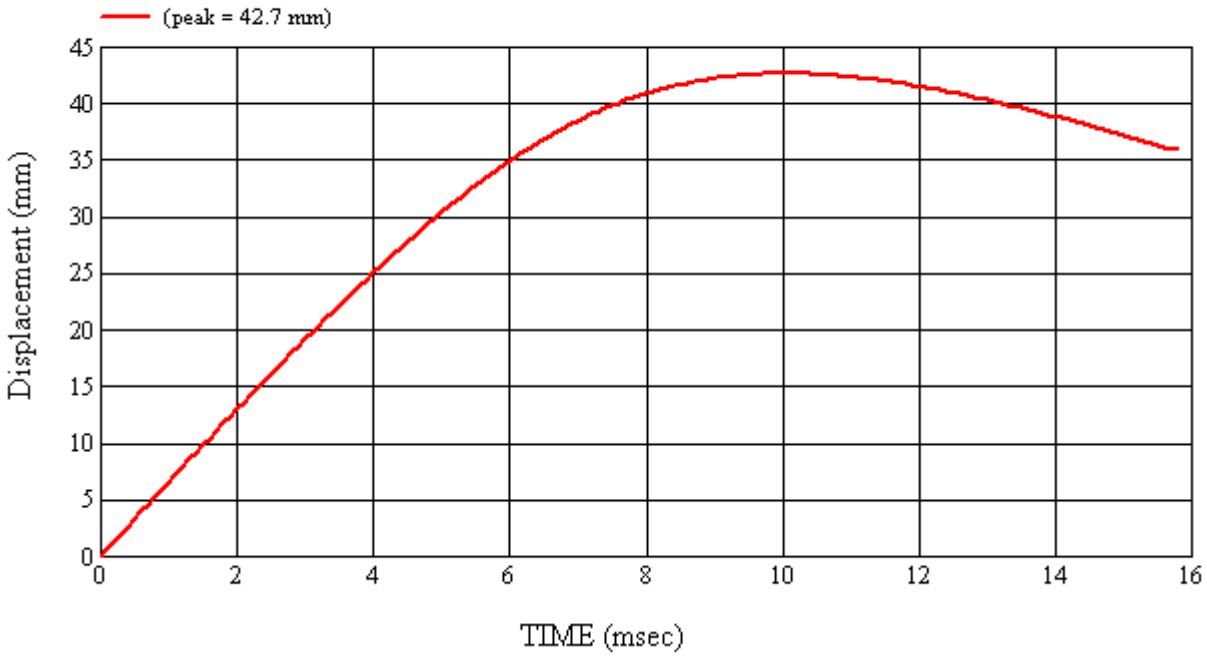



(peak = 117.6 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
TIME (msec)


(peak = 10.3 G)
Head Y (G)
6
4
2
0
-2
-4
-6
-8
-10
-12
0
2
4
6
8
10
12
14
16
TIME (msec)


(peak = 35.7 G)
Head Z (G)
0
-5
-10
-15
-20
-25
-30
-35
-40
0
2
4
6
8
10
12
14
16
TIME (msec)


(peak = 24.2 kph)
Impact Velocity: 24.04 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
10
20
30
40
50
60
70
80
90
100
110
TIME (msec)


(peak = 42.7 mm)
Displacement (mm)
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
TIME (msec)


mga
Impact Testing
G09I7-001.2
5/21/2009
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #9 LEFT SR3-2
H/V IMPACT ANGLE= 270 / 45
FM9132
PRE TEST


mga
5/21/2009
Impact Testing
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #9 LEFT SR3-2
H/V IMPACT ANGLE= 270 / 45
FM9132
PRE TEST


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #9 LEFT SR3-2
H/V IMPACT ANGLE= 270 / 45
FM9132
Post-Test


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #9 LEFT SR3-2
H/V IMPACT ANGLE= 270 / 45
FM9132
Post-Test


mga
5/21/2009
Impact Testing
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #9 LEFT SR3-2
H/V IMPACT ANGLE= 270 / 45
FM9132
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#9

Target (Vehicle Side): SR3-2Left

Temperature:22.3C

MGA Test Reference No.:FM9132

Humidity:46.5%

Approach Horizontal Angles:270º

Time of Test:1:01:26 PM

Approach Vertical Angles:45º

FMH Serial No:[038]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
583	552	5.9	23.8	22	3 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-94	1.06	1.06
Y	6	J36197	106.3	0.85	0.85
Z	7	J36353	97.5	0.94	0.94

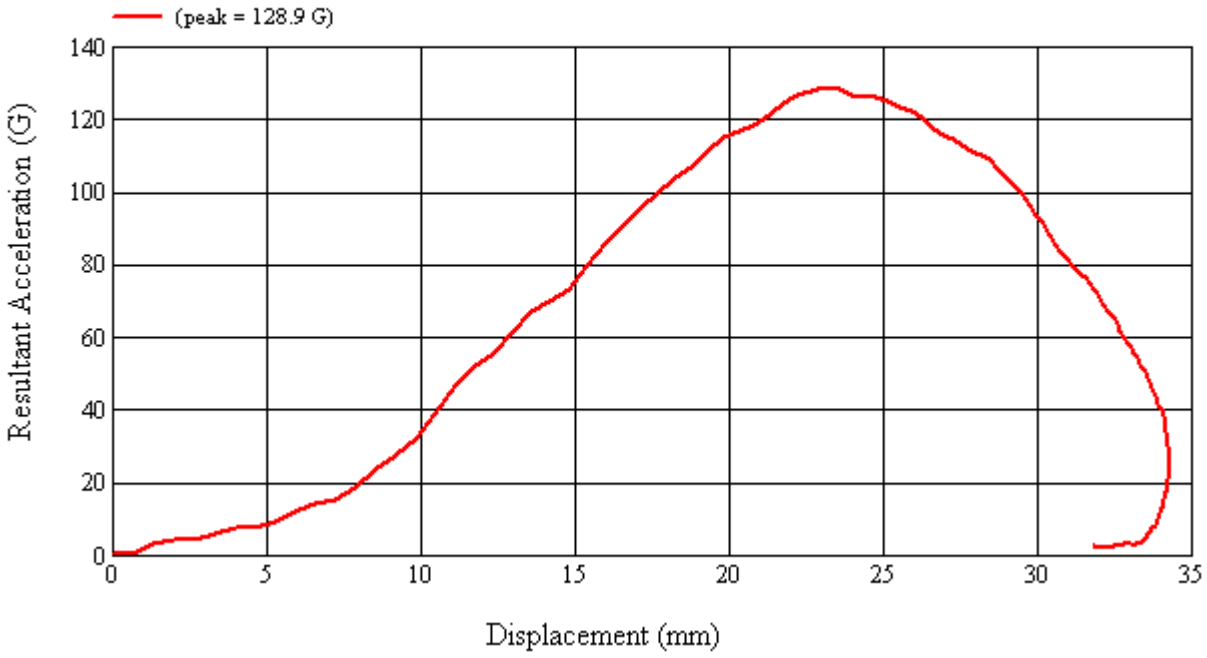
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

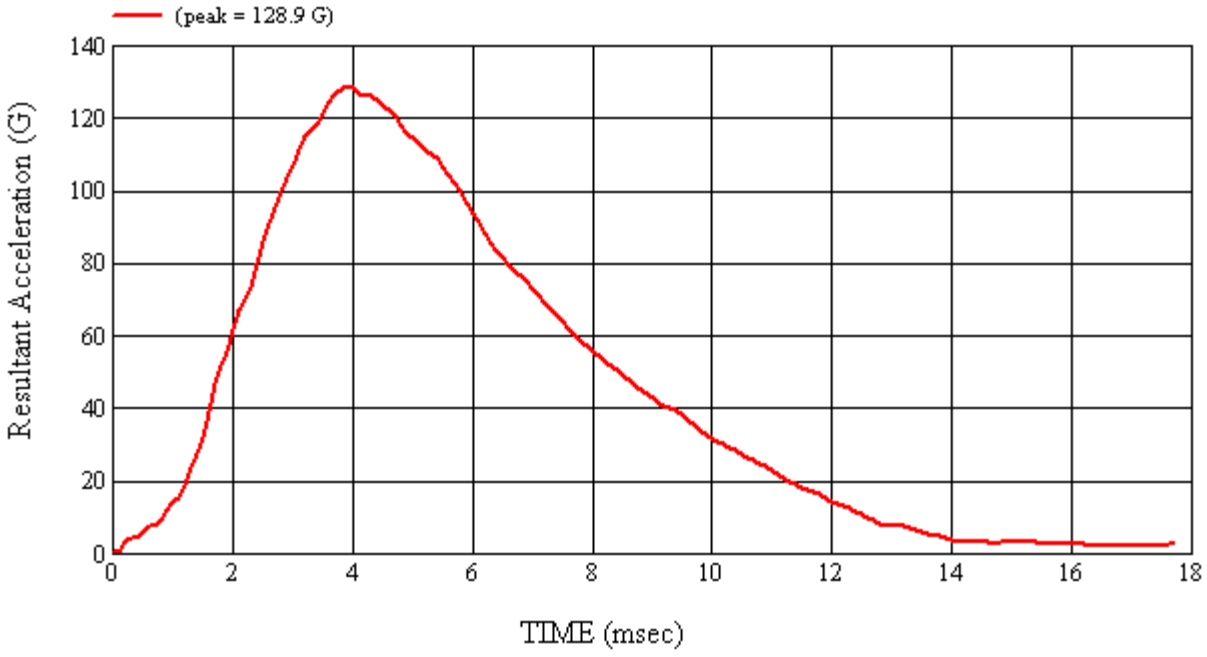
No damage observed

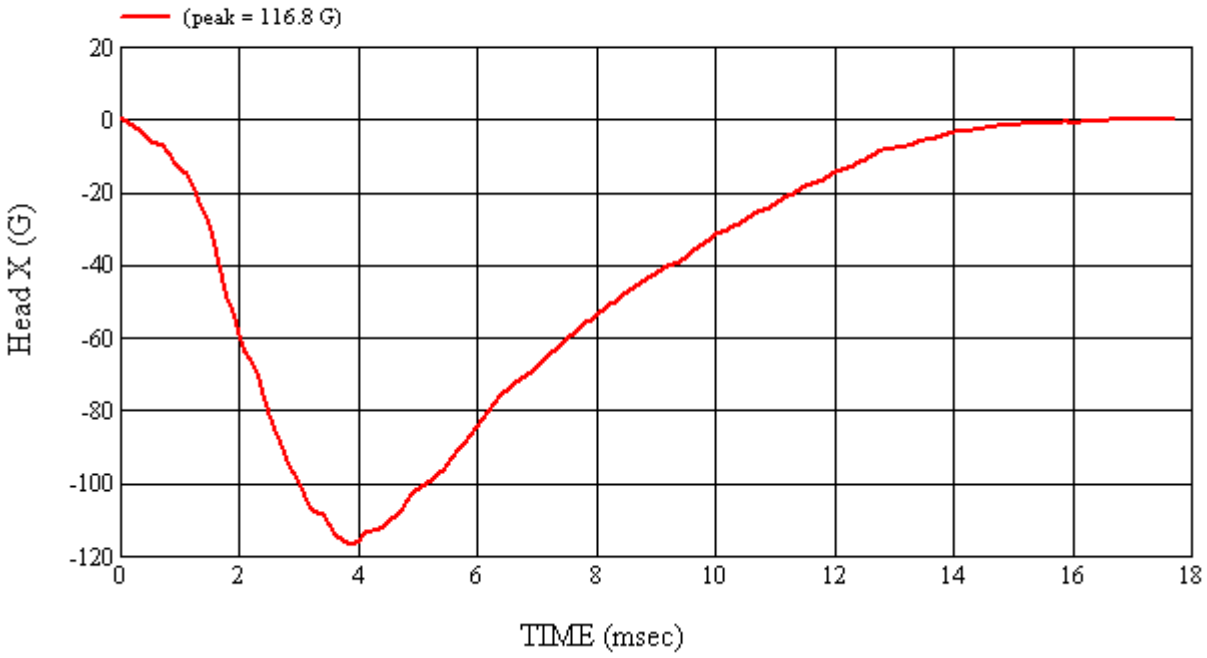
Recorded By: _____ Approved By*: _____ Date: 5/21/2009

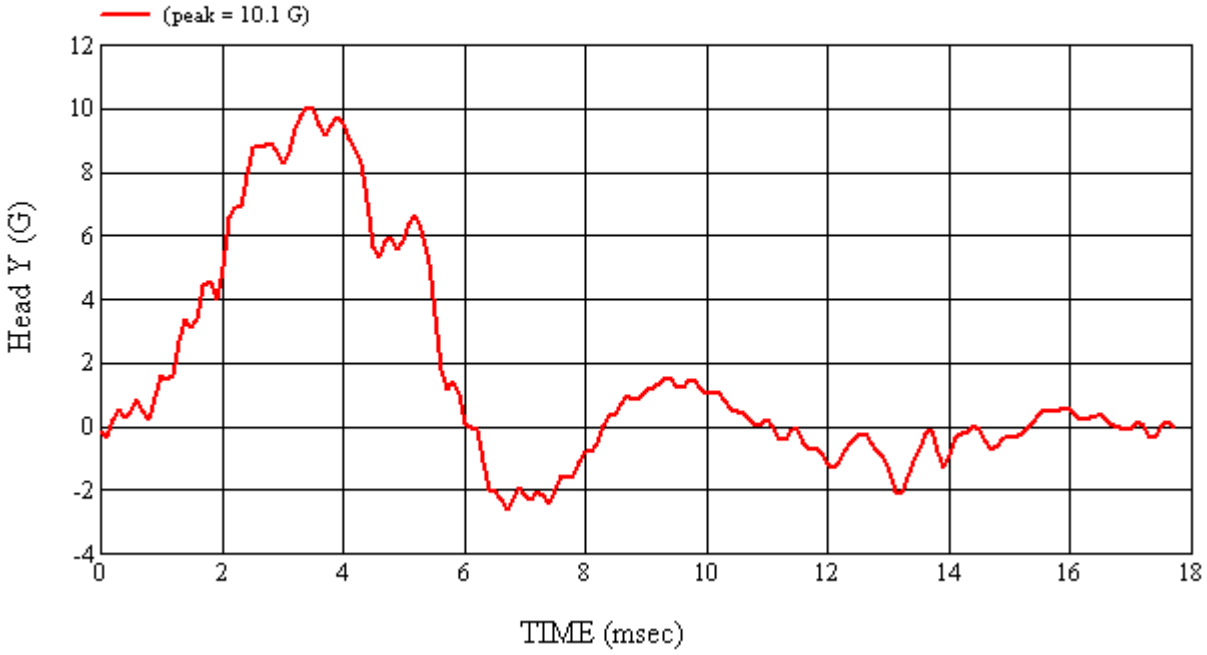
*Only necessary for NHTSA (Government) Compliance testing.

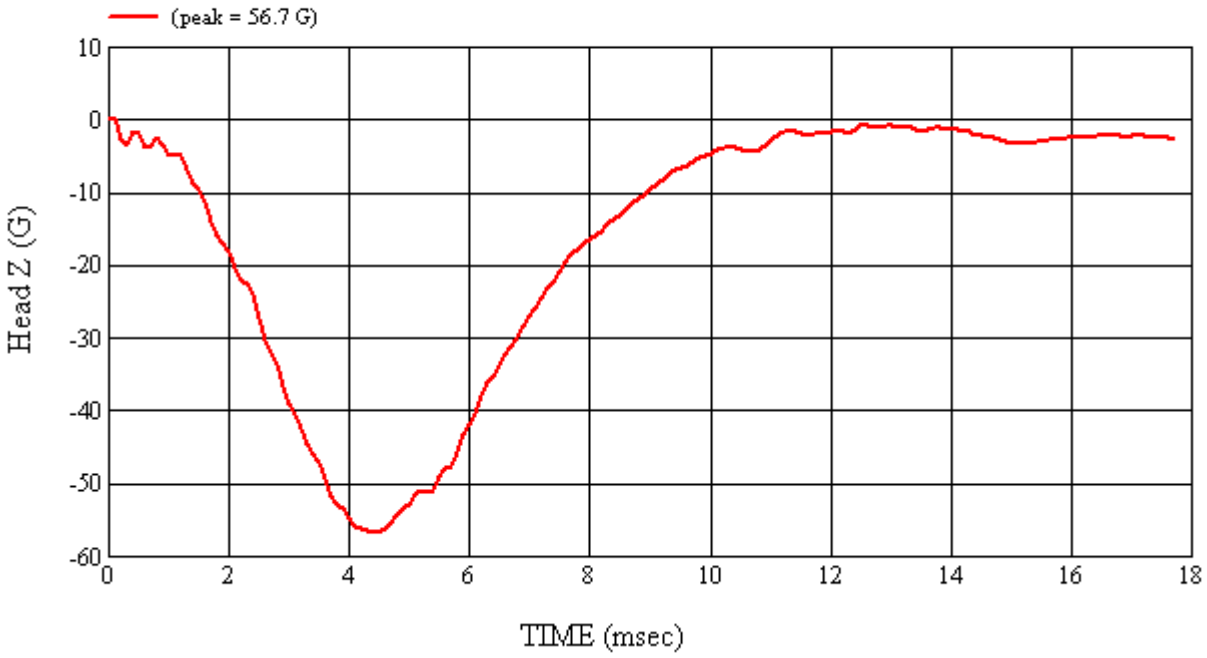
MGA Test #: FM9132 Target Location: SR3-2, Left Side Test Date: 5/21/2009

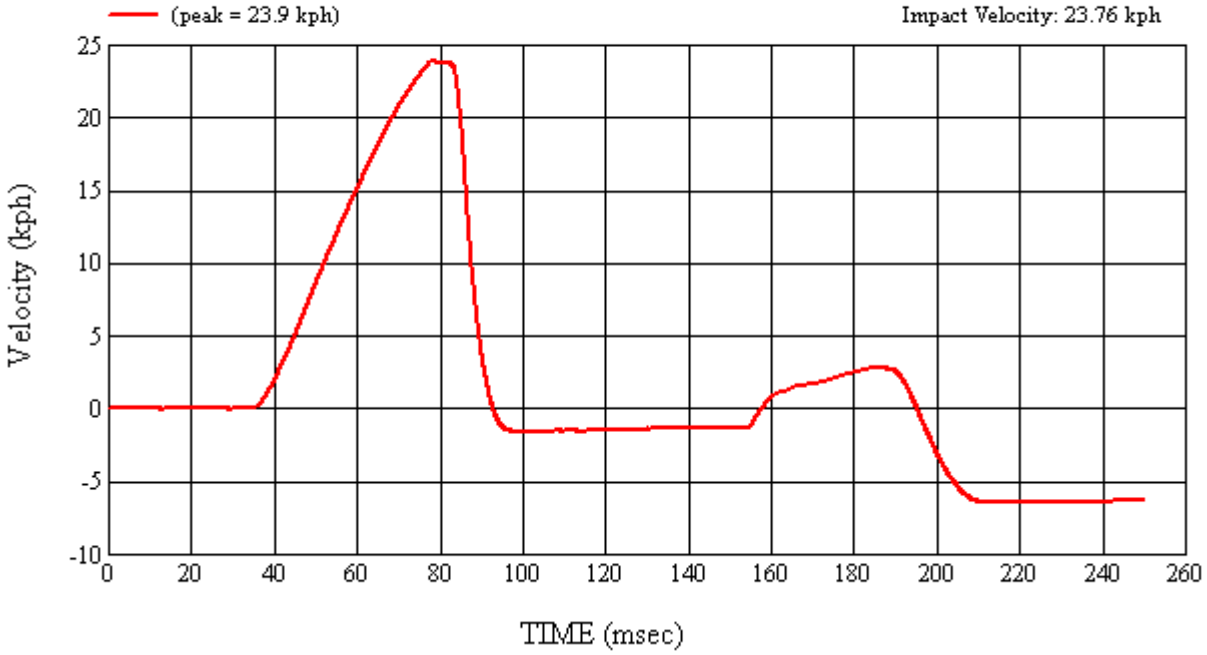


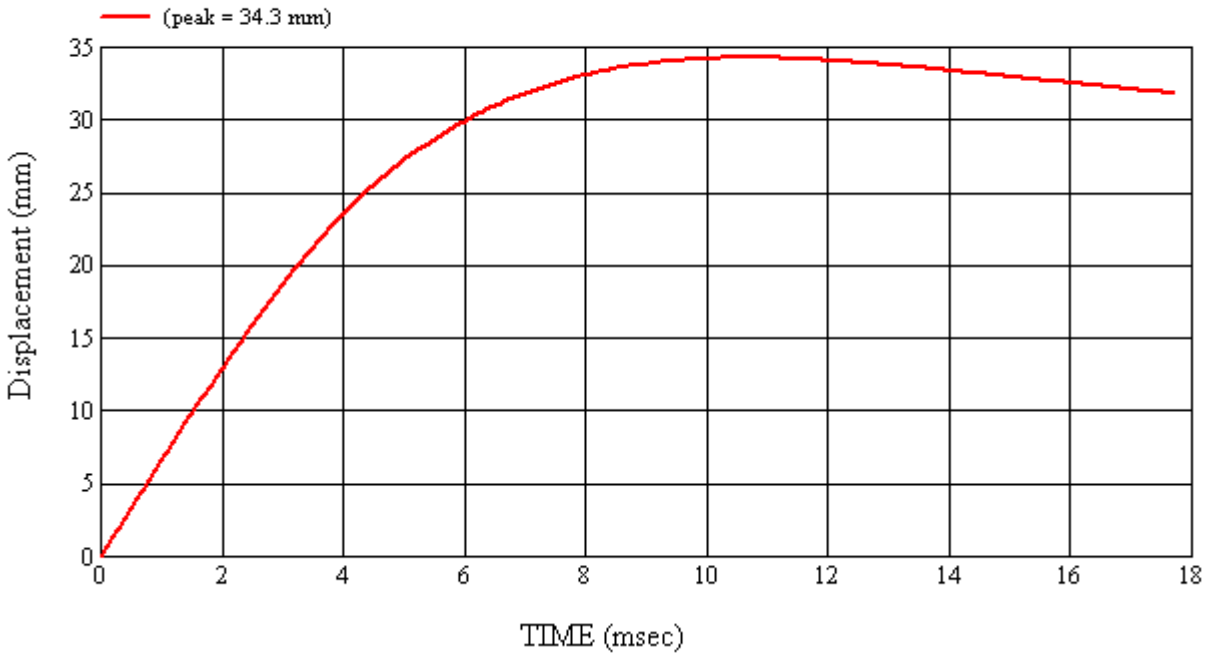



(peak = 116.8 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
TIME (msec)

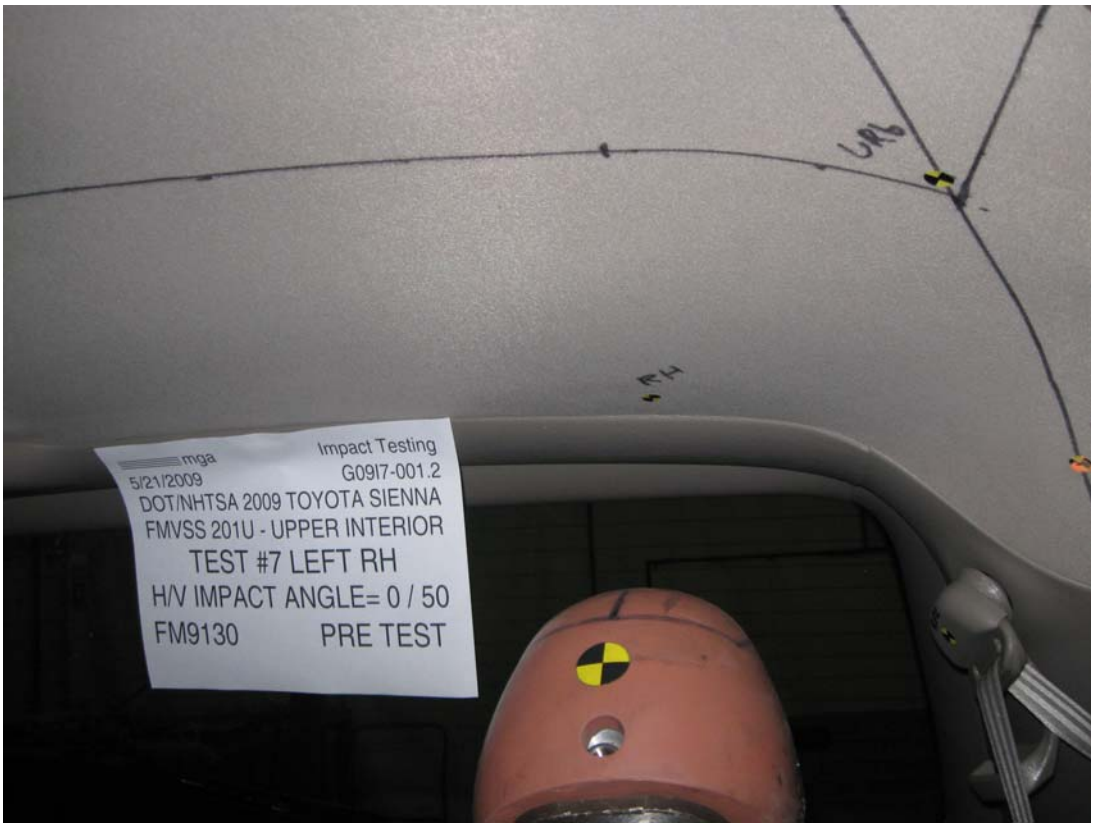

(peak = 10.1 G)
Head Y (G)
12
10
8
6
4
2
0
-2
-4
0
2
4
6
8
10
12
14
16
18
TIME (msec)

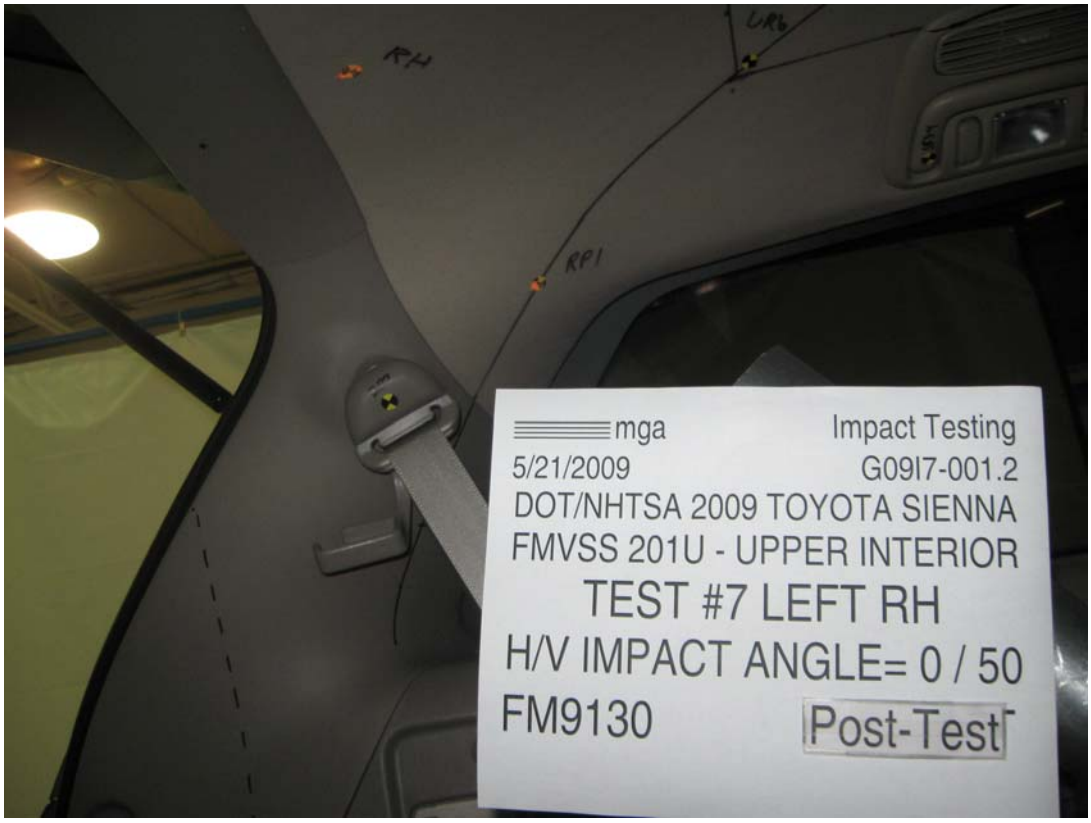

(peak = 56.7 G)
Head Z (G)
10
0
-10
-20
-30
-40
-50
-60
0
2
4
6
8
10
12
14
16
18
TIME (msec)

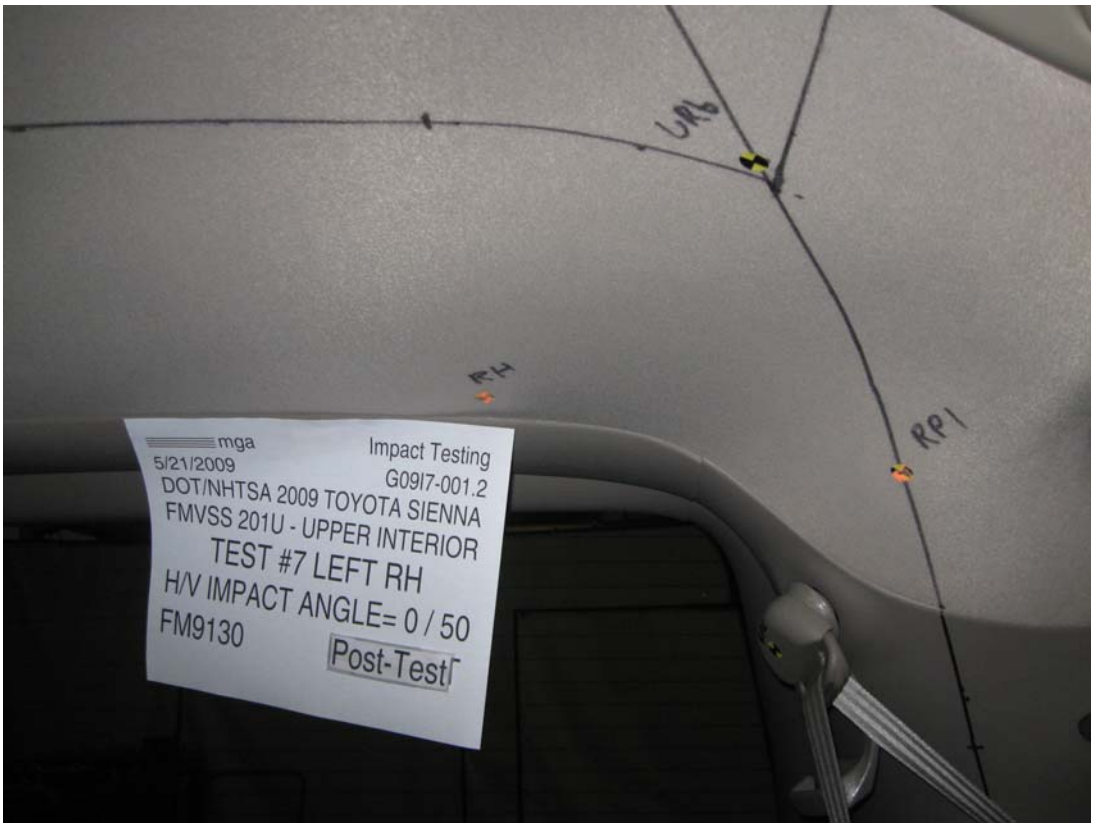

(peak = 23.9 kph)
Impact Velocity: 23.76 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 34.3 mm)
Displacement (mm)
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
TIME (msec)


mga
Impact Testing
G09I7-001.2
5/21/2009
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #7 LEFT RH
H/V IMPACT ANGLE= 0 / 50
FM9130
PRE TEST


mga
Impact Testing
G09I7-001.2
5/21/2009
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #7 LEFT RH
H/V IMPACT ANGLE= 0 / 50
FM9130
PRE TEST


RH
RP1
mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #7 LEFT RH
H/V IMPACT ANGLE= 0 / 50
FM9130
Post-Test


URB
RH
RP1
mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #7 LEFT RH
H/V IMPACT ANGLE= 0 / 50
FM9130
Post-Test


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #7 LEFT RH
H/V IMPACT ANGLE= 0 / 50
FM9130
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#7

Target (Vehicle Side): RHLeft

Temperature:22.1C

MGA Test Reference No.:FM9130

Humidity:49.8%

Approach Horizontal Angles:0º

Time of Test:10:05:10 AM

Approach Vertical Angles:50º

FMH Serial No:[035]

Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
675	674	4.4	23.8	25	7 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.6	1.06	1.06
Y	6	J22664	94.3	0.85	0.85
Z	7	J35924	92.8	0.94	0.94

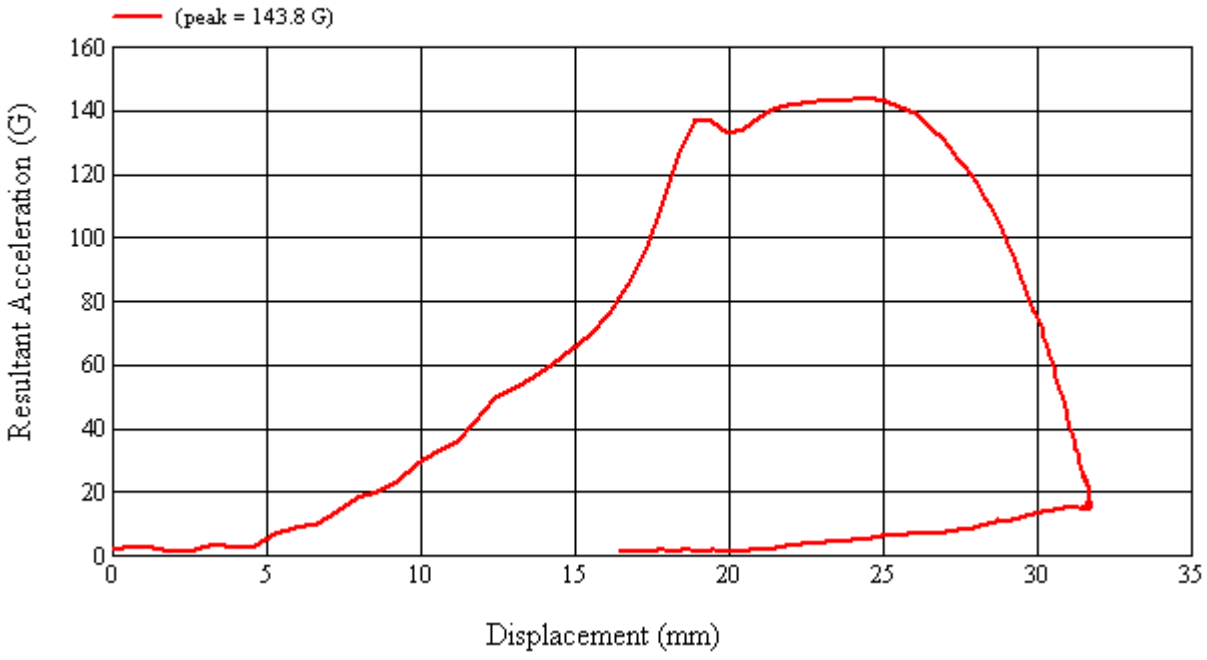
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

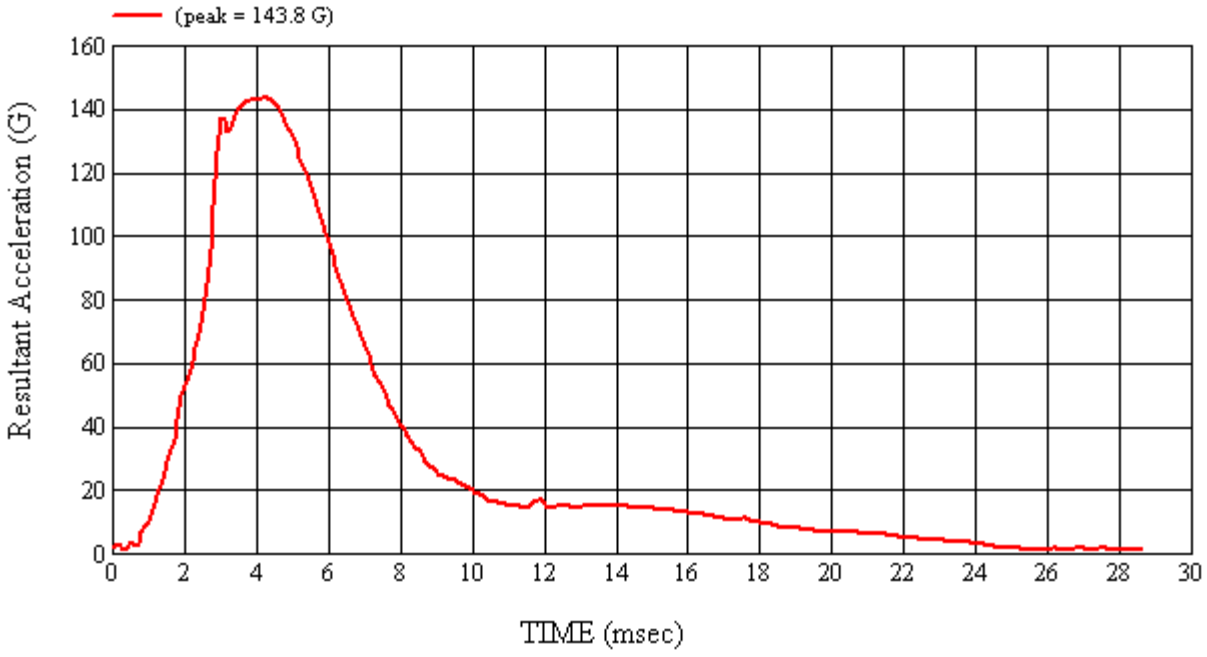
No damage observed

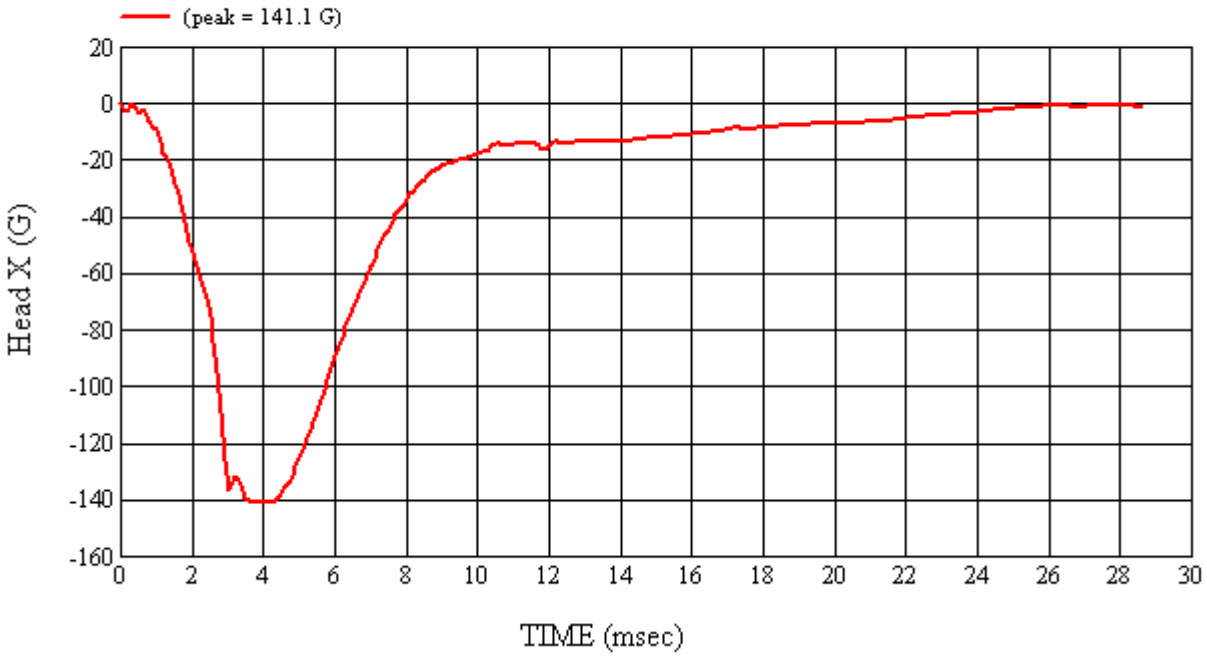
Recorded By: _____ Approved By*: _____ Date: 5/21/2009

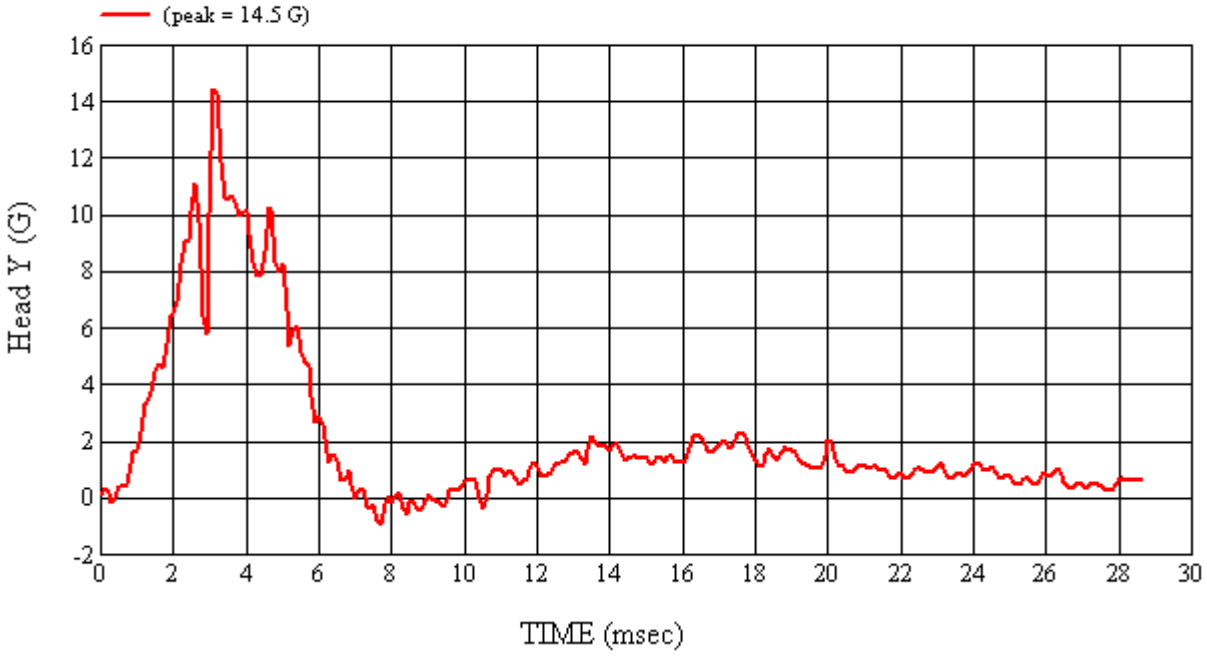
*Only necessary for NHTSA (Government) Compliance testing.

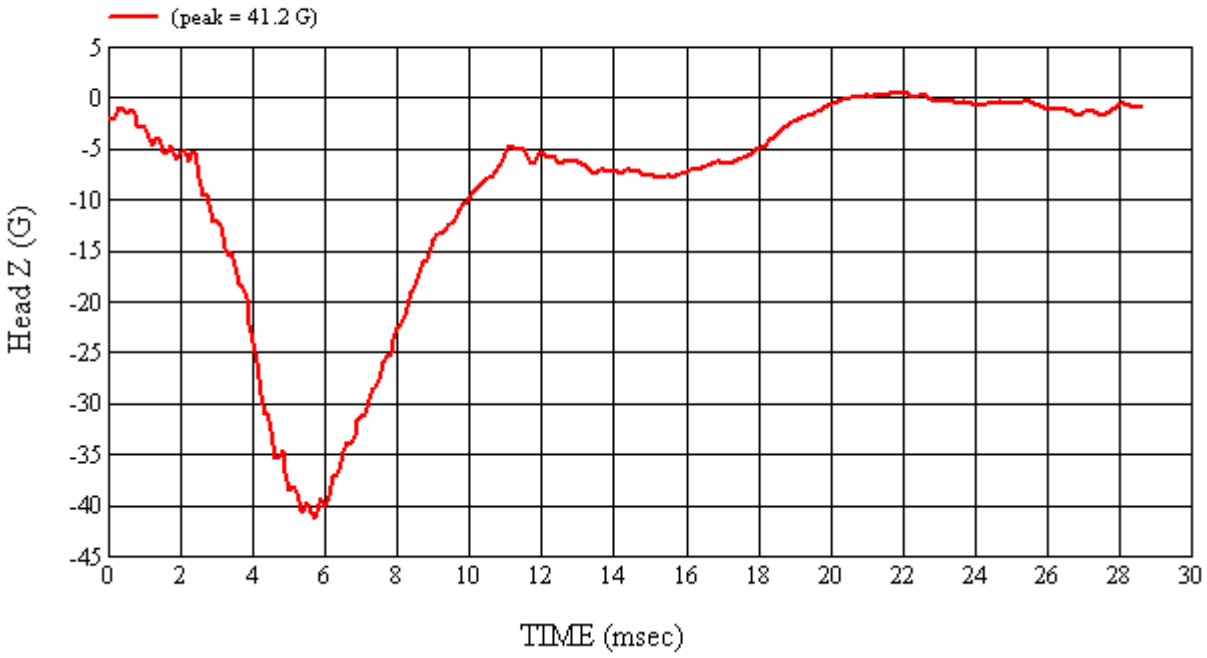
MGA Test #: FM9130 Target Location: RH, Left Side Test Date: 5/21/2009

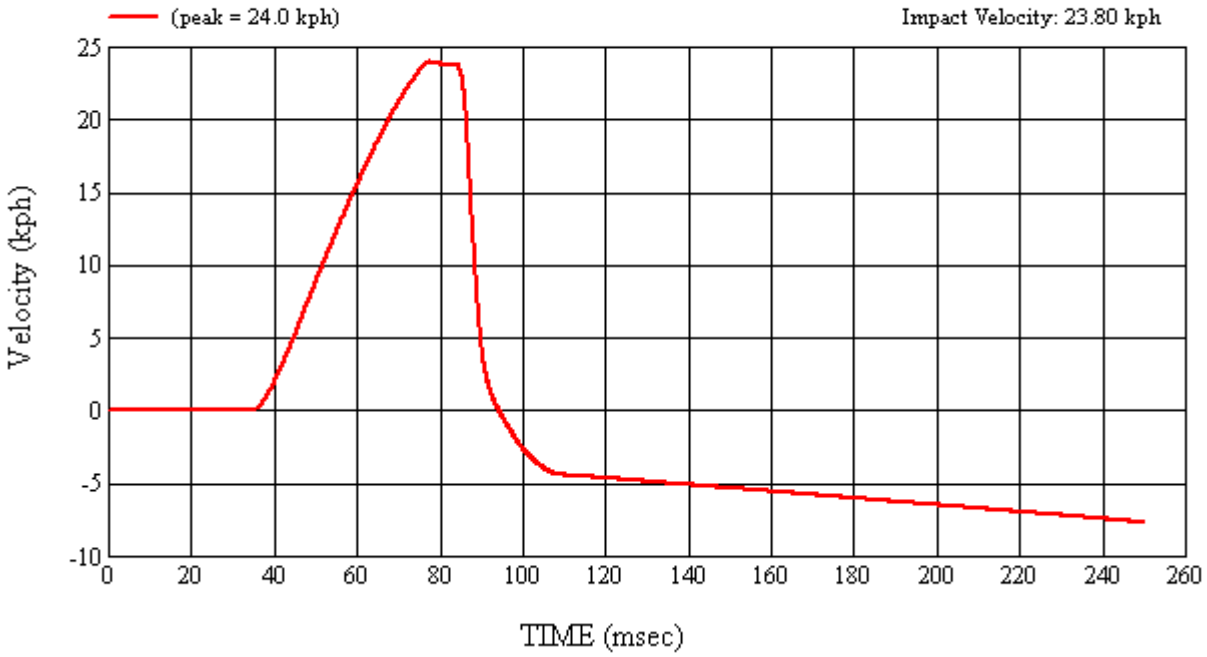


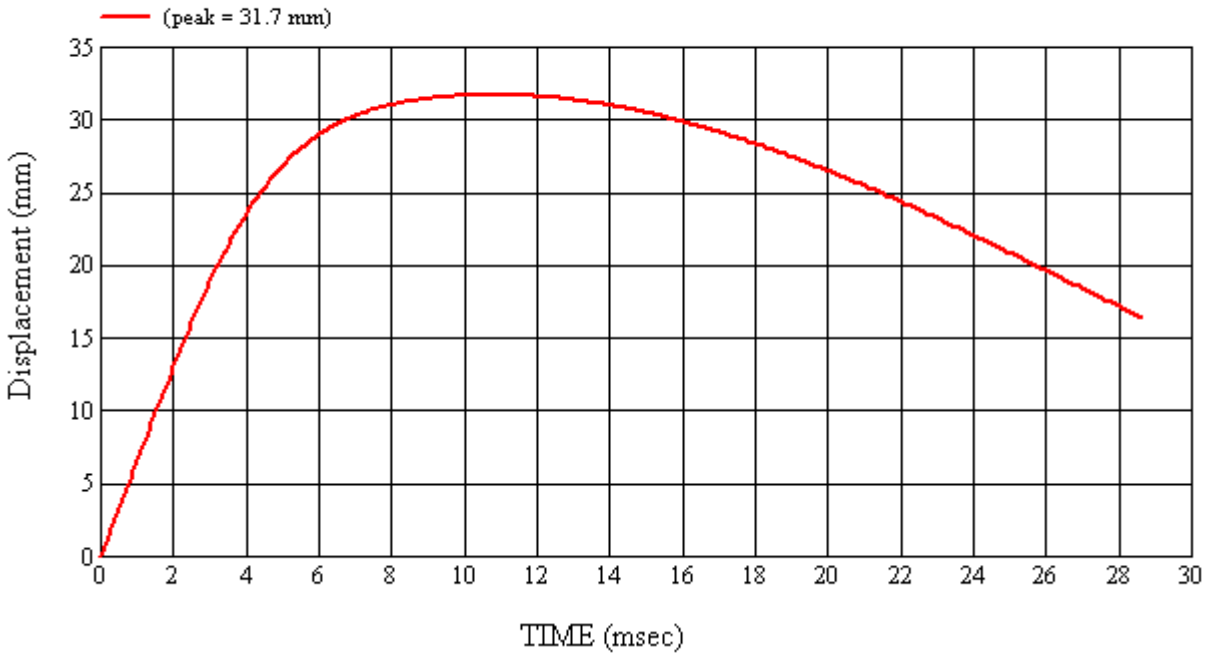



(peak = 141.1 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
TIME (msec)

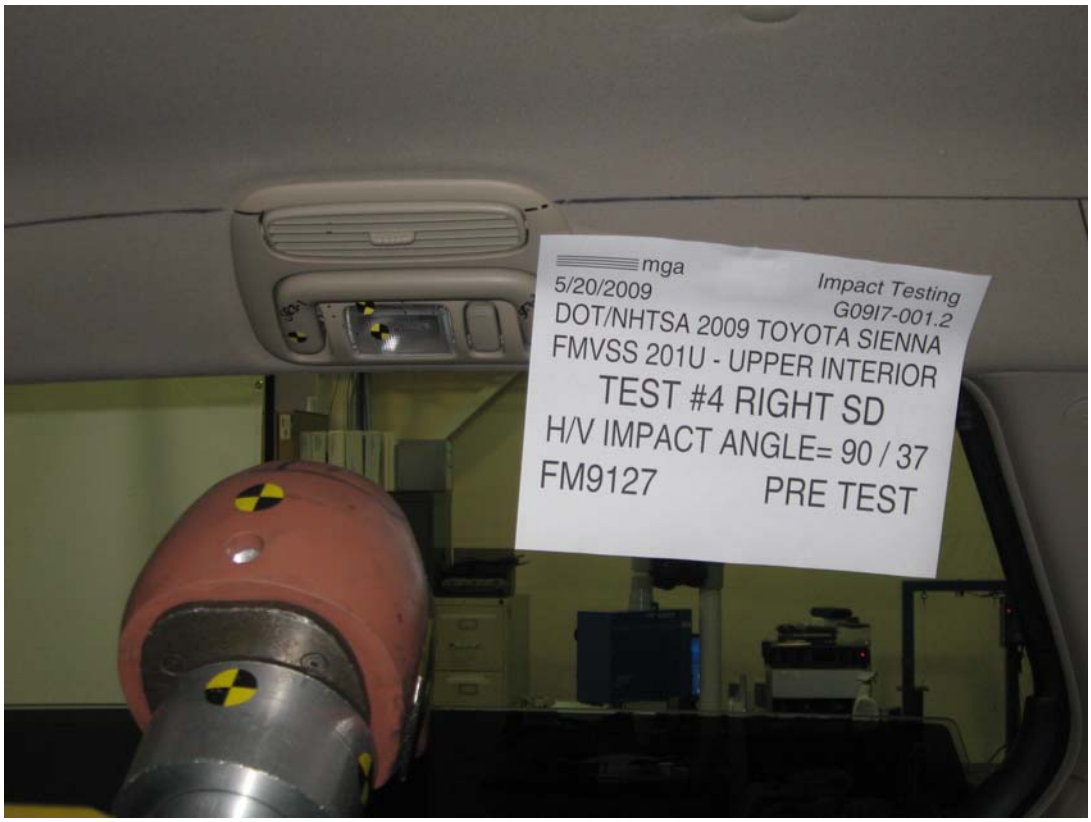

(peak = 14.5 G)
Head Y (G)
16
14
12
10
8
6
4
2
0
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
TIME (msec)

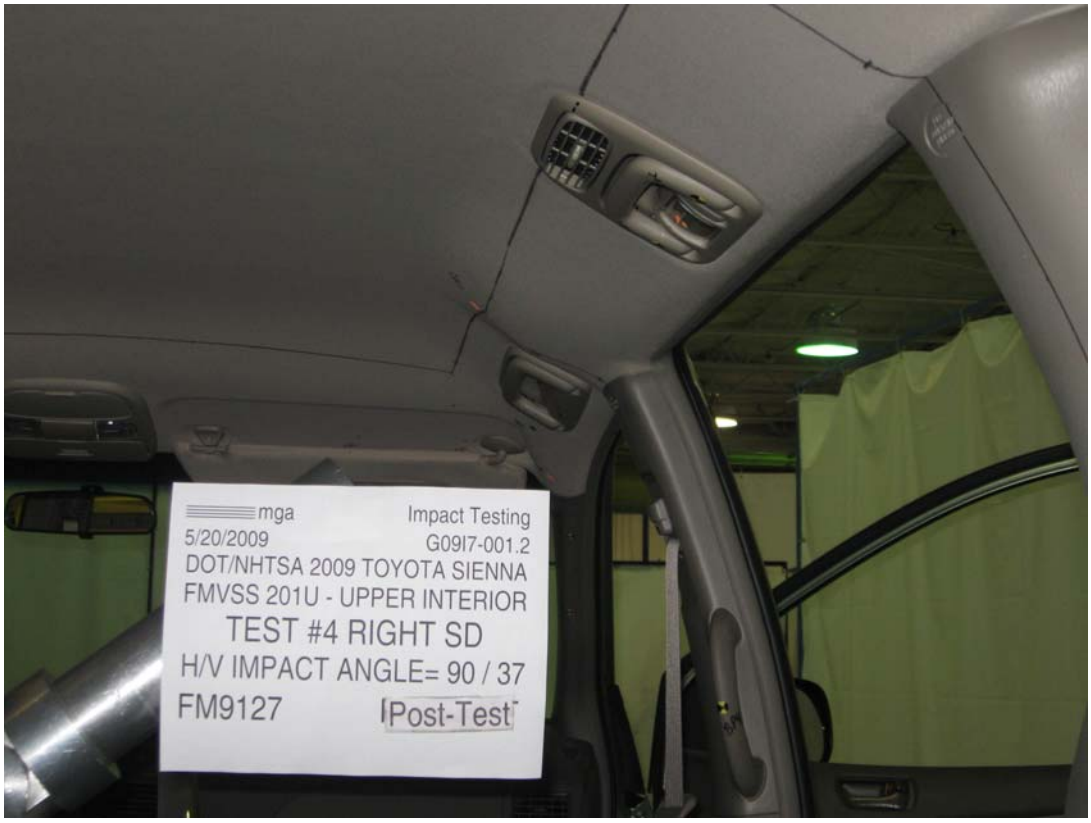

(peak = 41.2 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
TIME (msec)

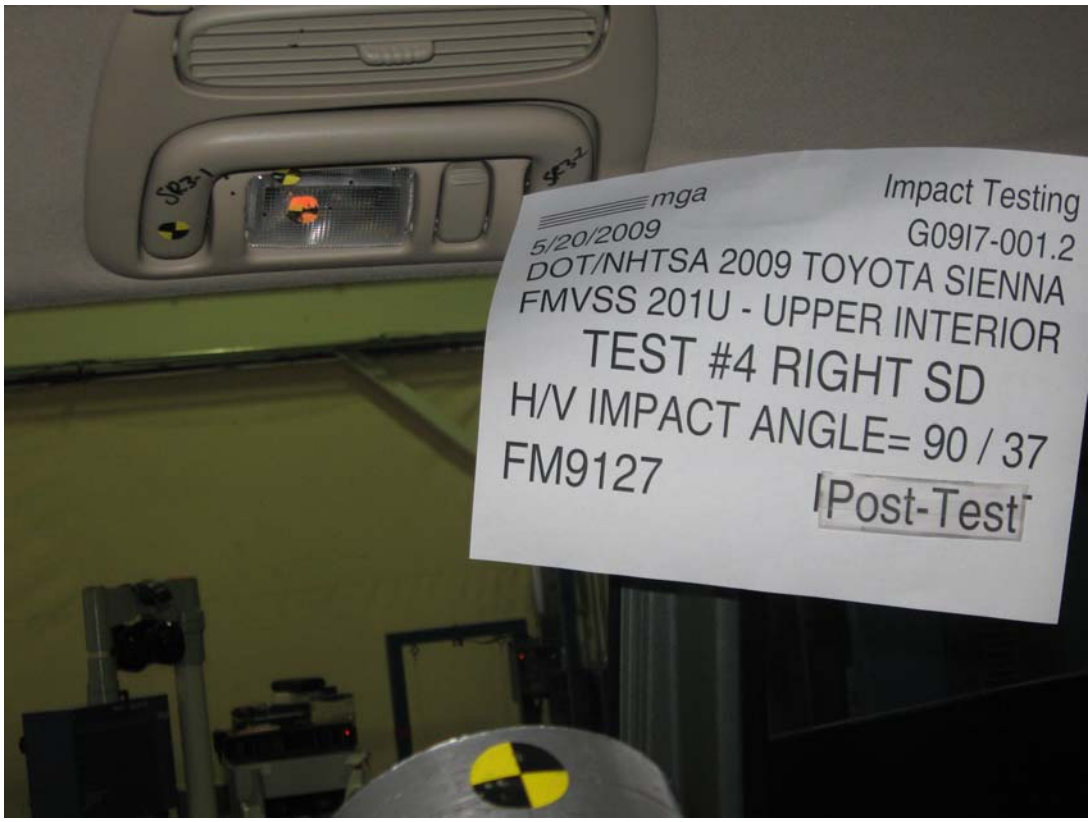

(peak = 24.0 kph)
Impact Velocity: 23.80 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 31.7 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
TIME (msec)


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #4 RIGHT SD
H/V IMPACT ANGLE= 90 / 37
FM9127
PRE TEST


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #4 RIGHT SD
H/V IMPACT ANGLE= 90 / 37
FM9127
PRE TEST


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #4 RIGHT SD
H/V IMPACT ANGLE= 90 / 37
FM9127
Post-Test


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #4 RIGHT SD
H/V IMPACT ANGLE= 90 / 37
FM9127
Post-Test


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #4 RIGHT SD
H/V IMPACT ANGLE= 90 / 37
FM9127
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#4

Target (Vehicle Side): SDRight

Temperature:22.1C

MGA Test Reference No.:FM9127

Humidity:46.7%

Approach Horizontal Angles:90º

Time of Test:3:08:34 PM

Approach Vertical Angles:37º

FMH Serial No:[035]

Additional Description:Located on reading light at grab handle; Relocations: 1

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
510	455	8.6	24.1	33	3 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.6	1.06	1.06
Y	6	J22664	94.3	0.85	0.85
Z	7	J35924	92.8	0.93	0.94

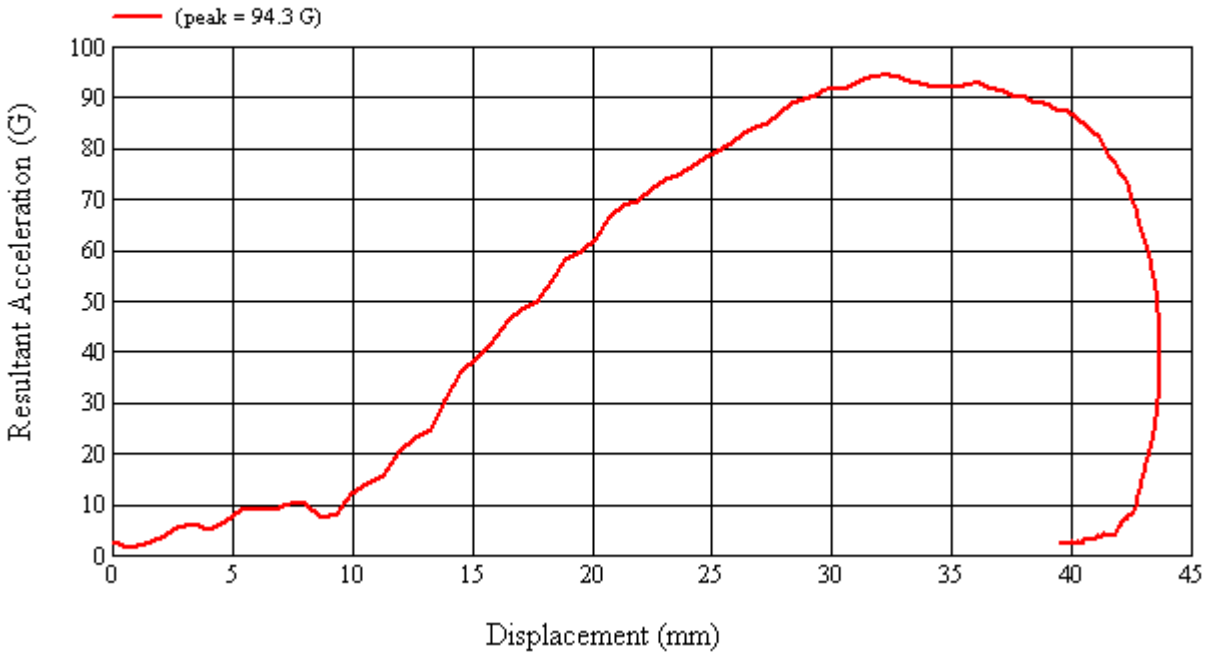
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

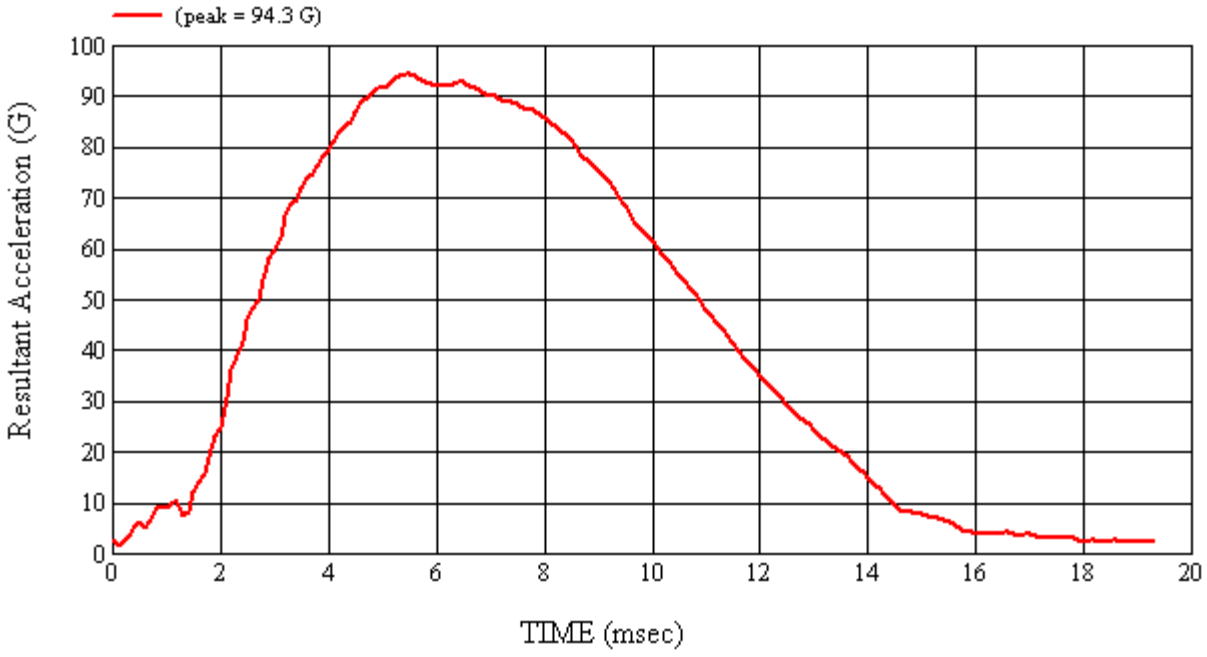
No damage observed

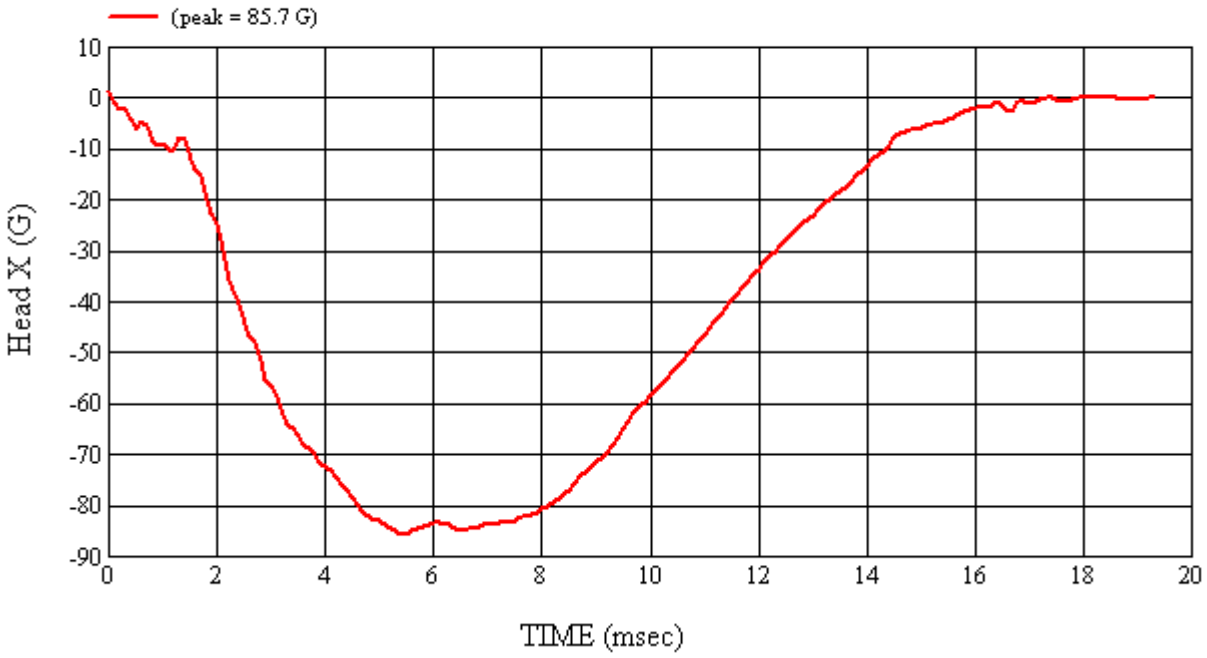
Recorded By: _____ Approved By*: _____ Date: 5/20/2009

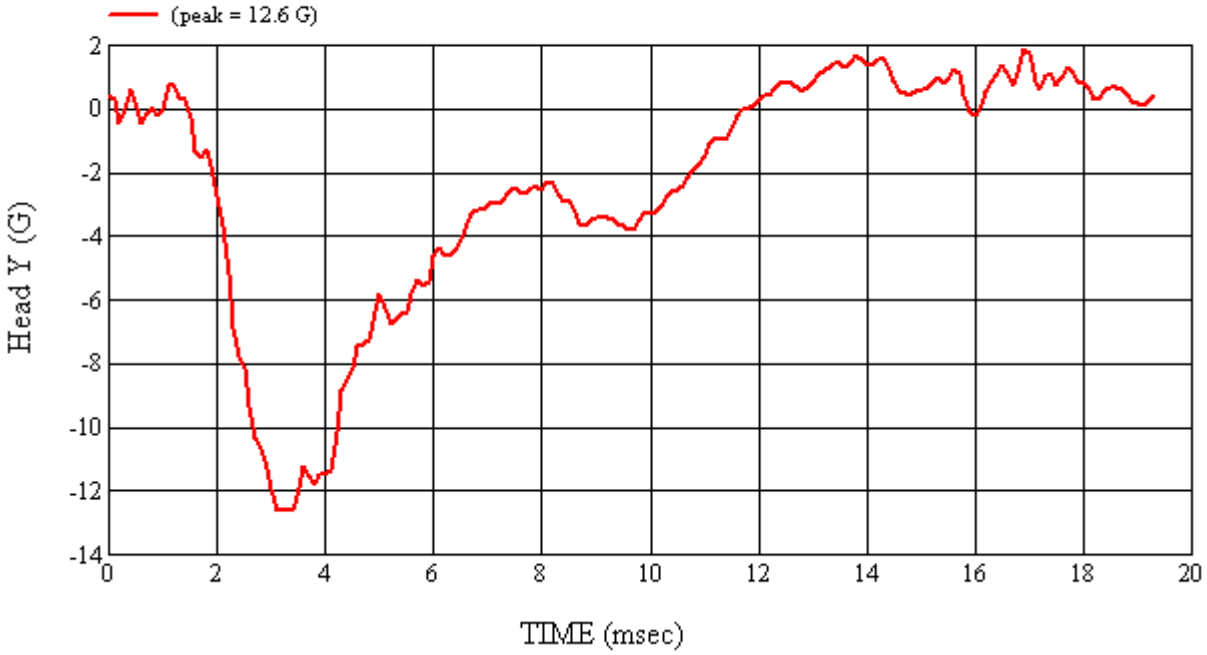
*Only necessary for NHTSA (Government) Compliance testing.

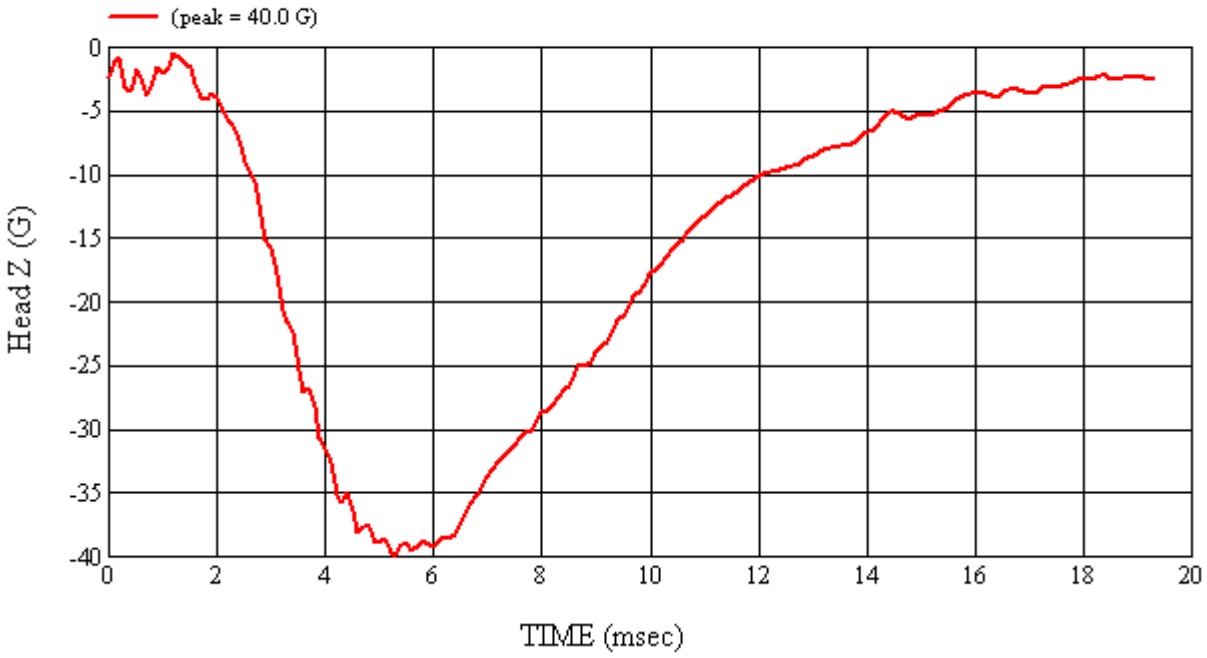
MGA Test #: FM9127 Target Location: SD, Right Side Test Date: 5/20/2009

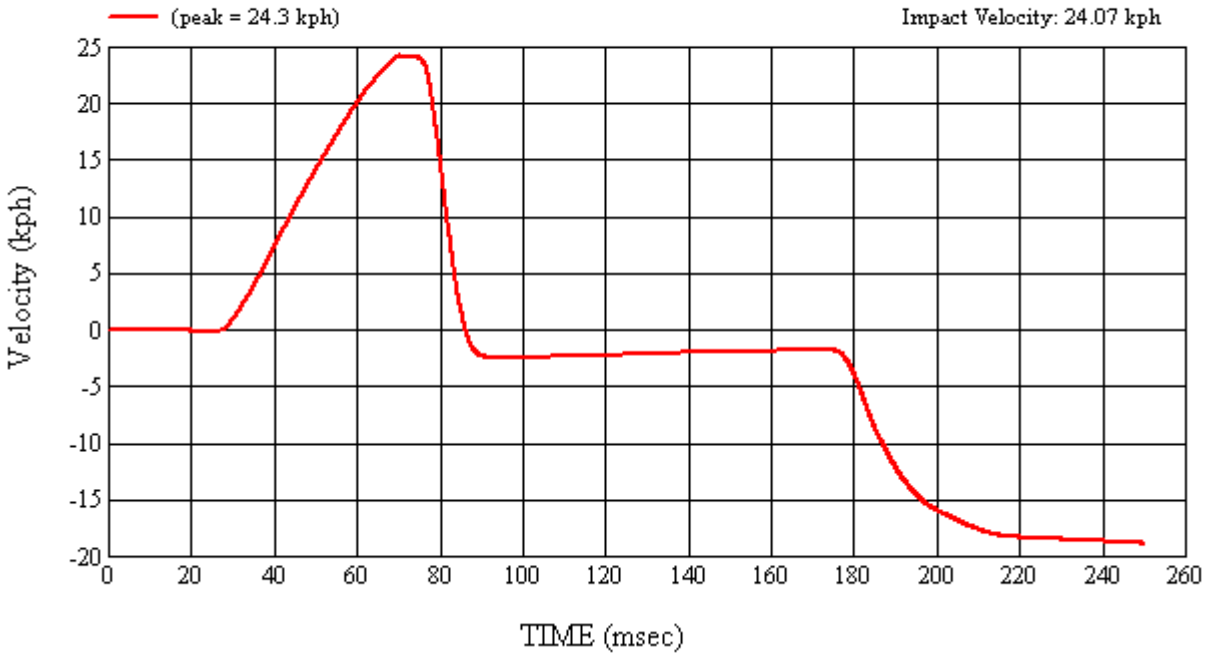


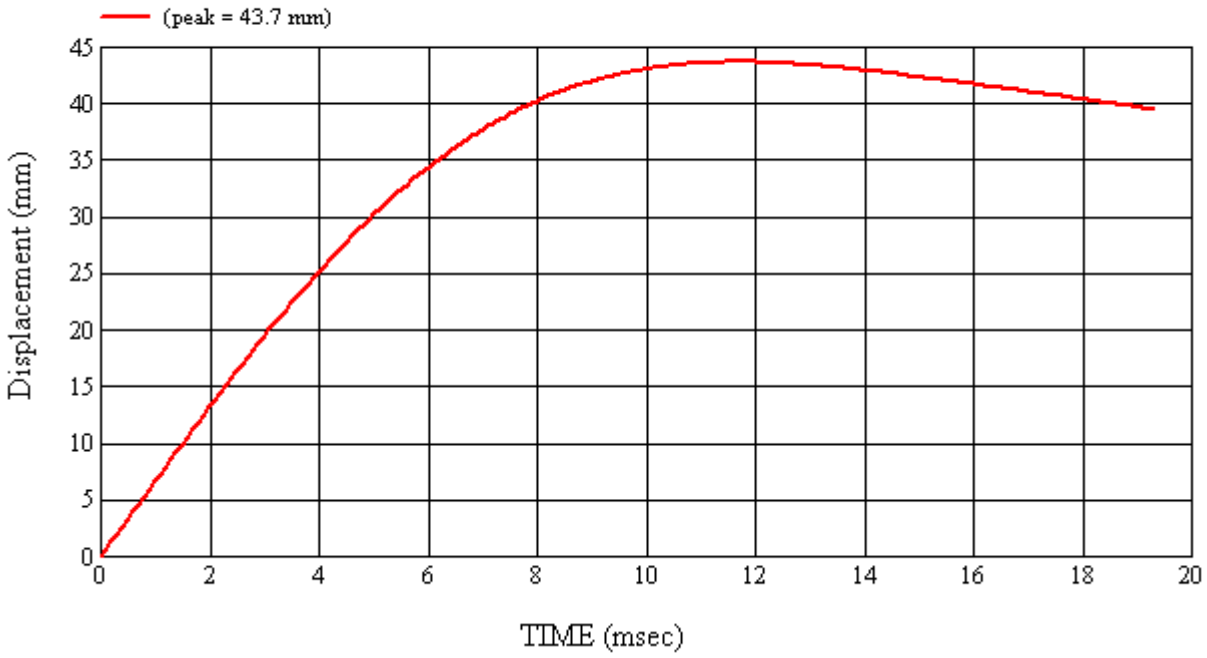



(peak = 85.7 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 12.6 G)
Head Y (G)
2
0
-2
-4
-6
-8
-10
-12
-14
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 40.0 G)
Head Z (G)
0
-5
-10
-15
-20
-25
-30
-35
-40
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 24.3 kph)
Impact Velocity: 24.07 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
-20
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 43.7 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
45
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #3 RIGHT UR2
H/V IMPACT ANGLE= 90 / 38
FM9126
PRE TEST


UR2
BP1
mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #3 RIGHT UR2
H/V IMPACT ANGLE= 90 / 38
FM9126
PRE TEST


C95107
FM9126
RIGHT UR2
H/V 90/38
mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #3 RIGHT UR2
H/V IMPACT ANGLE= 90 / 38
FM9126
Post-Test


UR2
BP1
mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #3 RIGHT UR2
H/V IMPACT ANGLE= 90 / 38
FM9126
Post-Test


mga
Impact Testing
5/20/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #3 RIGHT UR2
H/V IMPACT ANGLE= 90 / 38
FM9126
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#3

Target (Vehicle Side): UR2Right

Temperature:21.9C

MGA Test Reference No.:FM9126

Humidity:44.7%

Approach Horizontal Angles:90º

Time of Test:1:39:13 PM

Approach Vertical Angles:38º

FMH Serial No:[038]

Additional Description:Located at BPR

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
620	601	9.1	24.0	18	1 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-94	1.06	1.06
Y	6	J36197	106.3	0.85	0.85
Z	7	J36353	97.5	0.93	0.93

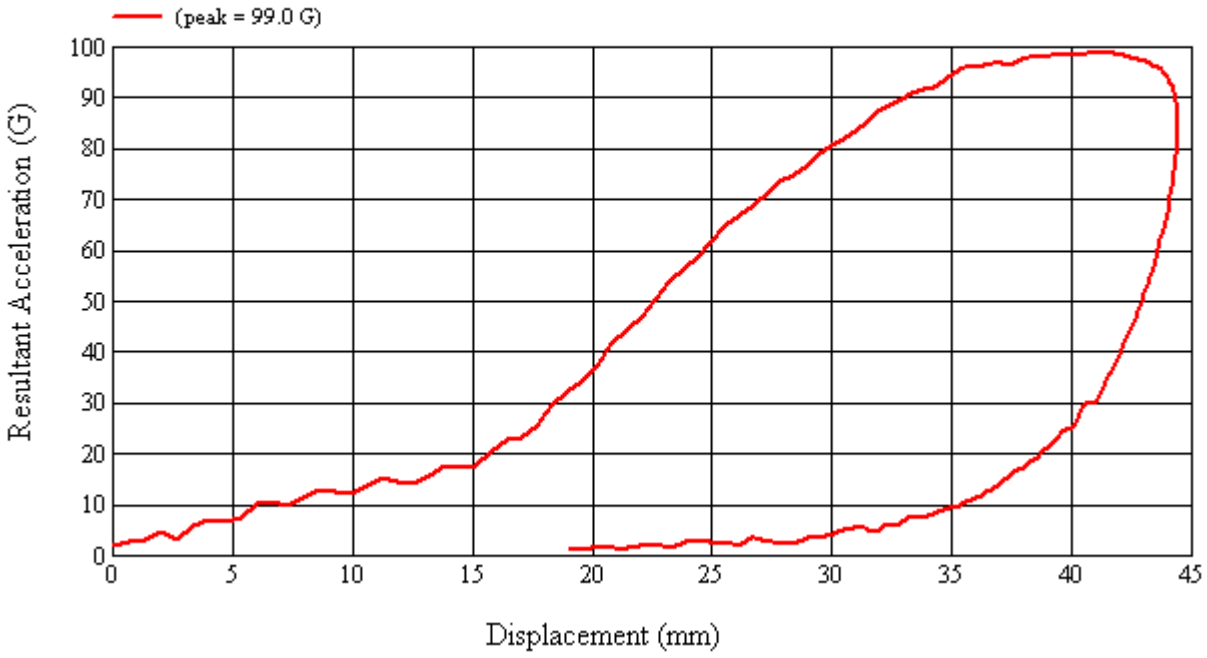
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

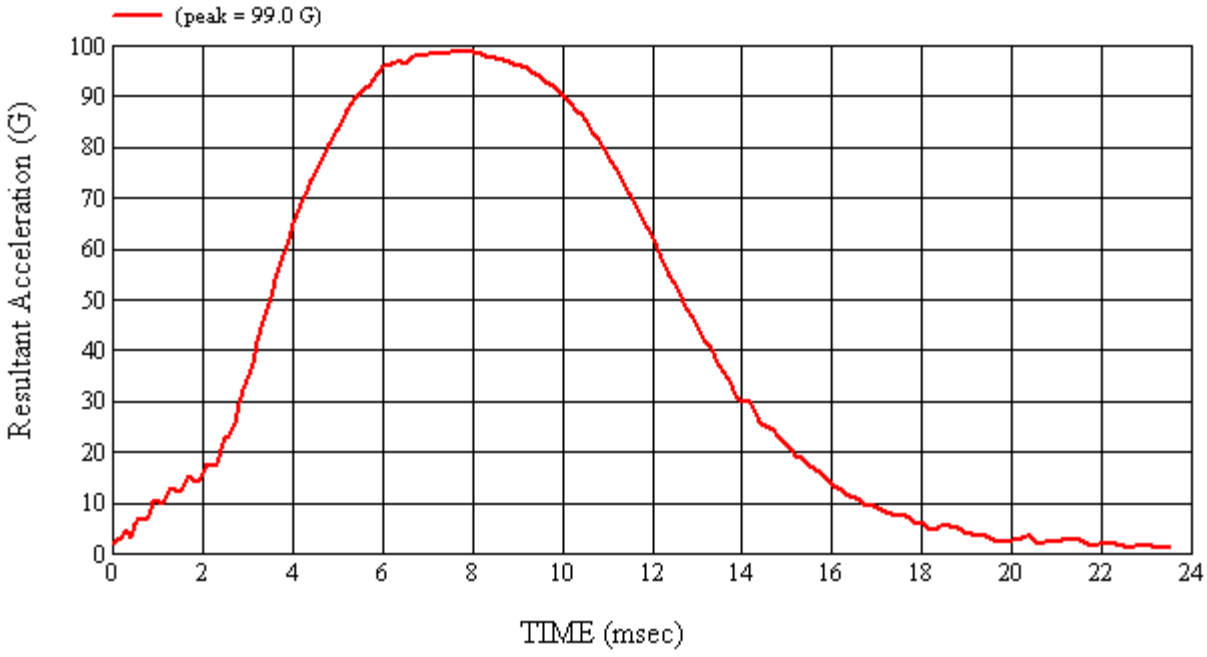
No damage observed

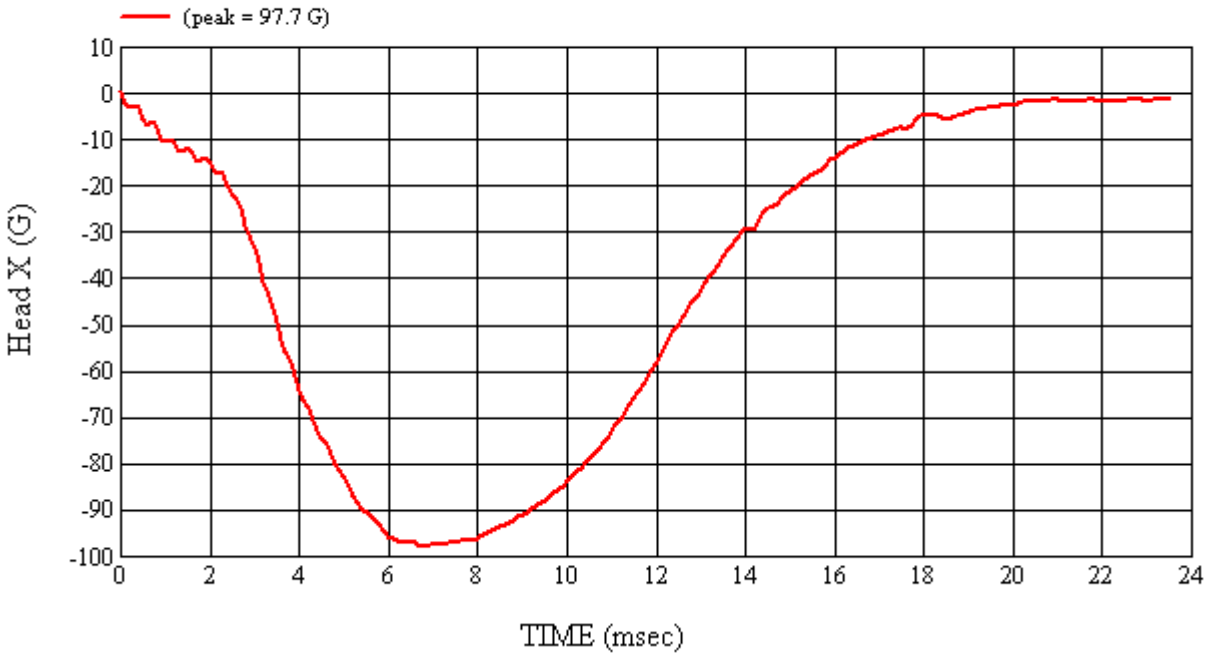
Recorded By: _____ Approved By*: _____ Date: 5/20/2009

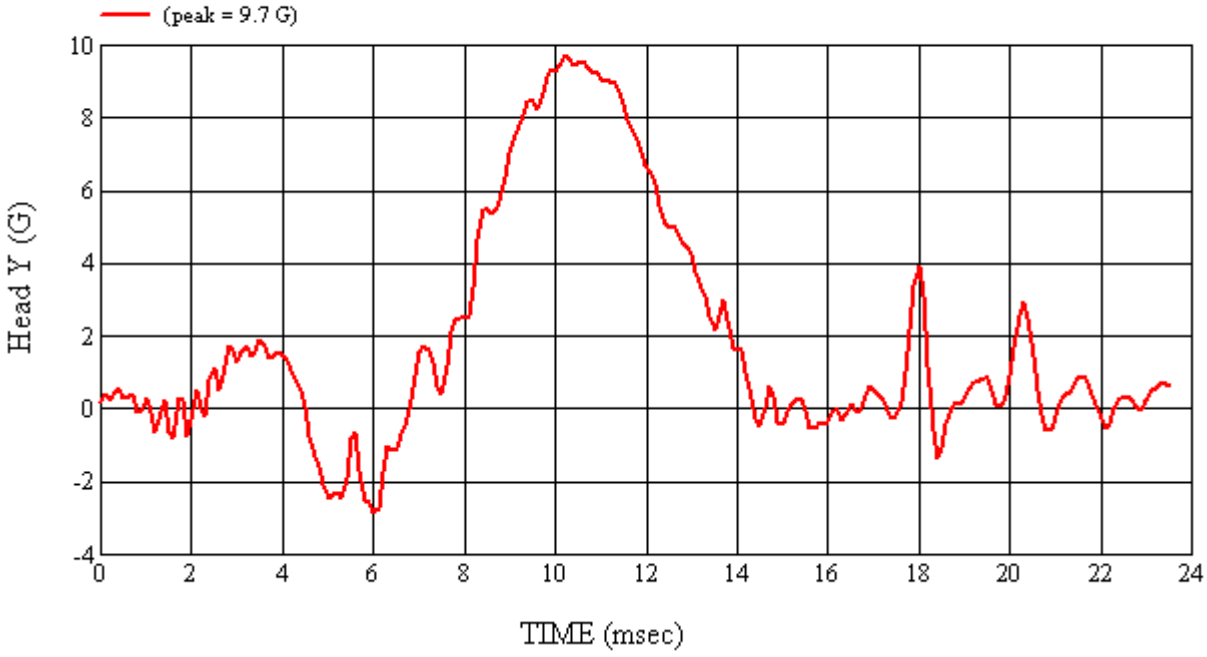
*Only necessary for NHTSA (Government) Compliance testing.

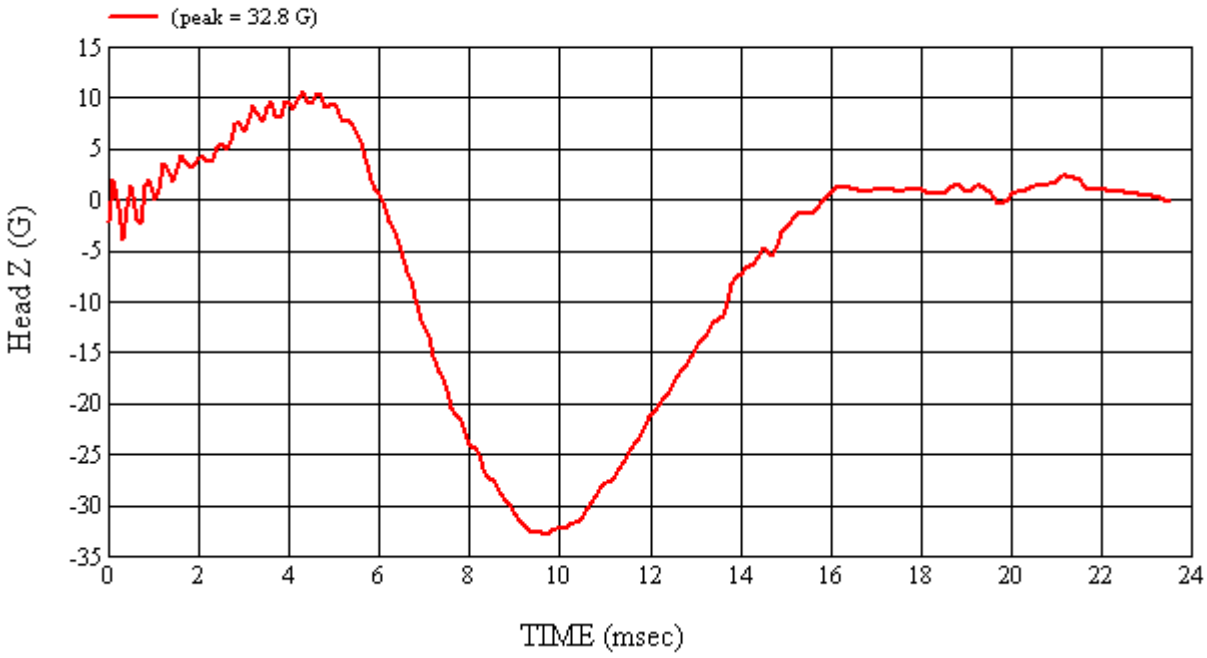
MGA Test #: FM9126 Target Location: UR2, Right Side Test Date: 5/20/2009

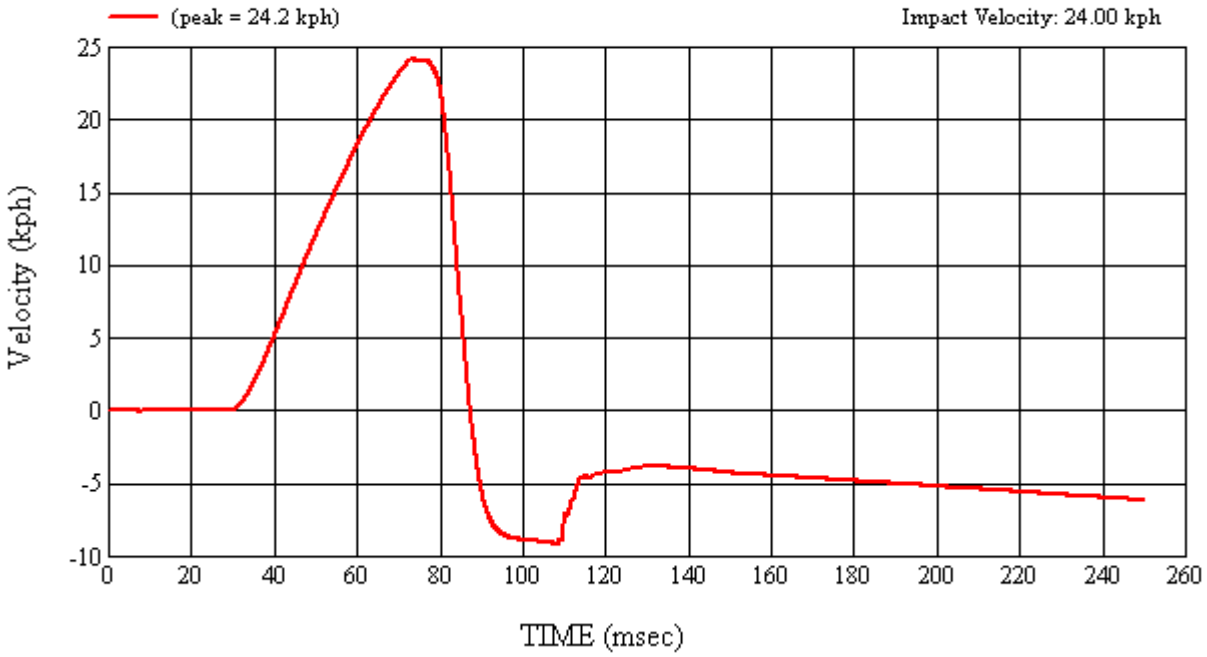


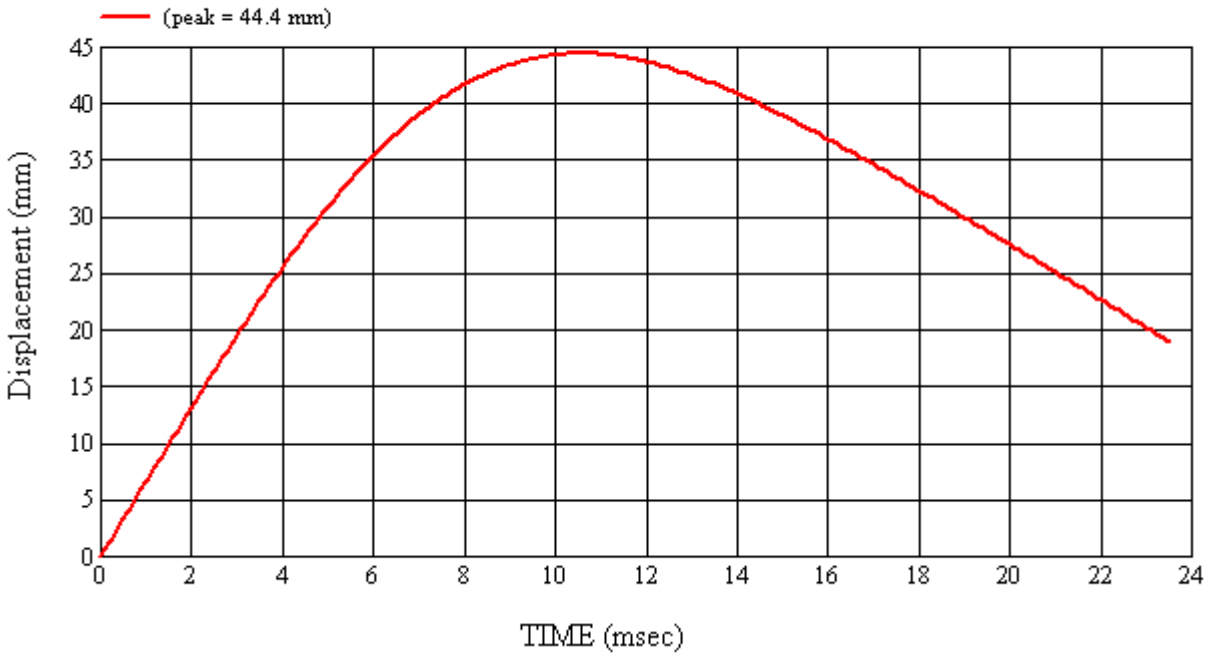



(peak = 97.7 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

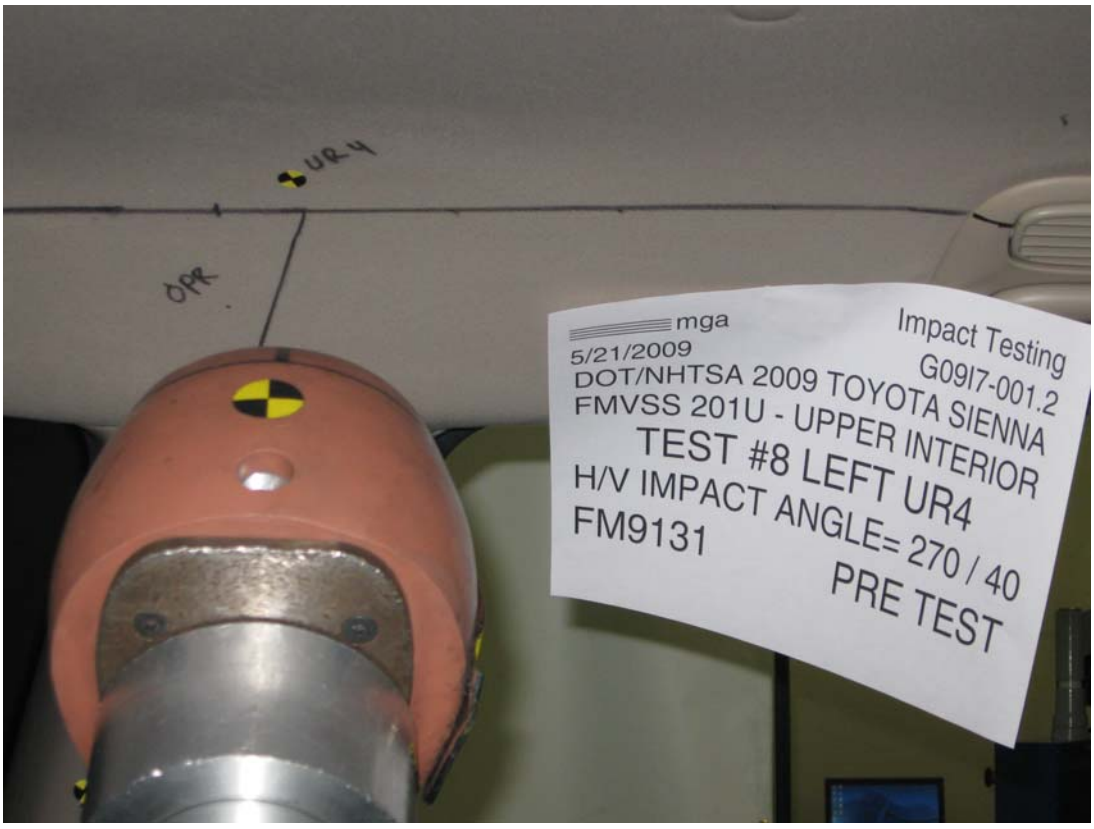

(peak = 9.7 G)
Head Y (G)
10
8
6
4
2
0
-2
-4
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

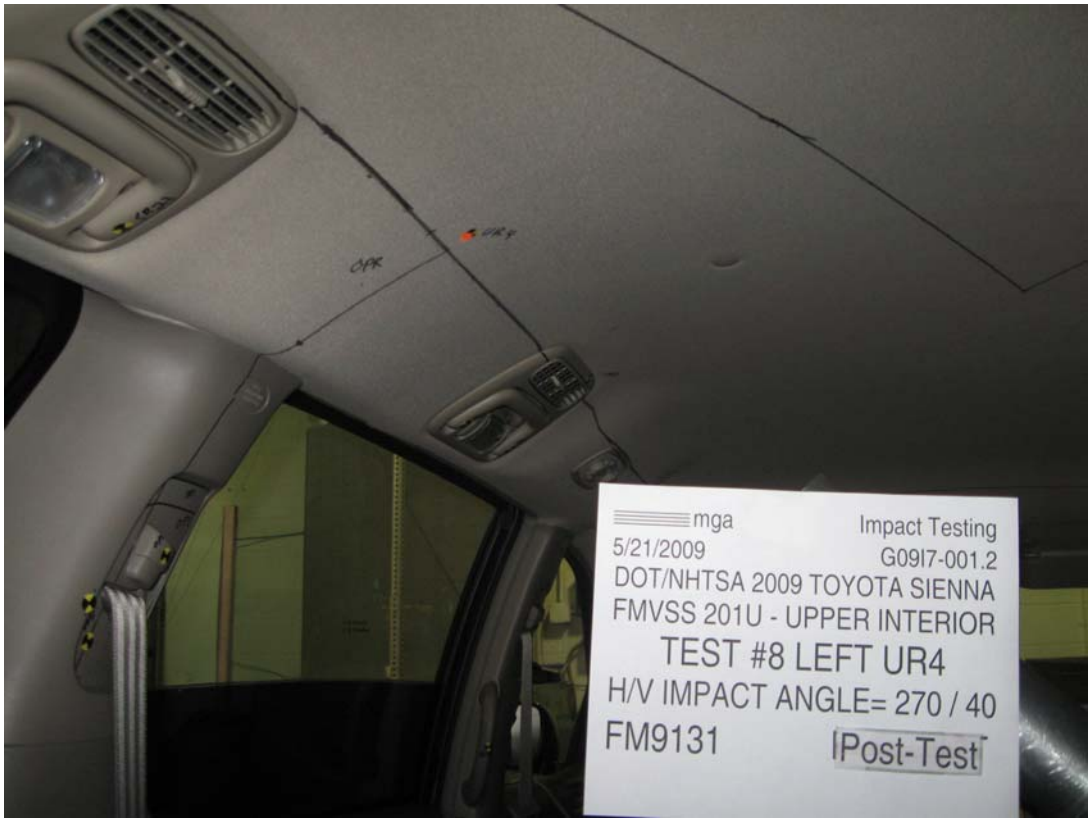

(peak = 32.8 G)
Head Z (G)
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

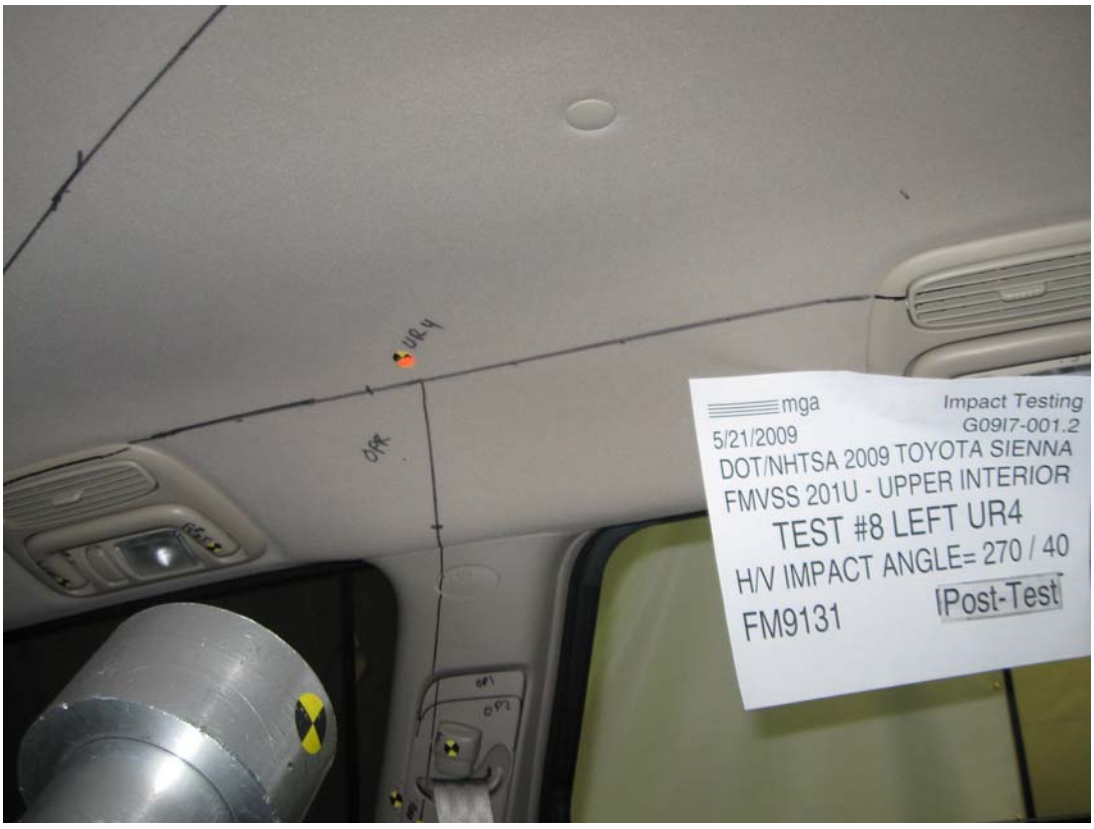

(peak = 24.2 kph)
Impact Velocity: 24.00 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 44.4 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
45
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


C95107
FM9131
LEFT UR4
H/V 270/40
mga
Impact Testing
G09I7-001.2
5/21/2009
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #8 LEFT UR4
H/V IMPACT ANGLE= 270 / 40
FM9131
PRE TEST


UR-4
OPR
mga
Impact Testing
G09I7-001.2
5/21/2009
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #8 LEFT UR4
H/V IMPACT ANGLE= 270 / 40
FM9131
PRE TEST


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #8 LEFT UR4
H/V IMPACT ANGLE= 270 / 40
FM9131
Post-Test


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #8 LEFT UR4
H/V IMPACT ANGLE= 270 / 40
FM9131
Post-Test


mga
Impact Testing
5/21/2009
G09I7-001.2
DOT/NHTSA 2009 TOYOTA SIENNA
FMVSS 201U - UPPER INTERIOR
TEST #8 LEFT UR4
H/V IMPACT ANGLE= 270 / 40
FM9131
Post-Test

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G09I7-001.2 VEHICLE YR/MAKE/MODEL:2009/DOT/NHTSA/Toyota Sienna

GENERAL TEST PARAMETERS:

Test Number:#8

Target (Vehicle Side): UR4Left

Temperature:22.3C

MGA Test Reference No.:FM9131

Humidity:46.5%

Approach Horizontal Angles:270º

Time of Test:11:12:40 AM

Approach Vertical Angles:40º

FMH Serial No:[037]

Additional Description:Located at OPR

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
485	422	11.7	24.1	27	8 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	AHTB2	-115.9	1.06	1.06
Y	6	J14103	93.7	0.85	0.85
Z	7	J35800	97.1	0.94	0.94

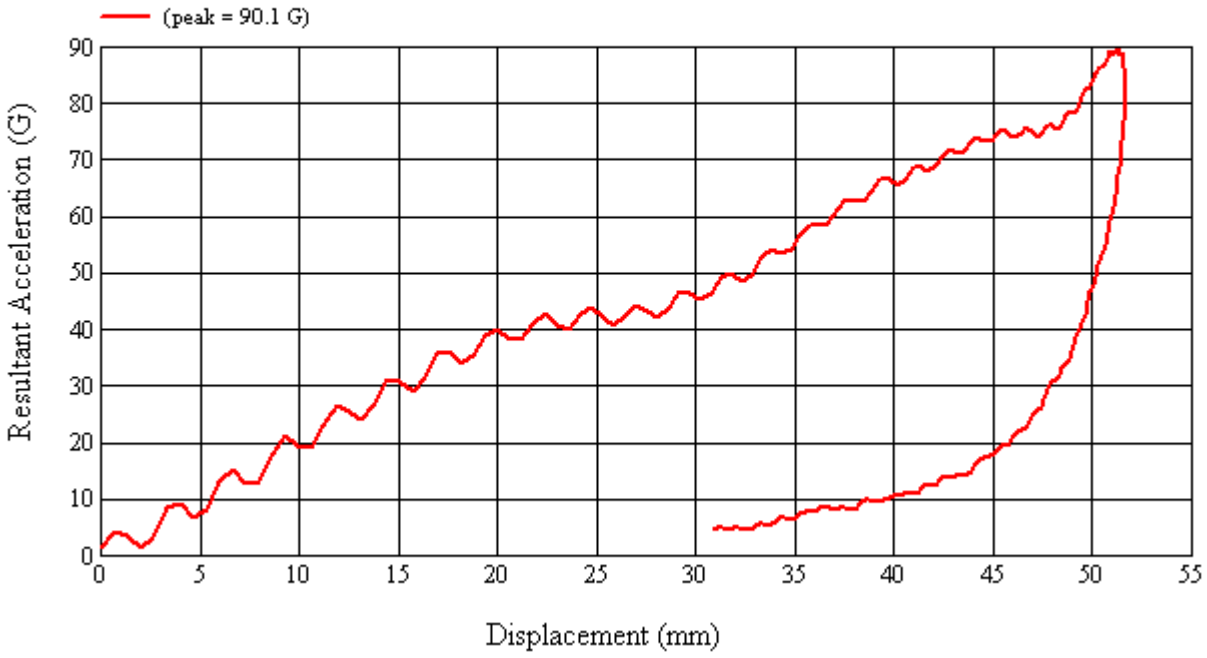
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

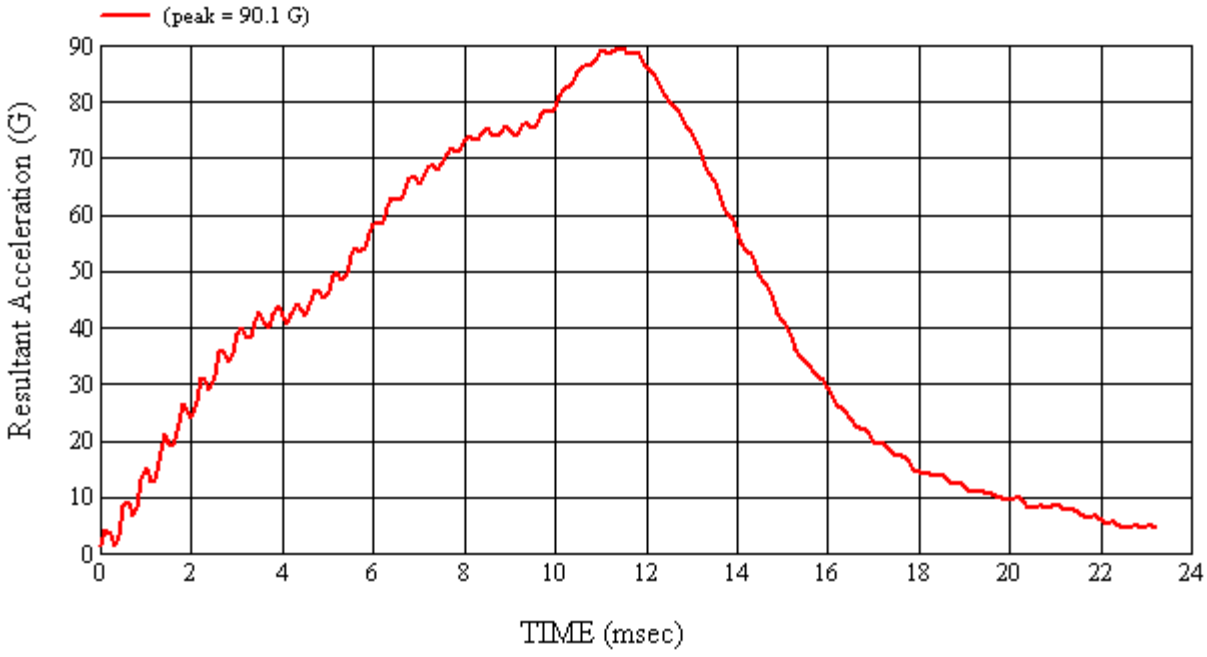
No damage observed

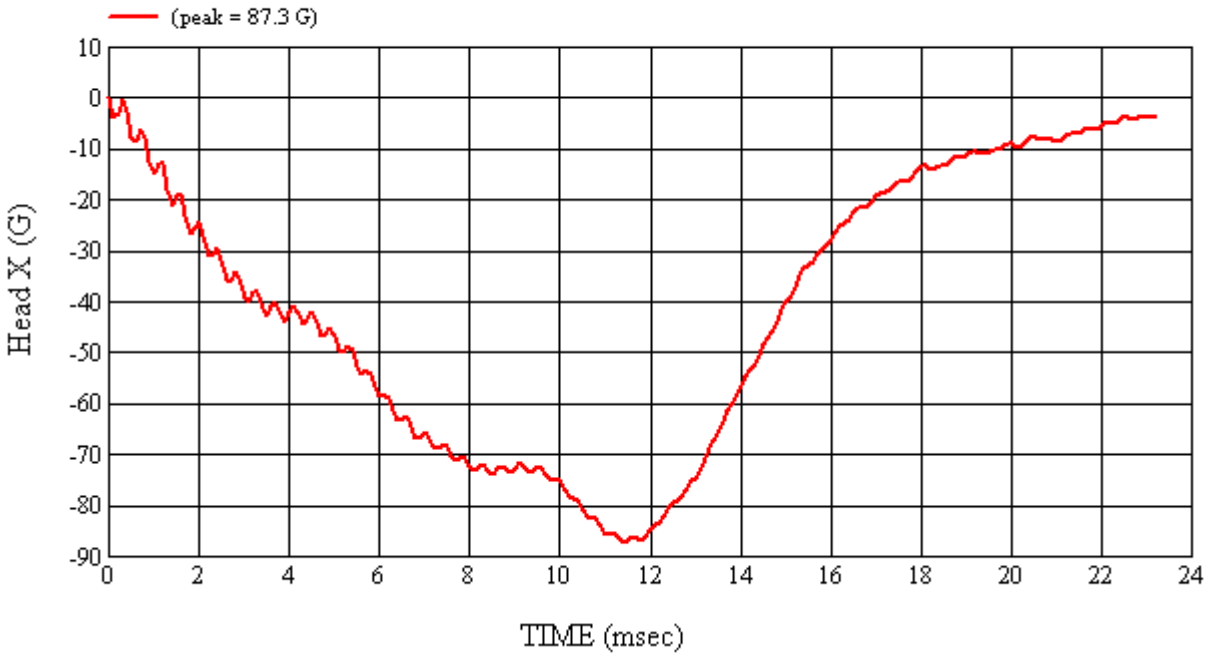
Recorded By: _____ Approved By*: _____ Date: 5/21/2009

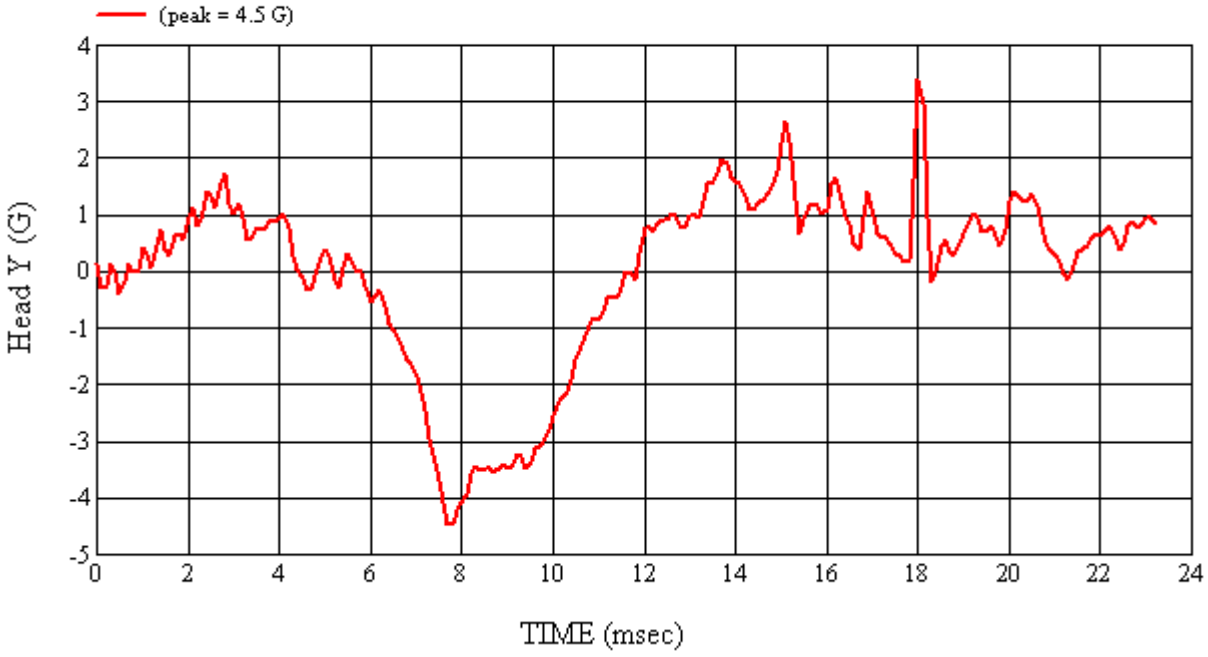
*Only necessary for NHTSA (Government) Compliance testing.

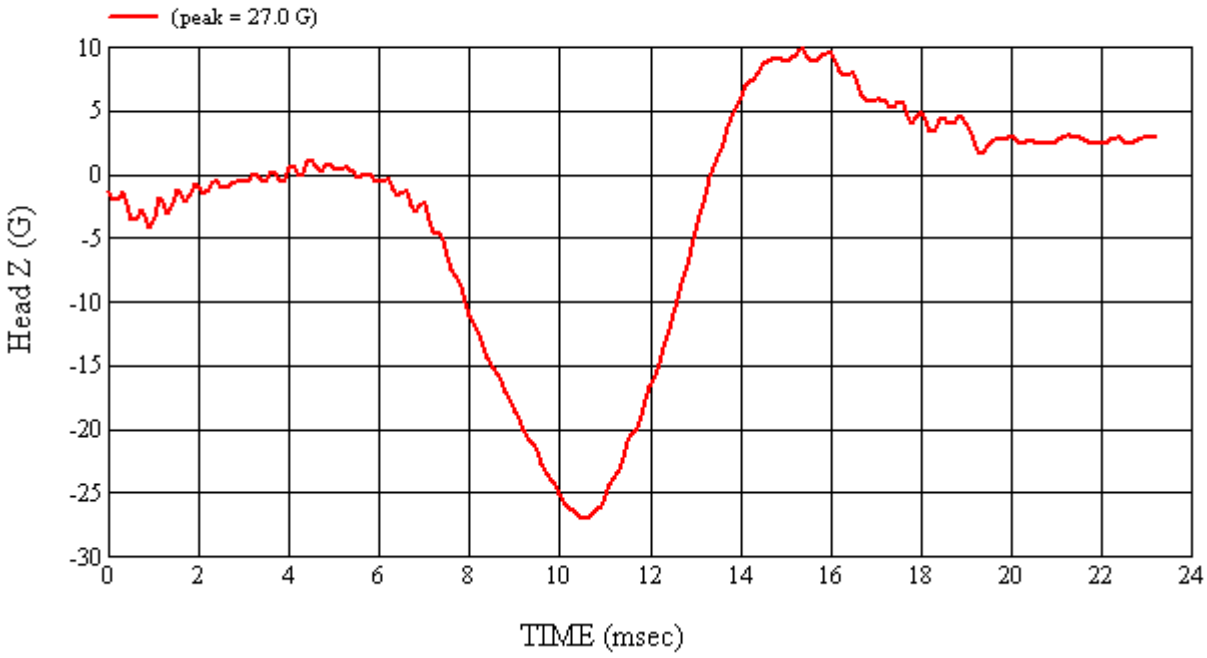
MGA Test #: FM9131 Target Location: UR4, Left Side Test Date: 5/21/2009

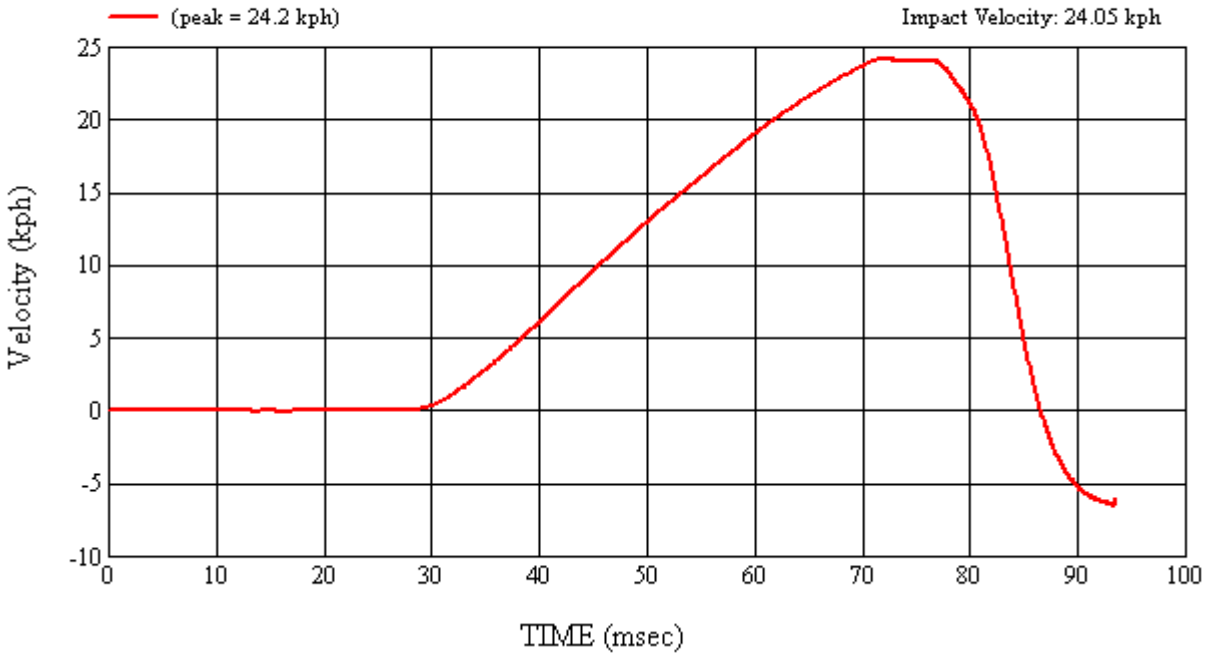


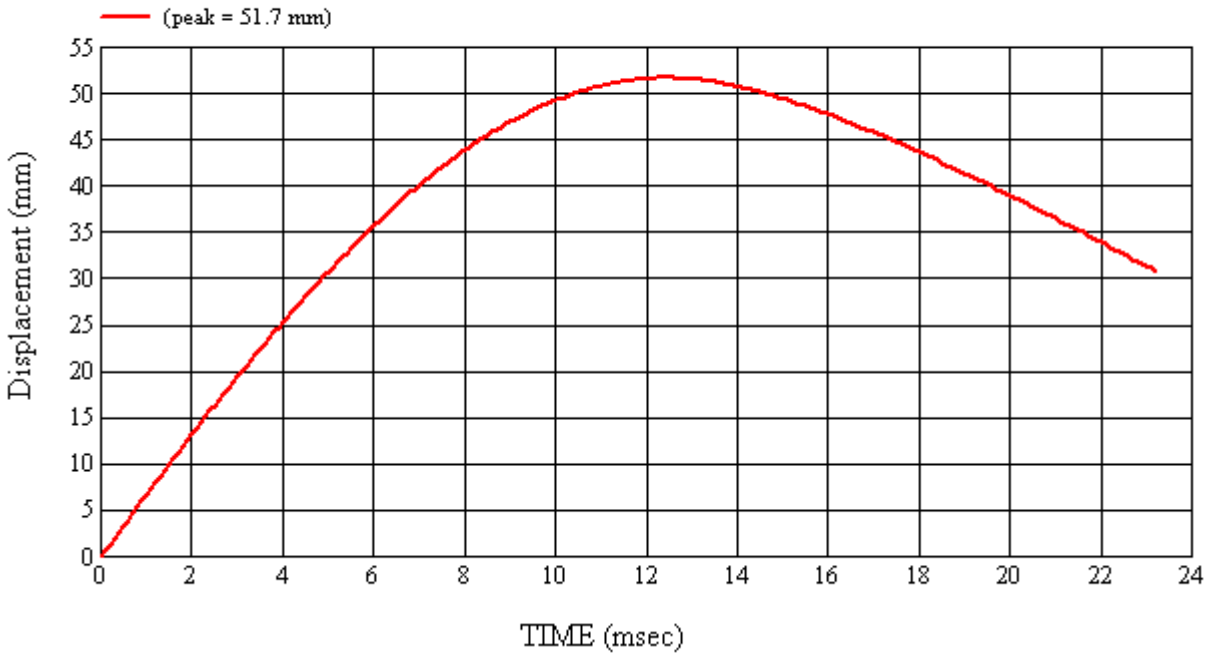



(peak = 87.3 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 4.5 G)
Head Y (G)
4
3
2
1
0
-1
-2
-3
-4
-5
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 27.0 G)
Head Z (G)
10
5
0
-5
-10
-15
-20
-25
-30
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 24.2 kph)
Impact Velocity: 24.05 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
10
20
30
40
50
60
70
80
90
100
TIME (msec)


(peak = 51.7 mm)
Displacement (mm)
55
50
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

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
*Digital Inclinometer	Mitutoyo	PRO 360 (MGA00730)	Set Angle of FMH/Targeting	0.1°	Annual
FMVSS 201U Test Frame (includes the propulsion control system, actuator, test frame, and DAS)	MGA Research Corp.	MGA-100-FMH	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	Record Event	N/A	N/A
*FARO™	Faro Technologies	S08059801273	Targeting	0.1 mm	Annual
Measuring Devices: - Tape Measure - Plumb Bobs - Digital Protractor	 Stanley N/A Mitutoyo	 TPM906 -- MGA00730	 Measurement Targeting FMH setup Horizontal Measurement	 1 mm N/A 0.5°	Annual
*Temperature Recorder	Dickson	MGA00152	Record Temperature and Humidity	± 1°C ± 1% RH	Annual
* Scale	Detecto	MGA00081	Weigh FMH Head	± 0.01 lb	Annual
*Vehicle Scale	Sterling Scale Co.	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 (lbs)	Temp (ºC)	% Humidity	Peak Resultant Acceleration (G's)	Peak Lateral Acceleration (G's)	Unimodal
Pre	#035	5/19/2009	9.90	21.6	41.0	236.4	3.8	Yes
Post	#035	5/22/2009	9.90	22.7	43.7	234.2	3.0	Yes
Pre	#037	5/19/2009	9.96	21.6	41.5	245.8	6.2	Yes
Post	#037	5/22/2009	9.96	22.8	42.9	243.7	5.8	Yes
Pre	#038	5/19/2009	9.90	20.7	44.1	255.4	12.6	Yes
Post	#038	5/22/2009	9.90	22.7	44.7	246.2	12.9	Yes

4-1 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

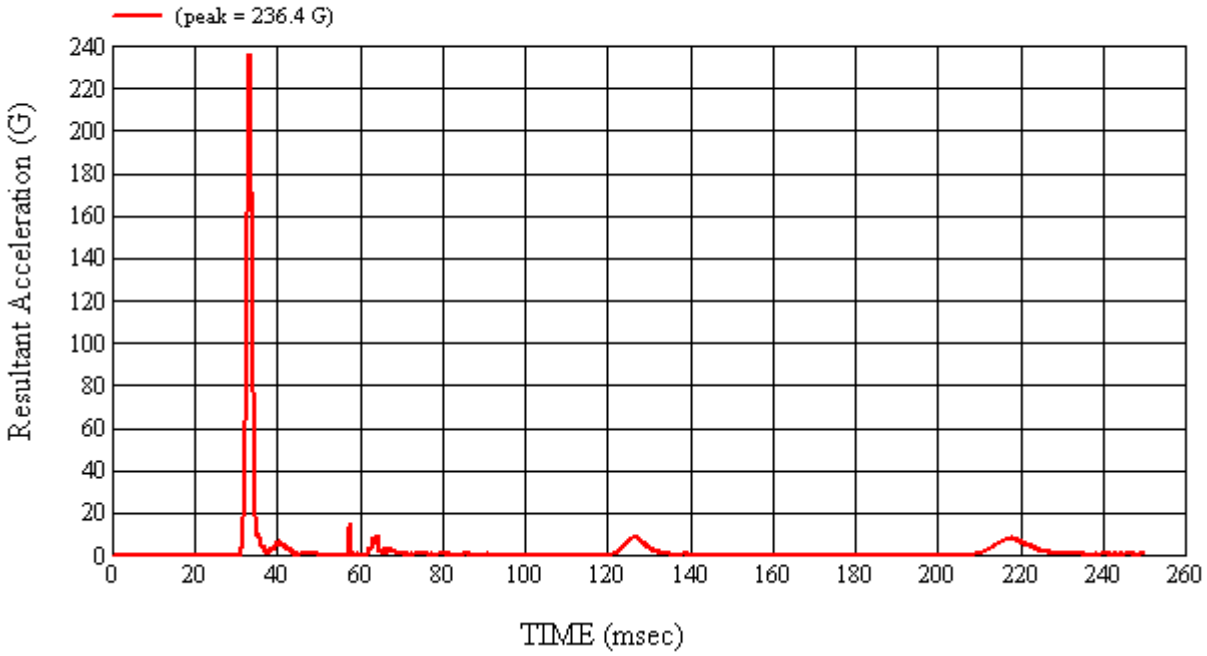
HEADFORM SERIAL NUMBER: 035	CALIBRATION DATE: 5/19/2009 CALIBRATION TIME: 4:53:34 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	21.6
Relative Humidity	10% to 70%	41.0
Peak Resultant Acceleration	225 G's to 275 G's	236.4
Peak Lateral Acceleration	15 G's Maximum	3.8
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	J35919	03/02/09	09/02/09
2	ENDEVCO	7264-2000	J22664	03/02/09	09/02/09
3	ENDEVCO	7264-2000	J35924	03/02/09	09/02/09

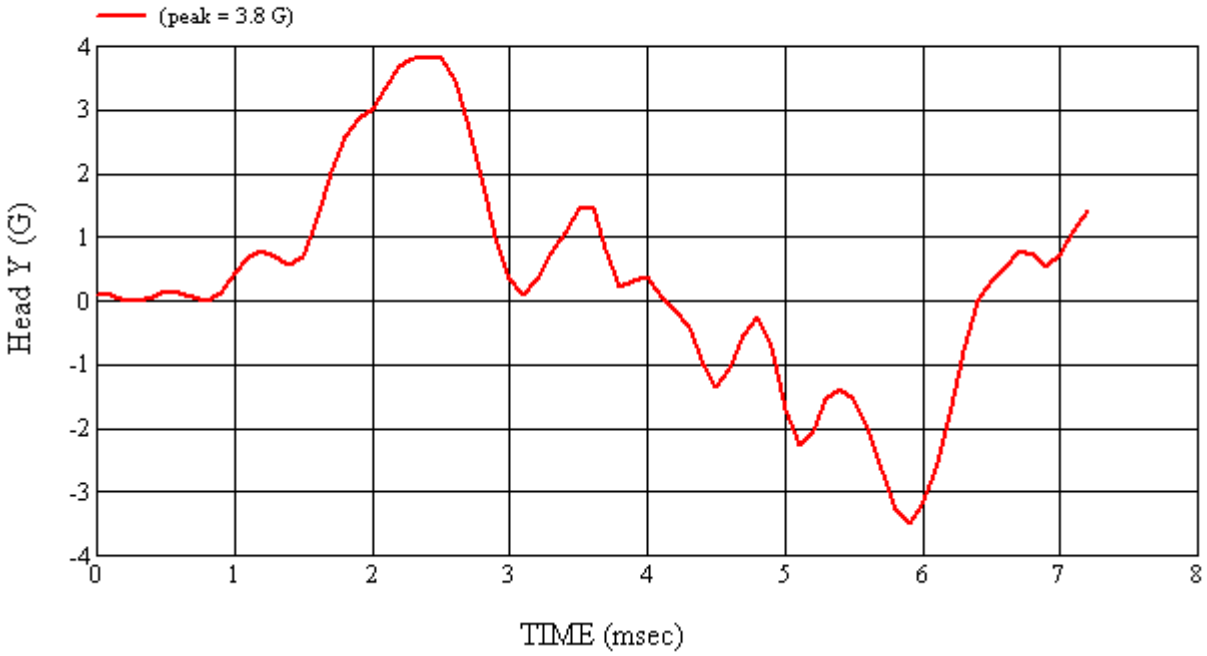
REMARKS:

RECORDED BY: _____ DATE: __5/19/2009____

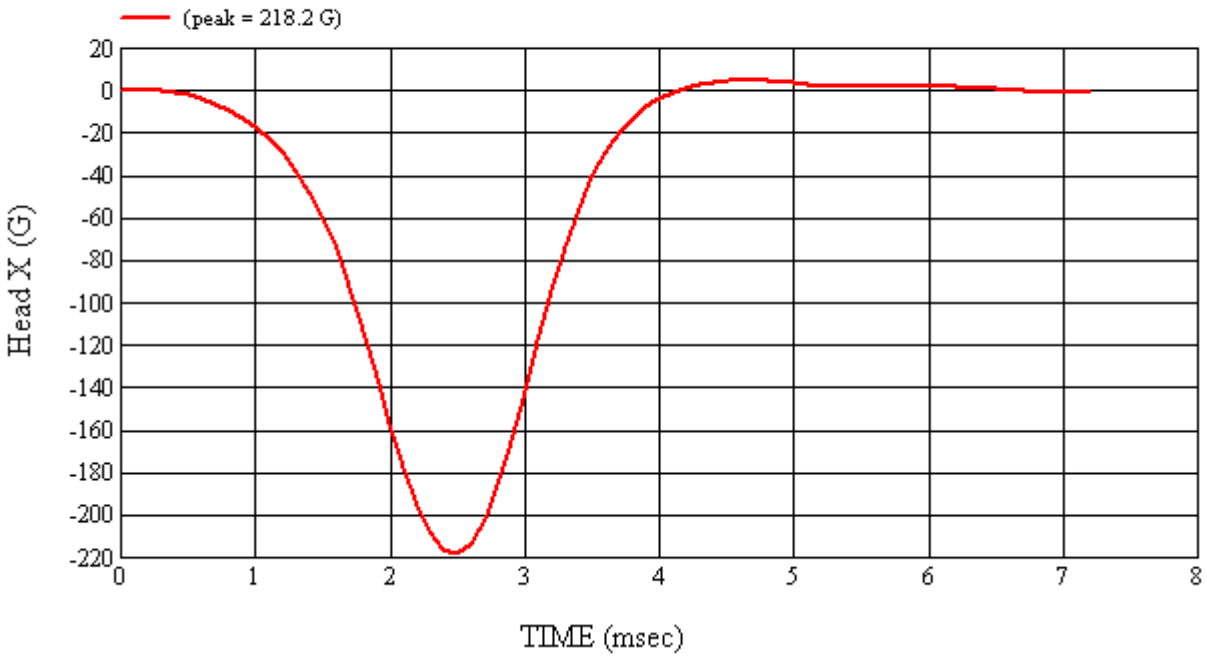
APPROVED BY: _____



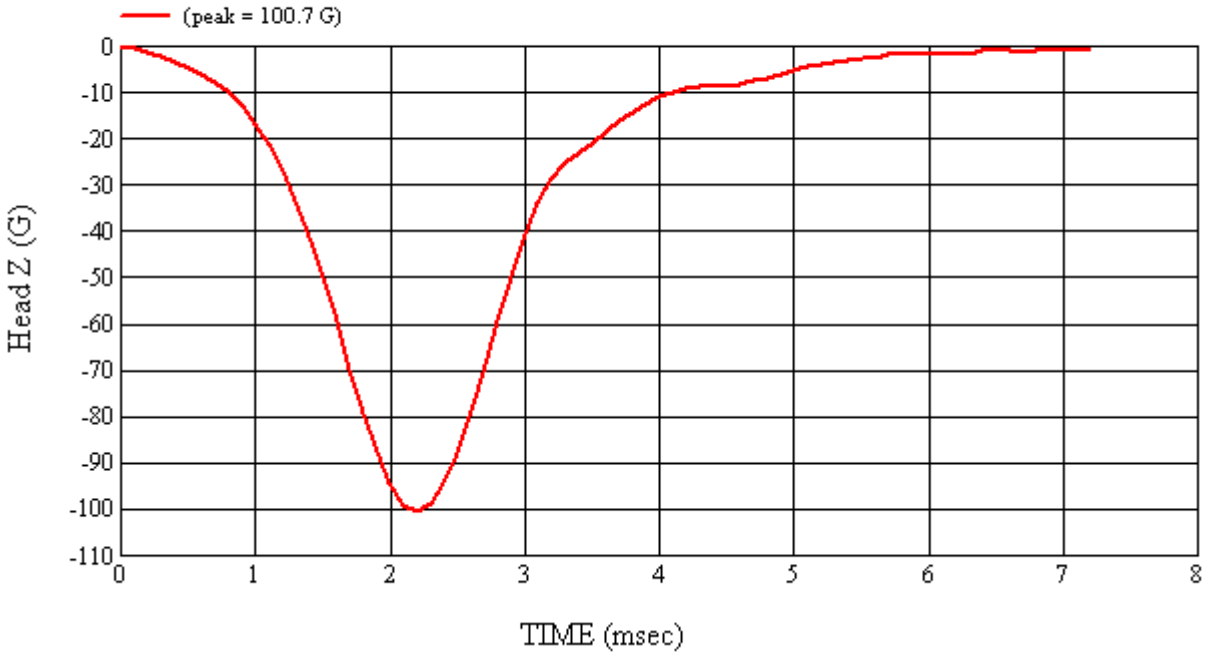
Head 035 (Pre) Calibration #H35015



Head 035 (Pre) Calibration #H35015



035 (Pre) Calibration #H35015



Head 035 (Pre) Calibration #H35015

4-2 Post-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

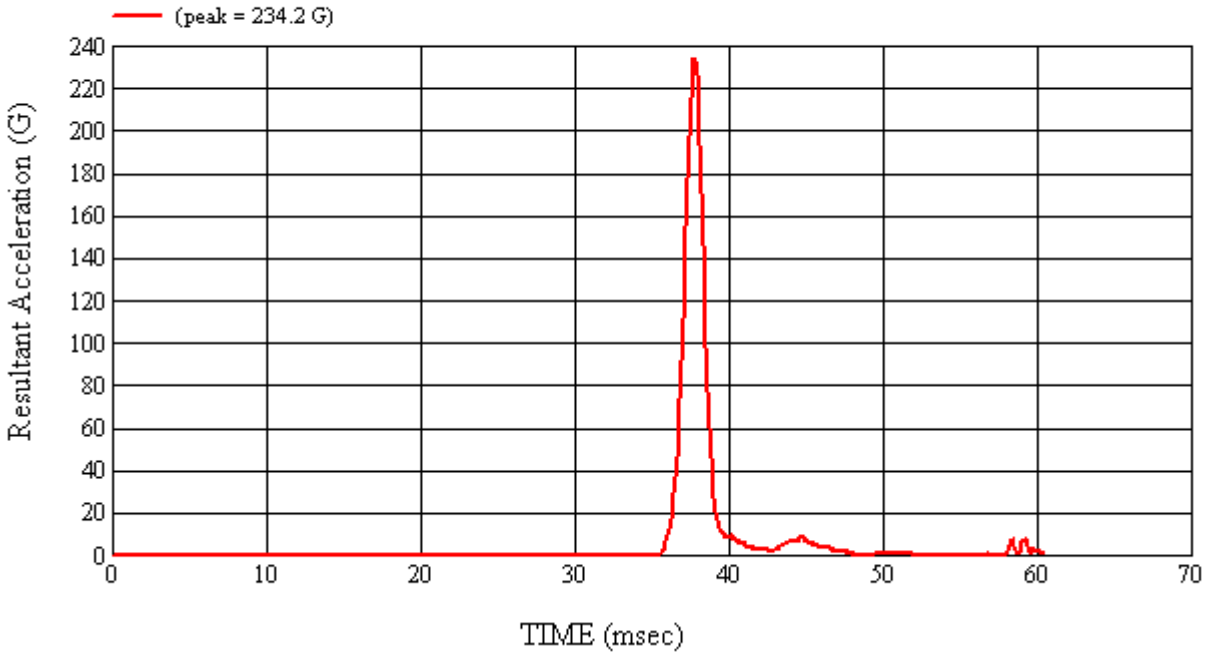
HEADFORM SERIAL NUMBER: 035	CALIBRATION DATE: 5/22/2009 CALIBRATION TIME: 12:47:43 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	22.7
Relative Humidity	10% to 70%	43.7
Peak Resultant Acceleration	225 G's to 275 G's	234.2
Peak Lateral Acceleration	15 G's Maximum	3.0
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	J35919	03/02/09	09/02/09
2	ENDEVCO	7264-2000	J22664	03/02/09	09/02/09
3	ENDEVCO	7264-2000	J35924	03/02/09	09/02/09

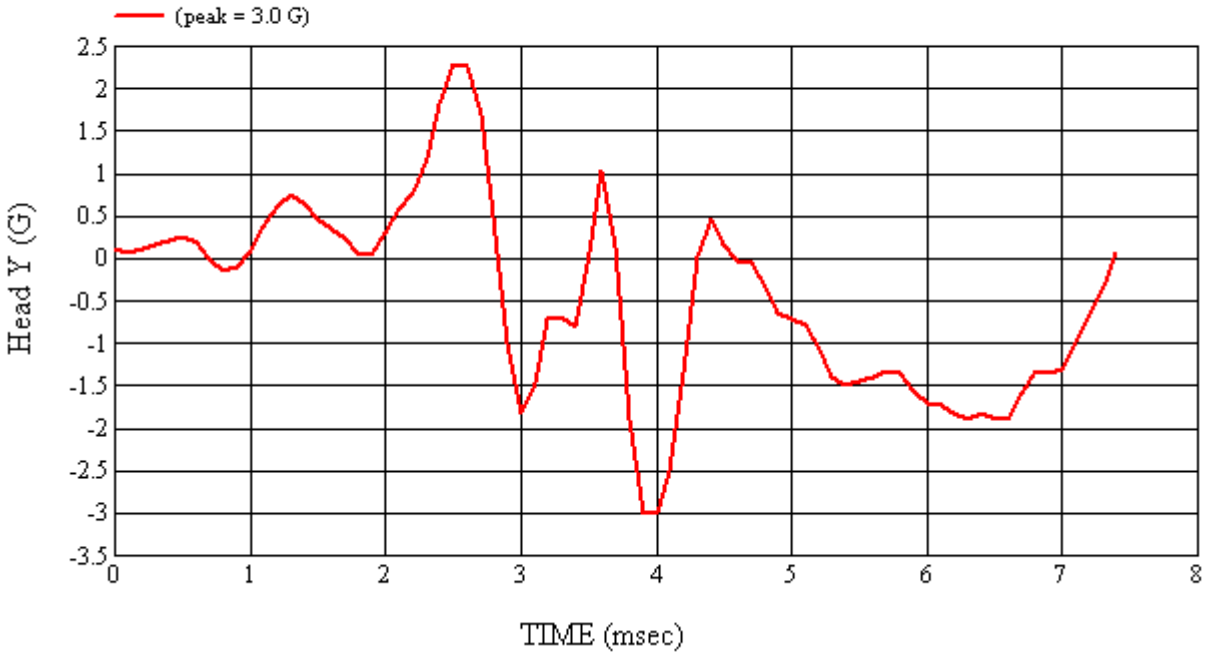
REMARKS:

RECORDED BY: _____ DATE: 5/22/2009

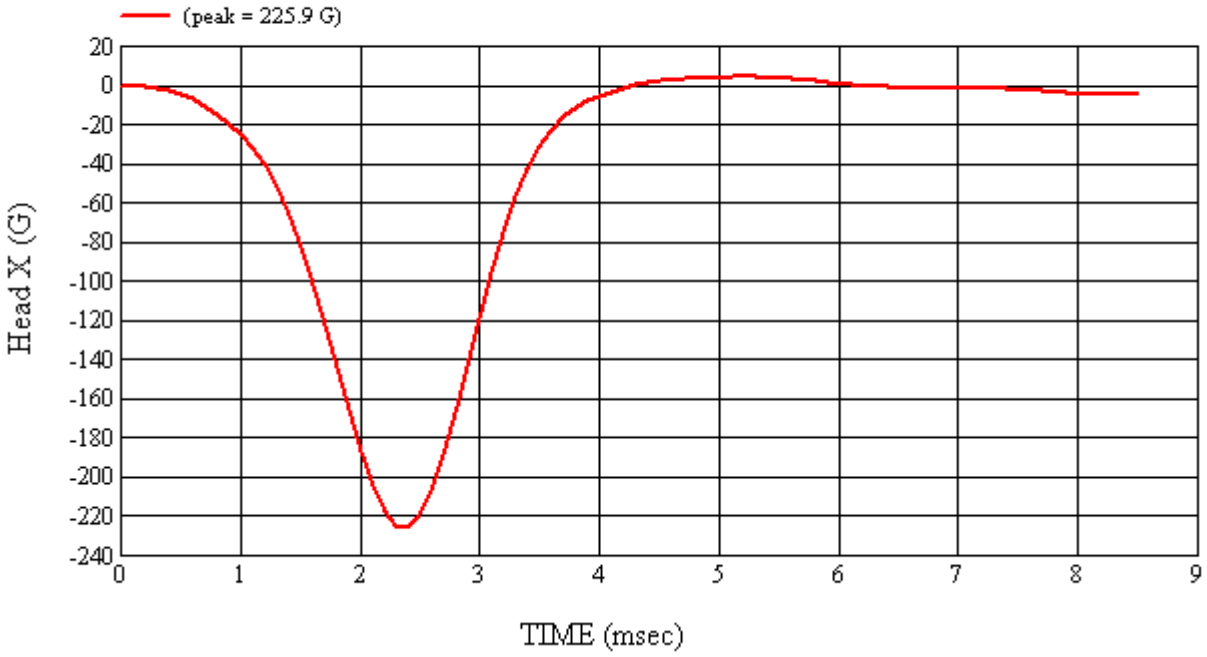
APPROVED BY: _____



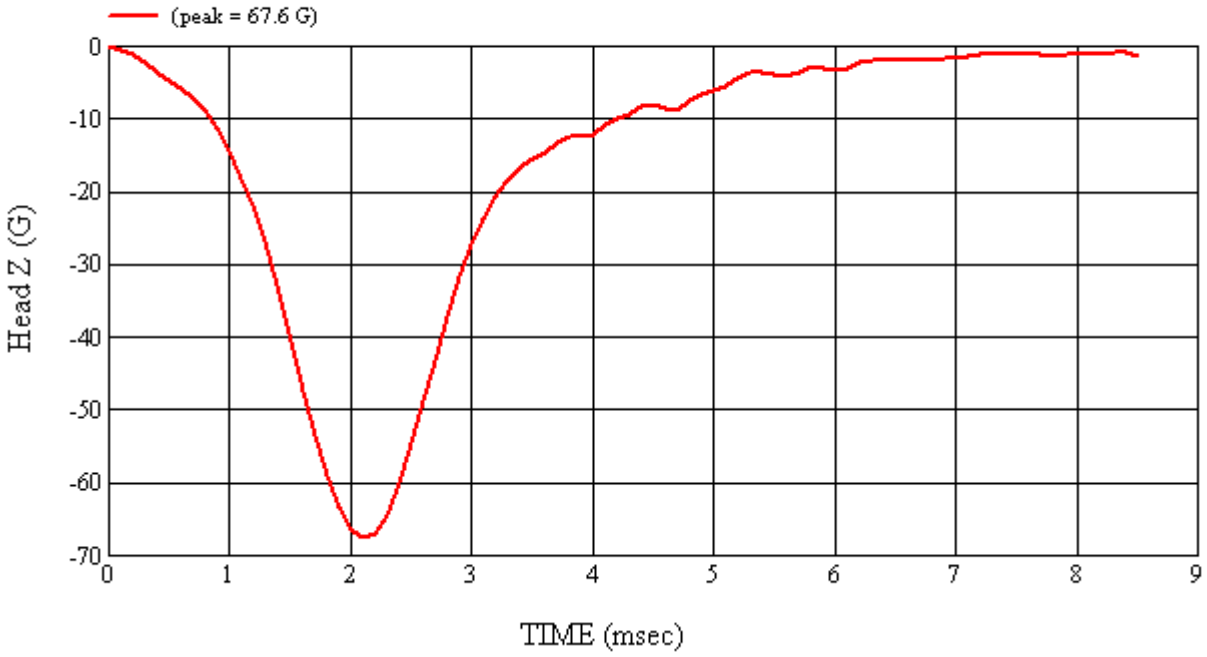
Head 035 (Post) Calibration #H35016



Head 035 (Post) Calibration #H35016



Head 035 (Post) Calibration #H35016



Head 035 (Post) Calibration #H35016

4-3 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

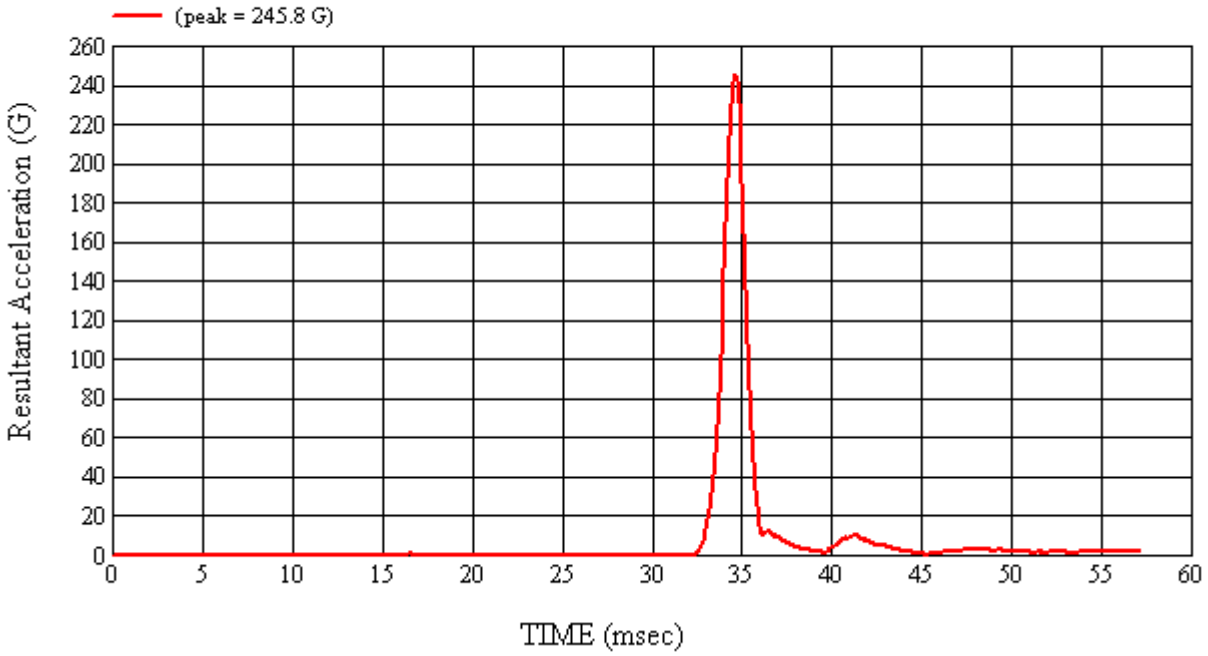
HEADFORM SERIAL NUMBER: 037	CALIBRATION DATE: 5/19/2009 CALIBRATION TIME: 4:35:06 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.96
Temperature	19° C to 26° C	21.6
Relative Humidity	10% to 70%	41.5
Peak Resultant Acceleration	225 G's to 275 G's	245.8
Peak Lateral Acceleration	15 G's Maximum	6.2
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	AHTB2	03/02/09	09/02/09
2	ENDEVCO	7264-2000	J14103	03/02/09	09/02/09
3	ENDEVCO	7264-2000	J35800	03/02/09	09/02/09

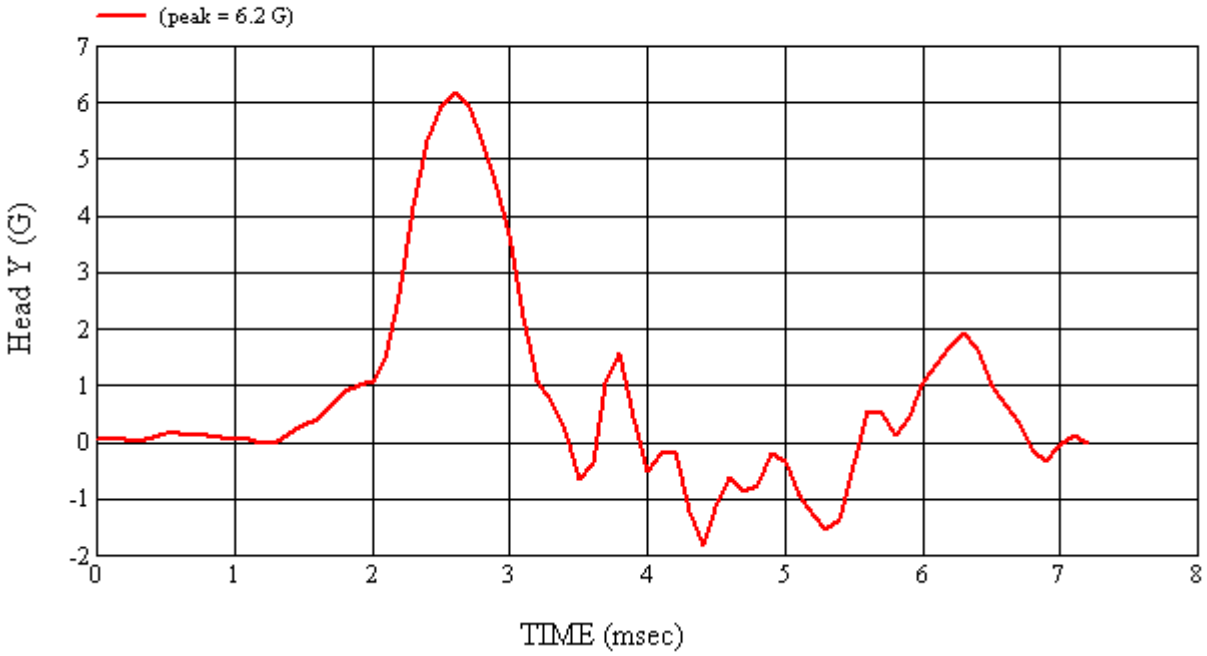
REMARKS:

RECORDED BY: _____ DATE: 5/19/2009

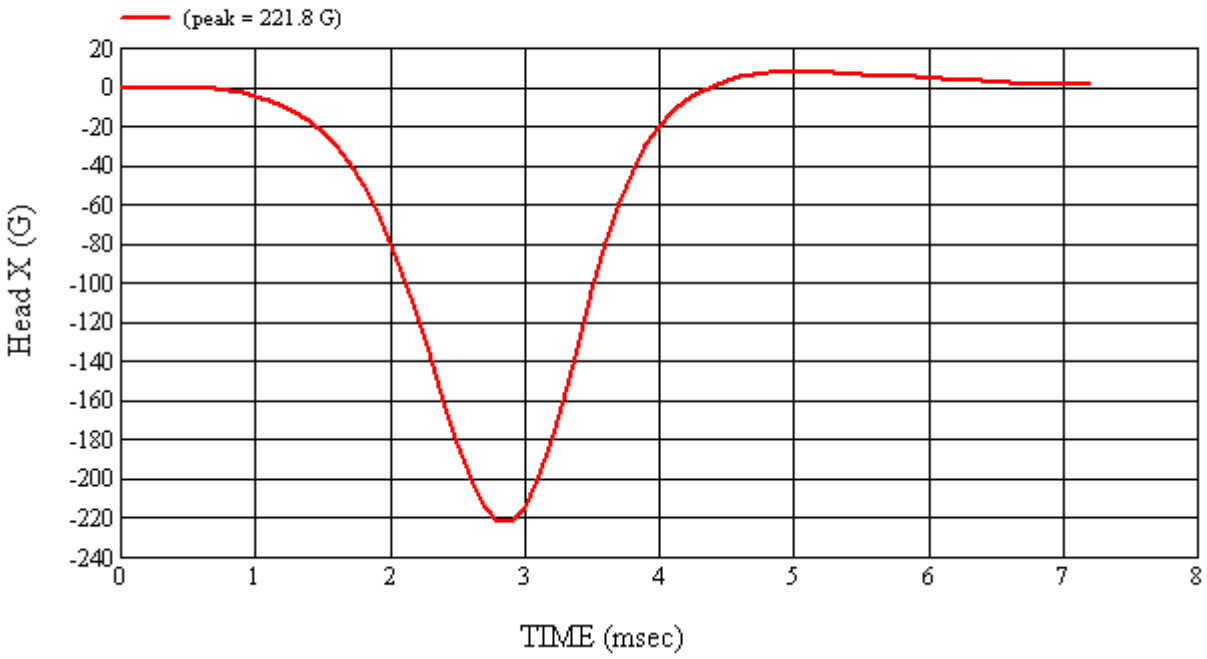
APPROVED BY: _____



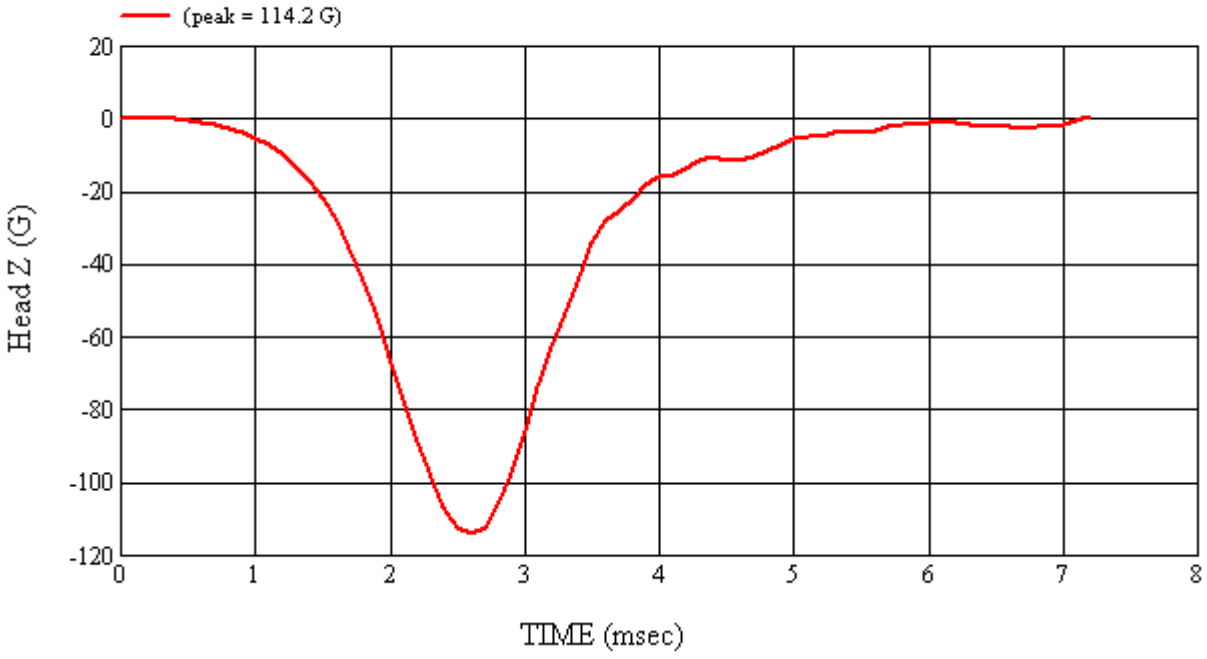
Head 037 (Pre) Calibration #H37015



Head 037 (Pre) Calibration #H37015



Head 037 (Pre) Calibration #H37015



Head 037 (Pre) Calibration #H37015

4-4 Post-Test Calibration

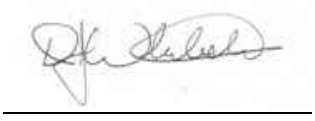
HEAD DROP TEST SUMMARY
PART 572L

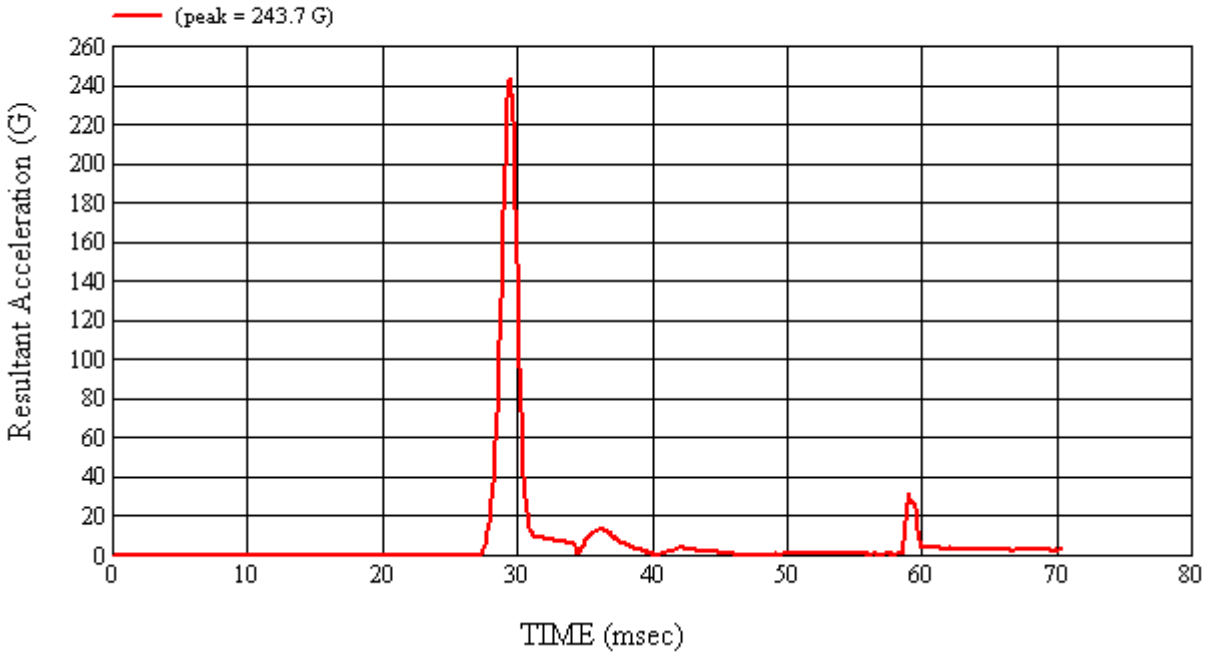
HEADFORM SERIAL NUMBER: 037	CALIBRATION DATE: 5/22/2009 CALIBRATION TIME: 1:09:06 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.96
Temperature	19° C to 26° C	22.8
Relative Humidity	10% to 70%	42.9
Peak Resultant Acceleration	225 G's to 275 G's	243.7
Peak Lateral Acceleration	15 G's Maximum	5.8
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	AHTB2	03/02/09	09/02/09
2	ENDEVCO	7264-2000	J14103	03/02/09	09/02/09
3	ENDEVCO	7264-2000	J35800	03/02/09	09/02/09

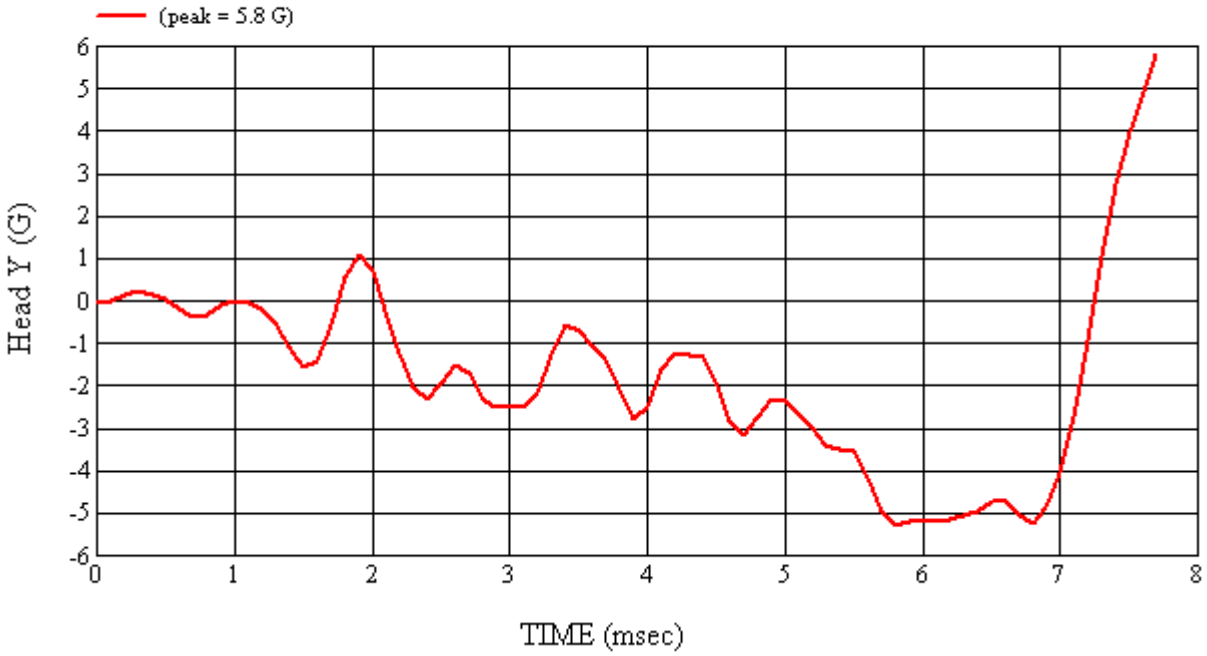
REMARKS:

RECORDED BY:  DATE: 5/22/2009

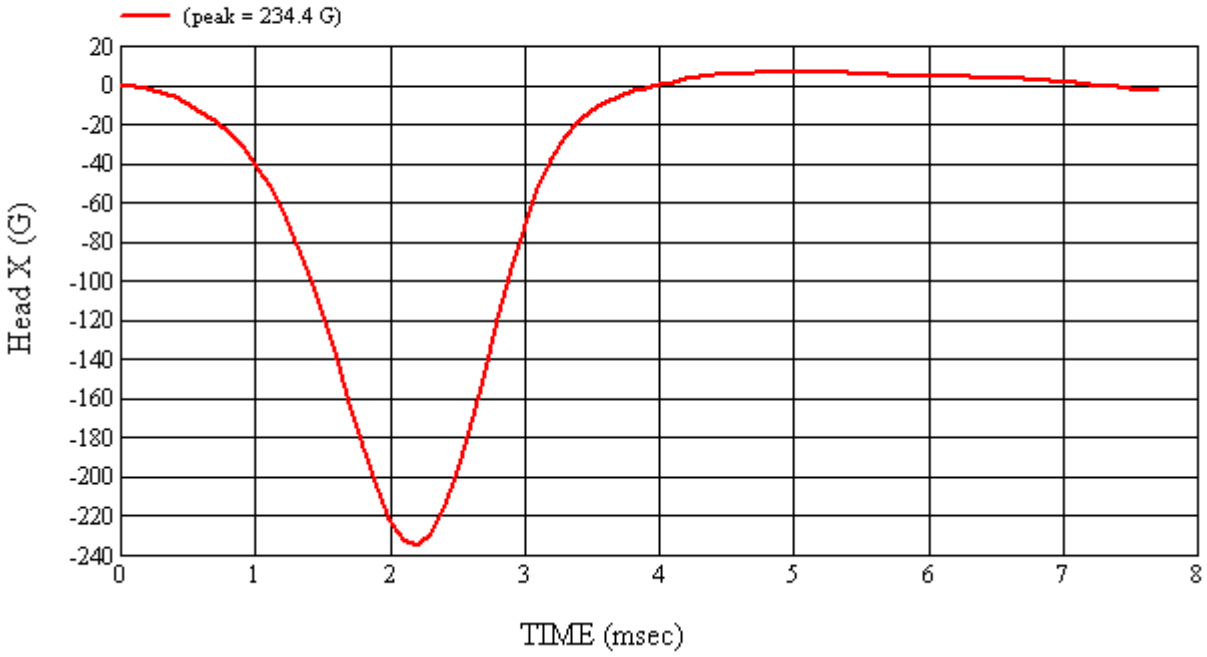
APPROVED BY: 



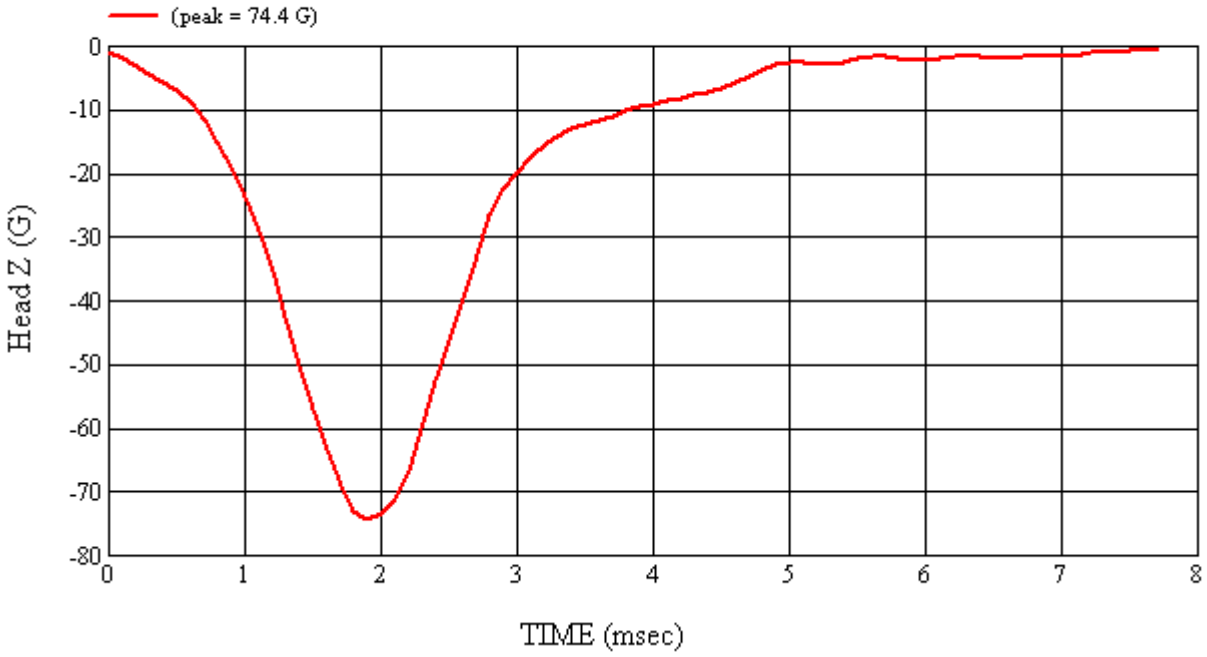
Head 037 (Post) Calibration #H37016



Head 037 (Post) Calibration #H37016



Head 037 (Post) Calibration #H37016



Head 037 (Post) Calibration #H37016

4-5 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

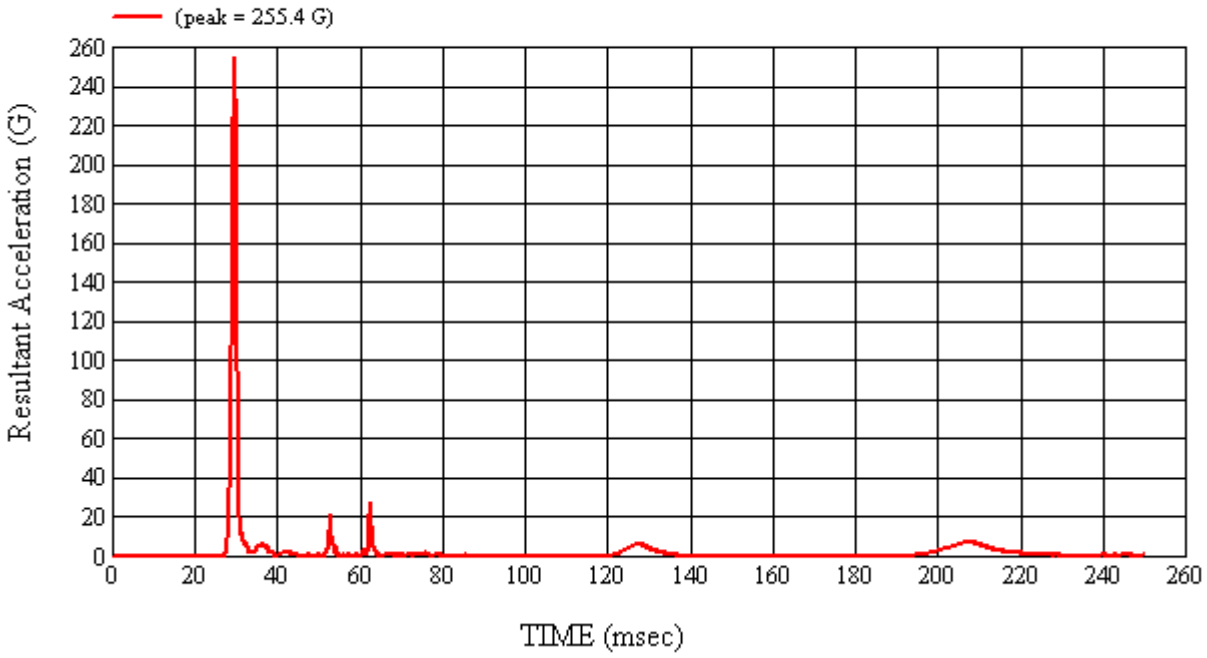
HEADFORM SERIAL NUMBER: 038	CALIBRATION DATE: 5/19/2009 CALIBRATION TIME: 3:15:33 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	20.7
Relative Humidity	10% to 70%	44.1
Peak Resultant Acceleration	225 G's to 275 G's	255.4
Peak Lateral Acceleration	15 G's Maximum	12.6
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	J22700	04/17/09	10/17/09
2	ENDEVCO	7264-2000	J36197	04/17/09	10/17/09
3	ENDEVCO	7264-2000	J36353	04/17/09	10/17/09

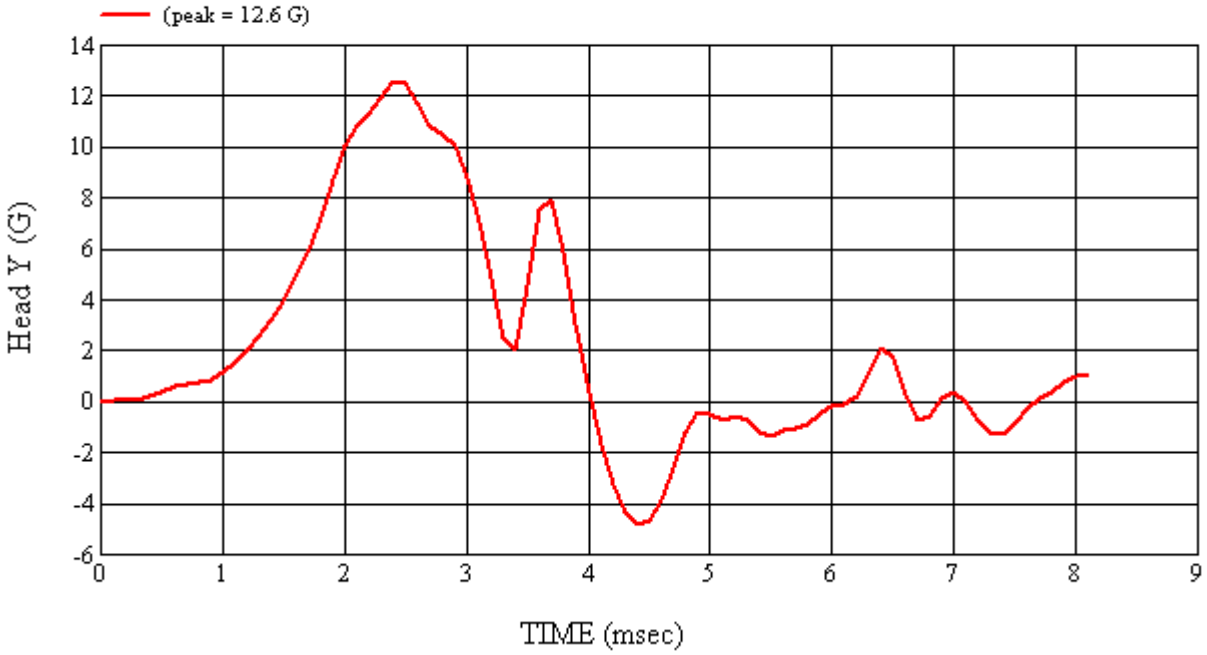
REMARKS:

RECORDED BY: _____ DATE: 5/19/2009

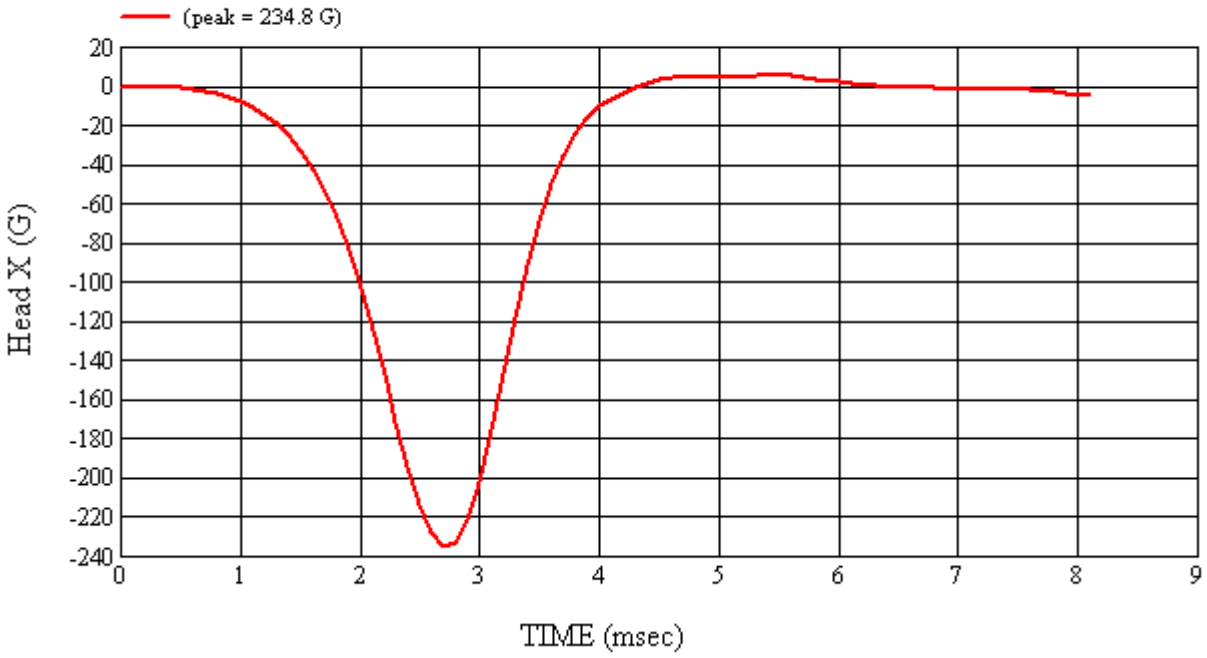
APPROVED BY: _____



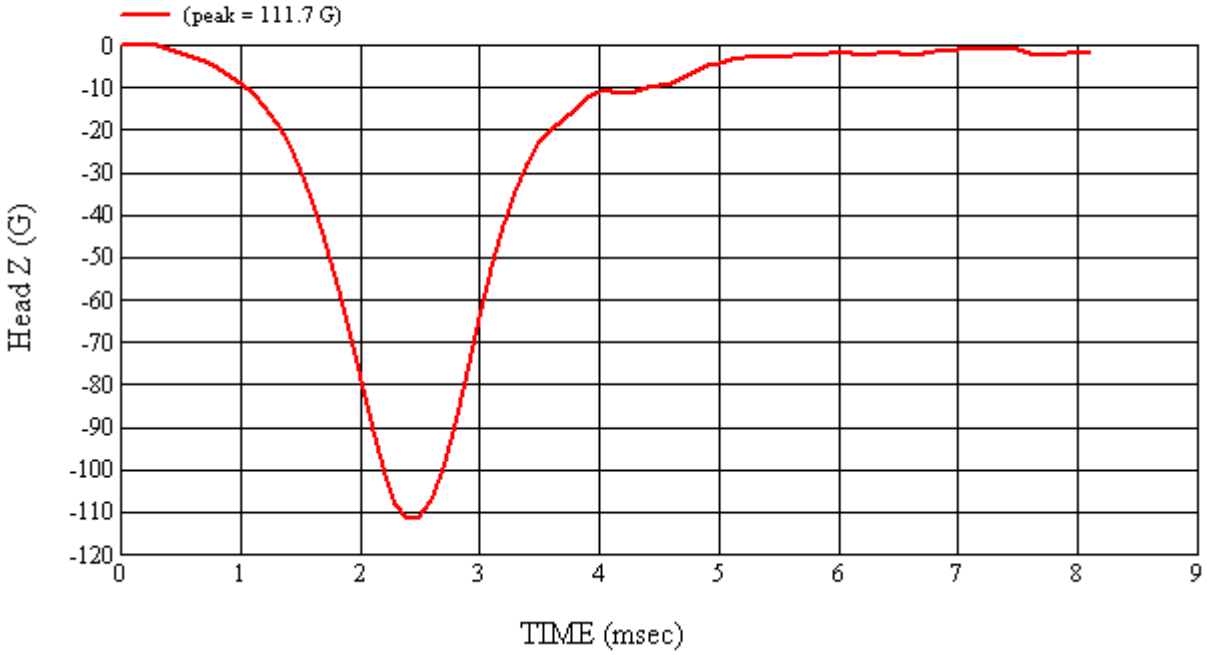
Head 038 (Pre) Calibration #H38015



Head 038 (Pre) Calibration #H38015



Head 038 (Pre) Calibration #H38015



Head 038 (Pre) Calibration #H38015

4-6 Post-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

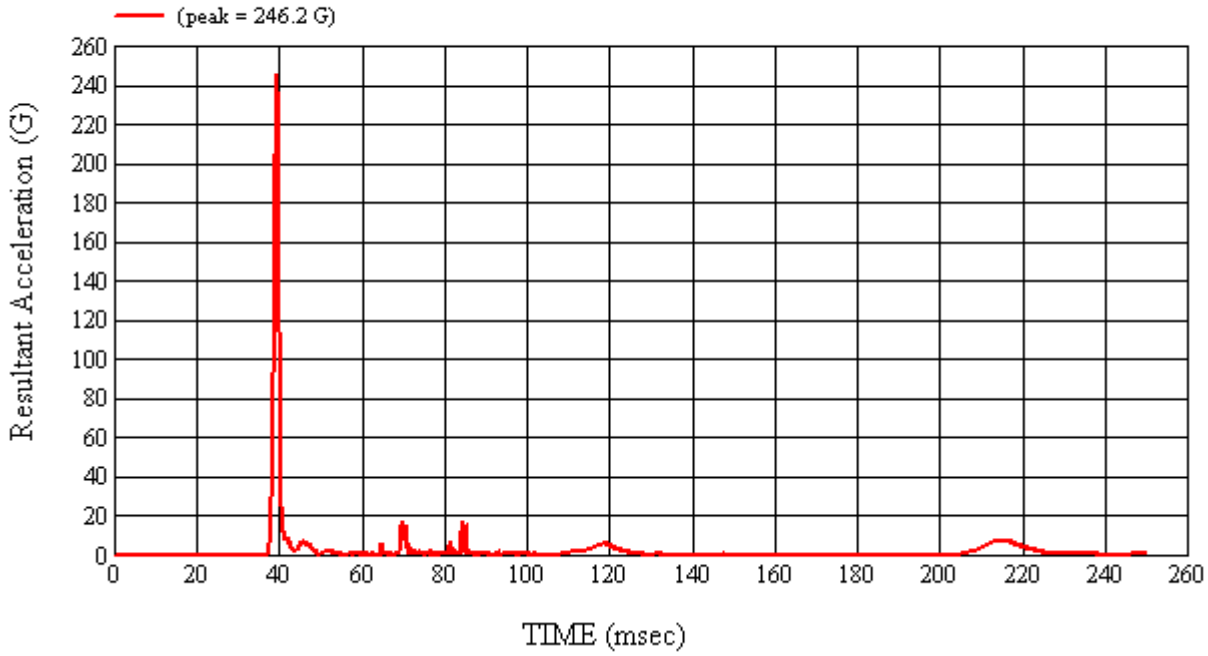
HEADFORM SERIAL NUMBER: 038	CALIBRATION DATE: 5/22/2009 CALIBRATION TIME: 1:39:16 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	22.7
Relative Humidity	10% to 70%	44.7
Peak Resultant Acceleration	225 G's to 275 G's	246.2
Peak Lateral Acceleration	15 G's Maximum	12.9
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	**Manufacturer**	**Model Number**	**Serial Number**	**Date of Last Calibration**	**Date of Next Calibration**
1	ENDEVCO	7264-2000	J22700	04/17/09	10/17/09
2	ENDEVCO	7264-2000	J36197	04/17/09	10/17/09
3	ENDEVCO	7264-2000	J36353	04/17/09	10/17/09

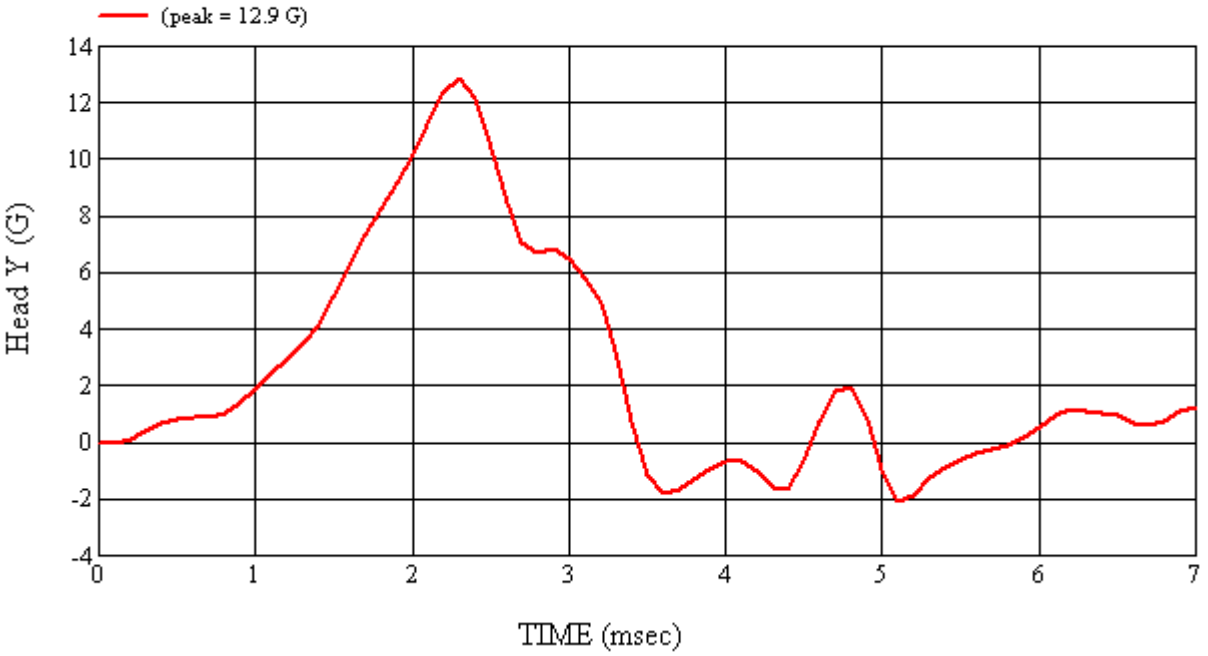
REMARKS:

RECORDED BY: _____ DATE: 5/22/2009

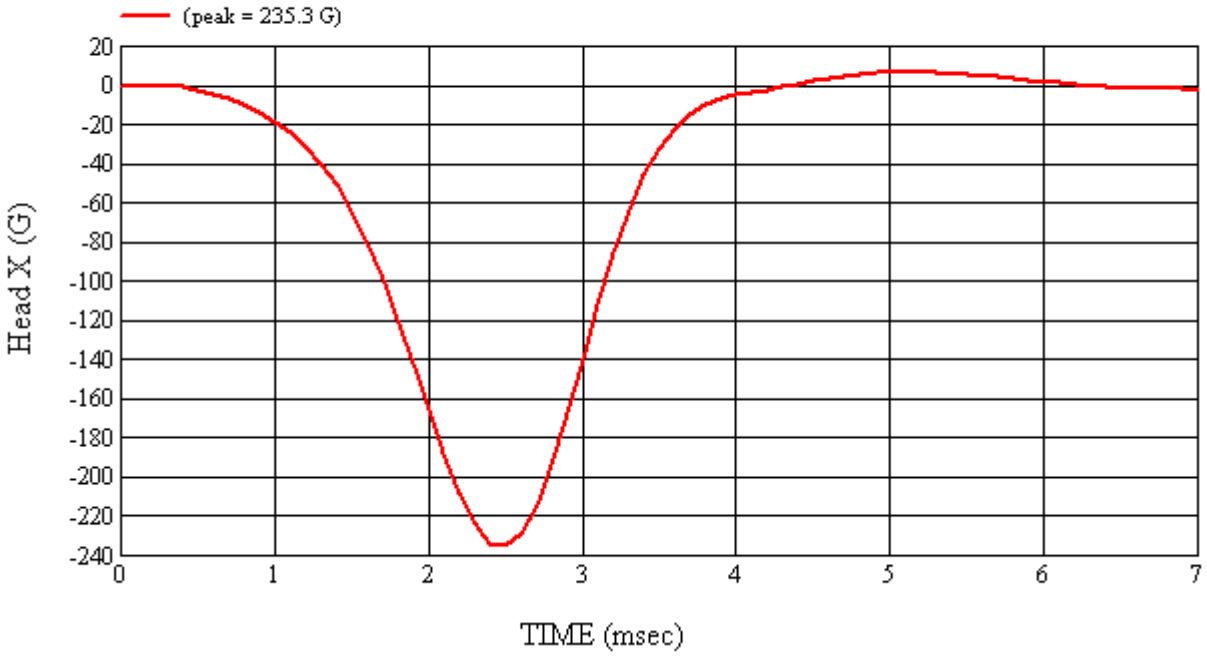
APPROVED BY: _____



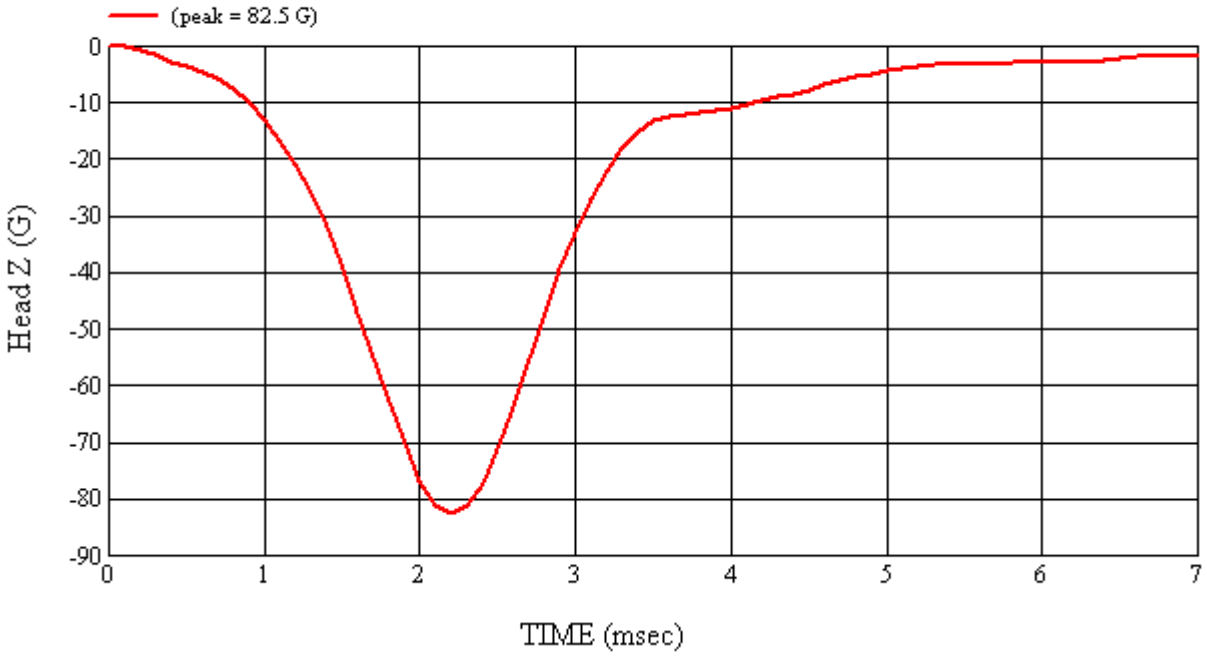
Head 038 (Post) Calibration #H38016



Head 038 (Post) Calibration #H38016



Head 038 (Post) Calibration #H38016



Head 038 (Post) Calibration #H38016

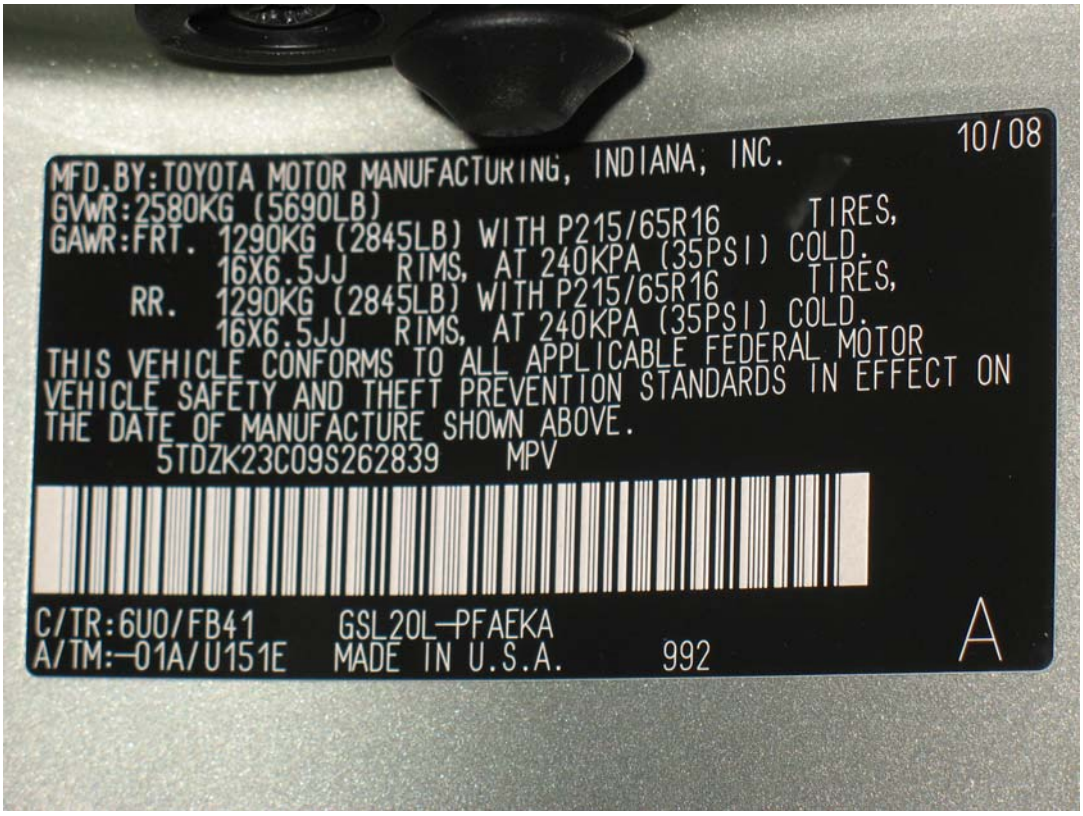
5.0 PHOTOGRAPHS

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


UR2
BP1
BP3
mga
05/20/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Pre-Test Component
G09I7-001.2


OP1
OP2
mga
05/20/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Pre-Test Component
G09I7-001.2

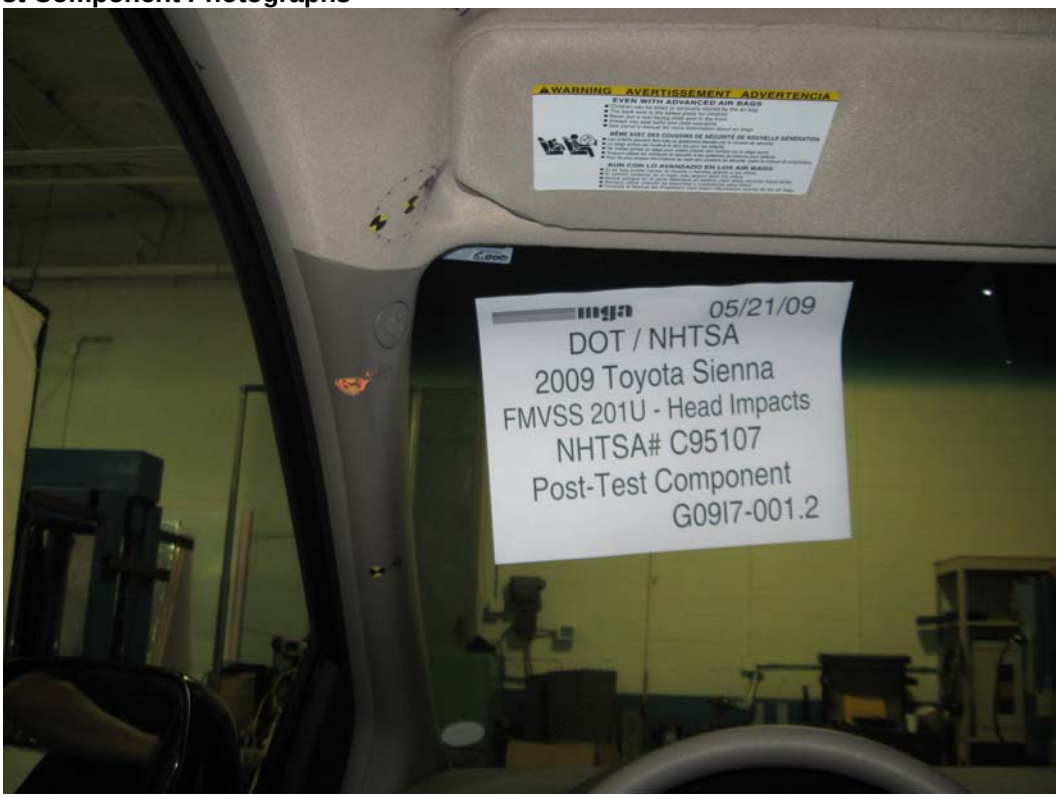

URS
RP1
05/20/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Pre-Test Component
G09I7-001.2

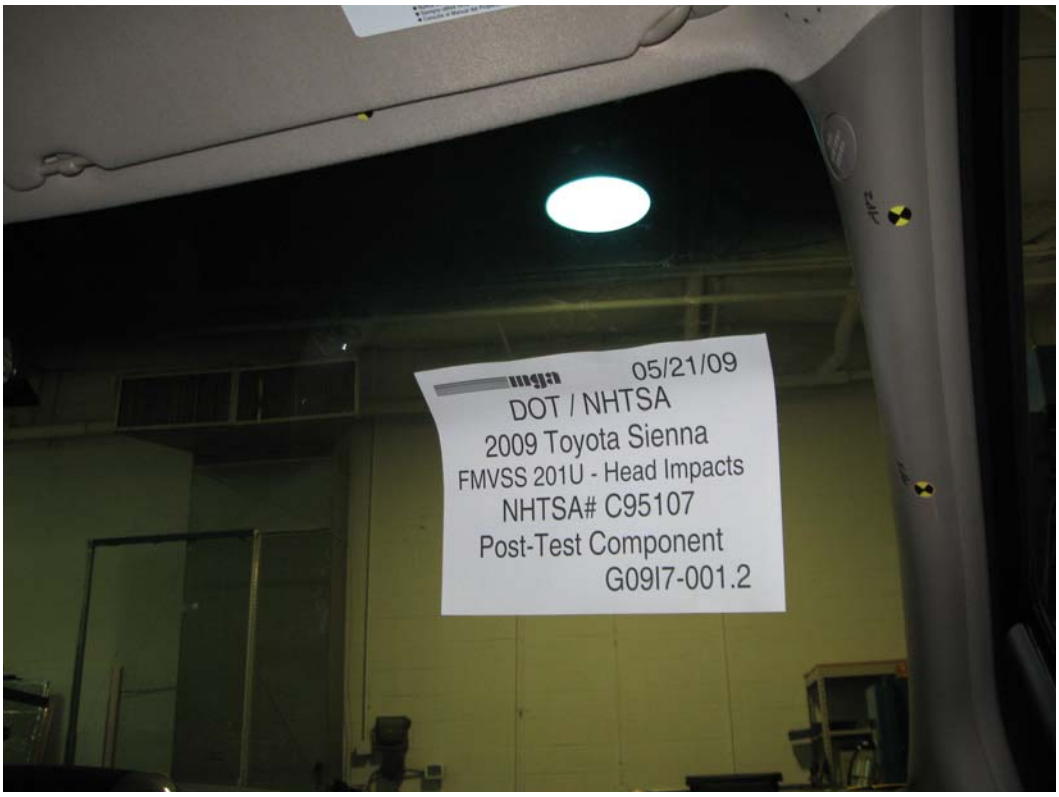

RH
URH
RH
RP1
05/20/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Pre-Test Component
G09I7-001.2


URL
UR-4
RP1
05/20/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Pre-Test Component
G09I7-001.2


05/20/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Pre-Test Component
G09I7-001.2

Post-Test Component Photographs






UR2
BP1
BPS
mga
05/21/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Post-Test Component
G09I7-001.2


OP1
OP2
mga
05/21/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Post-Test Component
G09I7-001.2

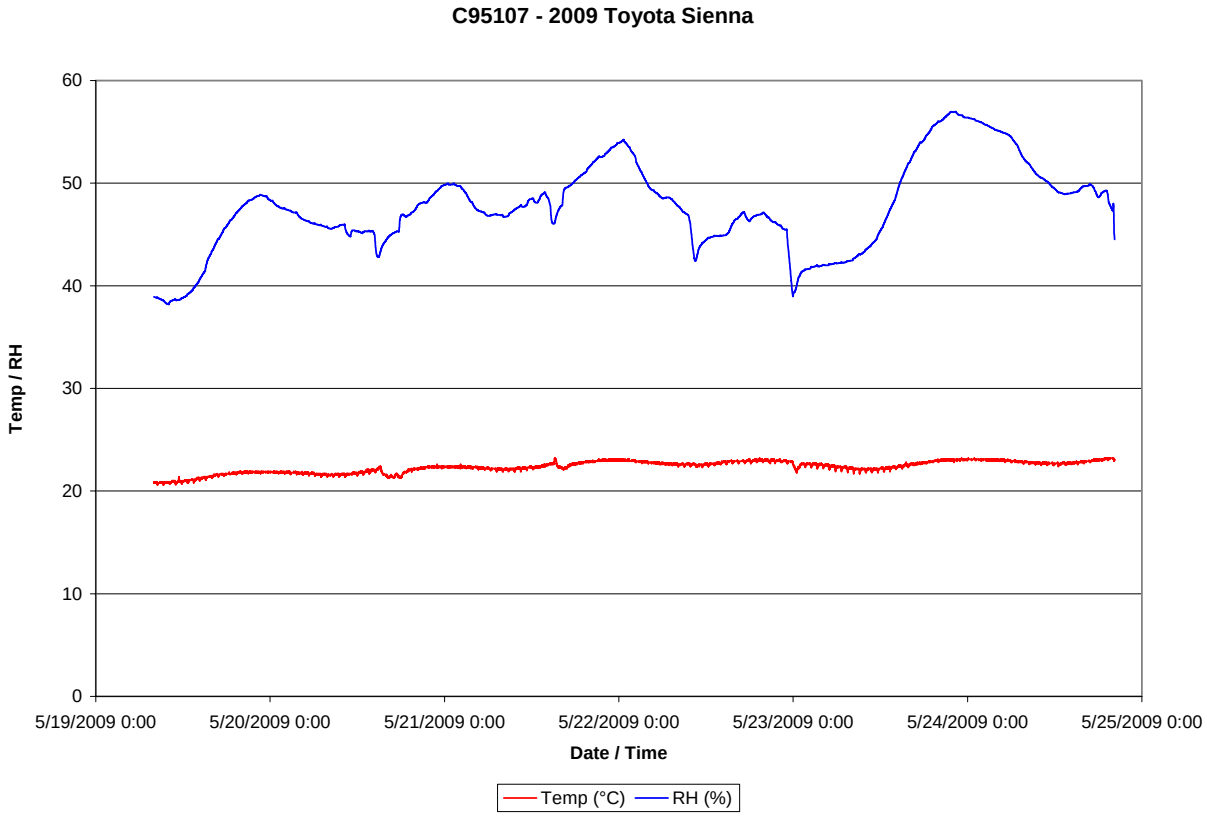

05/21/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Post-Test Component
G09I7-001.2


05/21/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Post-Test Component
G09I7-001.2


05/21/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Post-Test Component
G09I7-001.2


05/21/09
DOT / NHTSA
2009 Toyota Sienna
FMVSS 201U - Head Impacts
NHTSA# C95107
Post-Test Component
G09I7-001.2

Appendix A – Temperature Trace



Appendix B – Calibration Certificates

Calibration Certificate

Part Description: Silver

Certification Date: 08/26/08

Serial#: S08-05-98-01273

Single Point (Max-Min/2) Specification: S08-05 .076mm (.0030")

Certificate#: S0127339686

Volumetric (Max Deviation) Specification: S08-05 +/-.108mm (+/-.0042")

Temperature: See attached data

Measurement Standards Traceability

Ball Bar Kit	Asset Number: 543	Calibration Date: 07/08/08	*SI Traceability: METAS-L20080708AB1
Thermometer	Asset Number: TQ023	Calibration Date: 02/19/08	*SI Traceability: NVLAP-A7C20031

*The artifact above has 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. Expanded measurement uncertainty is 3.9 + 5.9X micrometers, where X=measured value in meters. Uncertainty is expressed at approximately a 95% Level of Confidence using k=2.00.

Certification Results

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

Calibration and certification conforms to procedures developed in accordance with ASME B89.4.22-2004.

Instrument condition as received:
Inoperative

Instrument condition outgoing:
Within specifications

Technician: [signature] Arnold Torres   Date: 8/26/08

This certificate shall not be reproduced, except in full, without permission of FARO Technologies, Inc.
The results of this certificate relate only to the items calibrated or tested.

FARO Technologies, Inc.
PH1:1-800-736-2771
PH2:407-333-9911
FAX:407-333-8056
L-A-B Cert Number: L1147

125 Technology Park
Lake Mary, FL 32746
USA

@ 9/2/08

FARO®

Page 1 of 6

LABORATORY ACCREDITATION BUREAU
ISO/IEC 17025 Accredited

Revised: March 15, 2008

f:\control\records\05manufa\partspec\XH08-0495 ens Rev1 RevDate: 12/08/04

MICHIGAN OPERATIONS
DATE: 2/7/04
SUPERCEDES: MGATPTMC.5

DOC. NO.: MGATPTMC
REVISION NO.: 6
PAGE 3 OF 3

Tape Measure Calibration Certificate

Reference Steel Rule
Brand: SWANSON
S/N: MGA00798
Calibration Date: 1/15/09

Subject Tape Measure
Brand: TPM 906 Stanley
S/N: TPM 906
Calibration Date: 1/23/09

Reference (in) (mm)	Subject Tape Measure	Difference	Reference (in) (mm)	Subject Tape Measure	Difference
0 (0)	0	0	18 (450)	18	0
1 (25)	1	0	19 (475)	19	0
2 (50)	2	0	20 (500)	20	0
3 (75)	3	0	21 (525)	21	0
4 (100)	4	0	22 (550)	22	0
5 (125)	5	0	23 (575)	23	0
6 (150)	6	0	24 (600)	24	0
7 (175)	7	0	25 (625)	25	0
8 (200)	8	0	26 (650)	26	0
9 (225)	9	0	27 (675)	27	0
10 (250)	10	0	28 (700)	28	0
11 (275)	11	0	29 (725)	29	0
12 (300)	12	0	30 (750)	30	0
13 (325)	13	0	31 (775)	31	0
14 (350)	14	0	32 (800)	32	0
15 (375)	15	0	33 (825)	33	0
16 (400)	16	0	34 (850)	34	0
17 (425)	17	0	35 (875)	35	0

If all differences are ± 1/32 of an inch (1 mm), then the tape measure is acceptable.
Pass X Fail ____ Maximum Difference = 0

Date: 1/23/2009 Performed By: [signature]

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.

MetroCal inc.

Cert#0513.01

4700 Barden Court SE, Kentwood MI 49512, Telephone: 616-698-3124, Fax: 616-698-2364, www.metrocal.com

Certificate of Calibration

MGA Research
446 Executive Drive
Troy, MI 48083

Order Number: **59696**
Certificate Number: **080604806**
Page: **1 of 1**

Gauge Number: **MGA00730**
Gauge Desc: **Digital Protractor**
Manufacturer: **Mitutoyo**
Model Number: **N/A**
Serial Number: **N/A**

Customer PO: **A070681**
Last Calibration: **N/A**
Calibration Date: **6/4/08**
Next Calibration: **6/4/09**

As Found Condition: **In Tolerance**

As Left Condition: **In Tolerance**

MetroCal, Inc maintains reference standards of measurement which are traceable to the National Institute of Standards and Technology, or other authorized National Standards. Calibration was performed in accordance with MetroCal Procedure CP045 and complies with the ANSI/NCSL Z540-1 and ISO/IEC 17025 Standards. Results shall not be reproduced, except in full, without the written approval of MetroCal, Inc. Results relate only to the item(s) calibrated. Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired. Statements of compliance made using simple acceptance rule.

Standard Used	Cal Date	Due Date	Traceable No.	Calibration Procedure Uncertainty Expressed at 95% confidence (K=2)
Gage Blk Set ID# 105	6/12/07	6/12/08	821/273187-06	0.0015°
DoAll Sine Bar ID#1879	12/31/07	12/31/08	Cert# 071231399	0.0015°

Results:

As Found Readings

Units	Nominal	Actual	Deviation
Decimal Deg.	5.00	5.0	0.00
	10.00	10.1	0.10
	20.00	20.0	0.00
Tolerance	30.00	30.0	0.00
± 0.1°	40.00	40.0	0.00

Reference Level Check: Within ± 0.1 degrees

As Left Readings

Nominal	Actual	Deviation
5.00	5.0	0.00
10.00	10.1	0.10
20.00	20.0	0.00
30.00	30.0	0.00
40.00	40.0	0.00

Reference Level Check: Within ± 0.1 degrees

Comments: Environmental conditions during calibration: 68 °F, 41% RH.

Issued: 6/5/08

Shannon Shoemaker/bjk
Calibration Technician

☐ Checked box indicate this calibration was performed at the customers facility.

6/6/08

Certificate of Calibration

Schober Calibration Service, Inc.
2550 Oakley Park Road, Suite #300
Walled Lake, MI 48390
Phone: (248) 926-6000 FAX: (248) 926-6006

ACCREDITED
CALIBRATION 1563.01

Certificate Number: 0001591:1212069510

CUSTOMER: MGA Research Corporation
446 Executive Drive
Troy MI 48083
Contact: Thomas Hutter

Calibration Location: **In House**

Equipment Calibrated

Manufacturer:	Dickson	Date Received:	05/08/2008
Description:	Temp/Humidity Recorder	Date Calibrated:	05/29/2008
Model Number:	FH125	Calibration Due Date:	05/29/2009
Serial Number:	06163263	Calibration Procedure:	CP0001
Asset Number:	MGA00152	Revision:	
Received Status:	Good	Performed By:	C. Atkinson

Condition as Received: In Tolerance
Condition as Returned: In Tolerance

Notes:

Ambient Calibration Conditions

Ambient Temperature: 21 °C Relative Humidity: 40 % RH Barometric Pressure: 988 mbar

Calibration Equipment Used

Asset Number:	Manufacturer:	Model:	Serial:	Cal Due:
RMS042	Fluke/Hart	1502A	A6C537	15 Feb 2009
RMS043	Hart Scientific	5614	778109	15 Feb 2009
RMS045	Vaisala	HMP76	C0630009	04 Jun 2008

The Uncertainty is estimated using expanded uncertainties and coverage factor (k) of 2, providing a confidence level of approximately 95%.
This calibration is traceable to the international system of units (SI) through standards calibrated by accredited laboratories, or through standards calibrated at NIST. This laboratory meets the requirements of ISO/IEC 17025-2005 and ANSI/NCSL Z540-1-1994. This certificate shall not be reproduced, except in full, without prior written approval by Schober Calibration Service.
Calibration interval determined by the customer. When determining the calibration interval, the customer should take into consideration that any number of factors may cause the calibration item to drift out of calibration before the calibration interval has expired.
The results herein apply only to the calibration of the item described above. No sampling plan was used for this calibration.

Approved By: Quality Manager Date: 5/29/08
6/2/08

Calibration Data

MFG/MODEL: **Dickson / FH125**

Serial / ID #: **06163263 / MGA00152**

Location: **Schober Cal Lab (MGA Research)**

Date Calibrated: **05/29/08**

Certificate No.: **0001591:1212069510**

All calculations and data transfers have been reviewed for accuracy and completeness

Range	Nominal	Lower Limit	As Found	As Left	Upper Limit
Data Logger with Sensor System Tests					
Channel 1					
	20.9° C	19.1° C	20.5° C		22.7° C
	-0.4° C	-2.2° C	-0.6° C		1.4° C
Channel 2 (RH @ 21° C)					
	41.0 %rh	39.0 %rh	40.5 %rh		43.0 %rh
	98.8 %rh	96.8 %rh	98.8 %rh		100.8 %rh
Calibration Performed By: C. Atkinson					

Temperature Measurement Uncertainty Utemp = 0.46°C Uhumidity = 1.6 %RH

MetroCal inc.
Cert#0513.01
4700 Barden Court SE, Kentwood MI 49512, Telephone: 616-698-3124, Fax: 616-698-2364, www.metrocal.com

Certificate of Calibration

MGA Research
446 Executive Drive
Troy, MI 48083

Order Number: **60394**
Certificate Number: **080711801**
Page: **1 of 1**

Gauge Number: **MGA00081**
Gauge Desc: **0 to 20lb x 0.01lb Digital Scale**
Manufacturer: **Detecto**
Model Number: **AP-20**
Serial Number: **E33603-0213**

Customer PO: **A070765**
Last Calibration: **7/9/07**
Calibration Date: **7/11/08**
Next Calibration: **7/11/09**

As Found Condition: **In Tolerance**

As Left Condition: **In Tolerance**

MetroCal Inc. maintains reference standards of measurement which traceable to the National Institute of Standards and Technology, or other authorized National Standards. Calibration was performed in accordance with MetroCal's Procedure No. CP-042 and the relevant sections of the manufacturers manual. This Calibration complies with the ISO/IEC 17025 and ANSI/NCSL Z540-1 Standards. Results shall not be reproduced except in full without the written approval of MetroCal Inc. Results relate only to the item(s) calibrated. Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired. Statements of compliance made using simple acceptance rule.

Standard Used	Cal. Date	Due Date	Traceable No.	Calibration Procedure Uncertainty Expressed at 95% confidence , (K=2)
Weight Set ID# 2463	8/10/06	8/10/08	MI-04-06-8325	+/-0.001% of Load

Results:
Tolerance used: ± 0.02

Units: lbs **TI Division/Increment:** 0.01

	As Found				As Left		
Weight Test	**Nominal**	**Indication**	**Deviation**		**Nominal**	**Indication**	**Deviation**
0-25% fs	5	5.00	0.00		5	5.00	0.00
26-50% fs	10	9.99	-0.01		10	9.99	-0.01
51-75% fs	15	14.99	-0.01		15	14.99	-0.01
76-100% fs	20	19.99	-0.01		20	19.99	-0.01
Shift Test:	Pass			**Shift Test:**	Pass		
Half Load Test:	Pass			**Half Load Test:**	Pass		

Comments: Environmental conditions during calibration: 68 °F, 46 % RH.

Issued: 7/15/08

Shannon Shoemaker/bjk
Calibration Technician

☐ Checked box indicate this calibration was performed at the customers facility.

7/17/08

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

Certificate of Calibration

F410/12-3
Rev. Date 11/23/05

calibration cert. 1448.01

Customer: MGA Research *Cert#* 08-4587 *Temp/Humidity:* 70-20
Location of Calibration: 2839 Elliott Ave. Troy MI 48083
Calibration Date: 6/15/2008 *Cal Due:* 7-09 *Condition of Item:* Good
Equipment Make: Intercomp *Model:* SWD Deluxe *Serial/ID:* 26032389
Capacity single pad capacity 2200 x 1lb

Applied Test Wt	*Before Adustment*	*Tolerance*	*In-Tolerance Y/N*	*After Adjustment*	*In-Tolerance Y/N*	*Unc .5lb*	
100lb	100lb	1lb	y	n/a	n/a	.5lb	RR
1000lb	1000lb	2lb	y	n/a	n/a	.5lb	
100lb	101lb	1lb	y	n/a	n/a	.5lb	LR
1000lb	1000lb	2lb	y	n/a	n/a	.5lb	
100lb	100lb	1lb	y	n/a	n/a	.5lb	RF
1000lb	1000lb	2lb	y	n/a	n/a	.5lb	
100lb	100lb	1lb	y	n/a	n/a	.5lb	LF
1000lb	1000lb	2lb	y	n/a	n/a	.5lb	

shift test

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

Tests performed: ☑ Repeatability ☑ Linearl☐ Sensitivity ☑ Discrimination

Technician COMMENTS/ System passes all tests.

Test wts used Our test weights s/n on file.

☑ Scale Certified ☐ Scale Rejected

Sterling Scale Service Rep: ED **Date:** 6/12/2008 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.
Test numbers on file. 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
This report shall not be reproduced, except in full without approval of the laboratory
Tolerances followed are maintenance/acceptance per HB 44 or as detremined by the customer

QA 6/19/08

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	Q353B01
Serial #:	84592
Capacity:	G's:250
Calibration Date:	9/18/2008
Calibrated By:	DTI

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J35919
Capacity/Range: (G's)	2,000

Calibration Date:	3/2/2009
New DLR(Units:G'S) [1] 100K SHUNT	95.6
Linearity:[2]	0.99981
New vs Old Sensitivit (% Difference)	-0.4
Temperature:	69.9 ^{o}F
Humidity:	38 %
Sensitivity (mV/V/G):	0.026030
Calibrated By:	Thomas Miller

Signature: Thom D Miller

Approved by: David Winkelbauer

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean) .

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	Q353B01
Serial #:	84592
Capacity:	G's:250
Calibration Date:	9/18/2008
Calibrated By:	DTI

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J22664
Capacity/Range: (G's)	2,000

Calibration Date:	3/2/2009
New DLR(Units:G'S) 100K SHUNT [1]	94.3
Linearity: [2]	0.99958
New vs Old Sensitivit (% Difference)	-0.5
Temperature:	69.9 ^{O}F
Humidity:	38 %
Sensitivity (mV/V/G):	0.026381
Calibrated By:	Thomas Miller

Signature: Thomas D Miller

Approved by: David Winkelbauer

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean) .

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference		Sensor	
Name:	Accel Standard	**Name:**	MGA MI
Model #	Q353B01	**Manufacturer**	Endevco
Serial #:	84592	**Model #:**	7264-2000
Capacity:	G's:250	**Serial #:**	J35924
Calibration Date:	9/18/2008	**Capacity/Range: (G's)**	2,000
Calibrated By:	DTI		

Calibration Date:	3/2/2009
New DLR(Units:G'S) [1] **100K SHUNT**	92.8
Linearity: [2]	0.99935
New vs Old Sensitivit (% Difference)	-0.4
Temperature:	69.9 ^{O}F
Humidity:	38 %
Sensitivity (mV/V/G):	0.026815
Calibrated By:	Thomas Miller

Signature: [signature]

Approved by: [signature]

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean) .

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	Q353B01
Serial #:	84592
Capacity:	G's:250
Calibration Date:	9/18/2008
Calibrated By:	DTI

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	AHTB2
Capacity/Range: (G's)	2,000

Calibration Date:	3/2/2009
New DLR(Units:G'S) 100K SHUNT [1]	115.9
Linearity: [2]	0.99947
New vs Old Sensitivit (% Difference)	-0.7
Temperature:	69.9 ^{o}F
Humidity:	38 %
Sensitivity (mV/V/G):	0.021450
Calibrated By:	Thomas Miller

Signature: Thomas D Miller

Approved by: David Winbellbauer

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean) .

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	Q353B01
Serial #:	84592
Capacity:	G's:250
Calibration Date:	9/18/2008
Calibrated By:	DTI

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J14103
Capacity/Range: (G's)	2,000

Calibration Date:	3/2/2009
New DLR(Units:G'S) [1] 100K SHUNT	93.7
Linearity:[2]	0.99893
New vs Old Sensitivit (% Difference)	-0.9
Temperature:	69.9 ^{o}F
Humidity:	38 %
Sensitivity (mV/V/G):	0.026528
Calibrated By:	Thomas Miller

Signature: Thomas D Miller

Approved by: David Winkelbauer

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean) .

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference		Sensor	
Name:	Accel Standard	Name:	MGA MI
Model #	Q353B01	Manufacturer	Endevco
Serial #:	84592	Model #:	7264-2000
Capacity:	G's:250	Serial #:	J35800
Calibration Date:	9/18/2008	Capacity/Range: (G's)	2,000
Calibrated By:	DTI		

Calibration Date:	3/2/2009
New DLR(Units:G'S) [1] 100K SHUNT	97.1
Linearity:[2]	0.99893
New vs Old Sensitivit (% Difference)	-0.5
Temperature:	69.9 ^{o}F
Humidity:	38 %
Sensitivity (mV/V/G):	0.025575
Calibrated By:	Thomas Miller

Signature: [signature]

Approved by: [signature]

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #:	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	7/24/2008
Calibrated By:	PCB

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J22700
Capacity/Range: (G's)	2,000

Calibration Date:	4/17/2009
New DLR(Units:G'S) 100K SHUNT [1]	94.0
Linearity: [2]	0.99977
New vs Old Sensitivity (% Difference)	2.0
Temperature:	70 ^{o}F
Humidity:	25 %
Sensitivity (mV/V/G):	0.02647
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Helen A. Kalata

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean) .

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #:	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	7/24/2008
Calibrated By:	PCB

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J36197
Capacity/Range: (G's)	2,000

Calibration Date:	4/17/2009
New DLR(Units:G'S) 100K SHUNT [1]	106.3
Linearity: [2]	0.99945
New vs Old Sensitivity (% Difference)	2.1
Temperature:	70 ^{o}F
Humidity:	25 %
Sensitivity (mV/V/G):	0.023407
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Helen A. Kalata

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean) .

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #:	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	7/24/2008
Calibrated By:	PCB

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J36353
Capacity/Range: (G's)	2,000

Calibration Date:	4/17/2009
New DLR(Units:G'S) 100K SHUNT [1]	97.5
Linearity: [2]	0.99962
New vs Old Sensitivity (% Difference)	1.4
Temperature:	70 ^{o}F
Humidity:	25 %
Sensitivity (mV/V/G):	0.025512
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Helen A. Kaleto

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean) .

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

Dynamic Technology, Inc.

Certificate of Calibration

Certificate #: 125456001 T

Calibration Laboratory
Certificate #: 1022.01

Acct #:	090100	**Manufacturer:**	PCB
Customer:	MGA Research Corporation	**Model:**	484B06
Shipper #:		**Description:**	Power Unit
Address:	5000 Warren Road Burlington, WI, 53105	**Serial Number:**	00001458
Contact:	Jessica Gall	**Asset Number:**	
PO #:	03-08-0741	**Barcode:**	

As Received	As Returned	Action Taken		
In Tolerance X	In Tolerance X	Full Calibration X	**Cal Date:**	09/18/2008
Out of Tolerance	Out of Tolerance	Special Calibration	**Due Date:**	03/18/2009
Malfunctioning	Malfunctioning	Oper. Verification	**Temperature:**	73.00 deg. F
Operational	Operational	Adjusted	**Humidity:**	36.00 %
Damaged	N/A	Repaired	**Baro. Press.:**	
N/A		Charted	**Procedure:**	DCN 05156
		Returned As Is	**Reference:**	manufacturer's manual

Incoming Remarks:
Replacement for unit on WO#124720006 In case with connector cable/power cord and accelerometer in case

Technical Remarks:
Uncertainty data to follow.

Calibration Standards Utilized

Cert. #	Manufacturer	Model #	Description	Cal Date	Due Date
108256017	TMS	9155C	Accelerometer Calibration W	02/18/2008	02/18/2009
108256027	PCB	442A102	Signal Conditioner	01/10/2008	01/10/2009

System Instrumentation Includes

ID	Manufacturer	Model	Description	Serial Number
84592	PCB	Q353B01	Accelerometer	84592

The above identified unit was calibrated in our laboratory at the address shown below.

Technician Name/Date: Joseph Leonard, 09/18/2008 Signatory: Mary Stanley QA Approved:

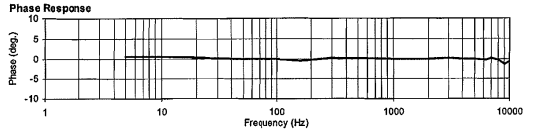
1200 N. Old US 23, PO Box 559, Hartland, MI 48353-0559 (810) 225-4601 FAX (810) 225-4602

JAG

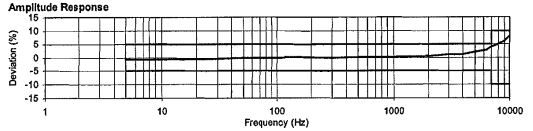
~Report of Calibration~

Sensor Information		Calibration Data			Transducer Specifications		
Model Number	484B06/Q353B01	Sensitivity @ Ref. Freq.:	20.28	mV/g	Range:	250.00	+/- g
Serial Number	1458/84592	Phase @ Ref. Freq.:	-0.06	deg.	Resolution:	0.0000	g
Manufacturer:	PCB	Test Level:	1.00	g	Temp Range:	-54 to 121	°C
ID Number:	1458/84592					-65 to 250	°F
Description:	ICP® Accelerometer				Axis:	Uniaxial	

Phase Response



Amplitude Response



Data Table

Frequency (Hz)	Sen(mV/g)	Phase (deg)
5.00	20.140	0.63
10.00	20.109	0.47
30.00	20.212	0.18
50.00	20.226	-0.07
100.00	20.281	-0.06
159.00	20.287	-0.44
300.00	20.254	0.04
500.00	20.325	0.03
1000.00	20.309	-0.10
2000.00	20.409	-0.16
3000.00	20.483	0.12
4000.00	20.498	-0.05
5000.00	20.672	-0.11
6300.00	20.825	-0.29
7000.00	21.059	0.14
8000.00	21.295	-0.25
9000.00	21.512	-1.27
10000.00	21.912	-0.67

Notes

Back-to-Back Comparison Calibration

This calibration was performed with TMS 9155c Calibration Workstation version 3.9.0

Calibration is NIST Traceable through project number 822/271196.

Customer	User Notes
090100	125456001 T

Unit Condition		Lab Conditions		
As Found:	In Tolerance	Temperature:	23.89	°C
As Left:	In Tolerance		75.00	°F
		Humidity:	36.00	%

Approval Information
Technician: J Leonard

Dynamic Technology, Inc.
1200 N. Old US 23 (PH)810.225.4601
P.O. Box 559 (FX)810.225.4602
Hartland, MI
48353-0559 www.dynamictechnology.com

~ *Calibration Certificate* ~

Per ISO 16063-21

Model Number: 352C03

Serial Number: 95980

Description: ICP® Accelerometer Method: Back-to-Back Comparison (AT401-3)

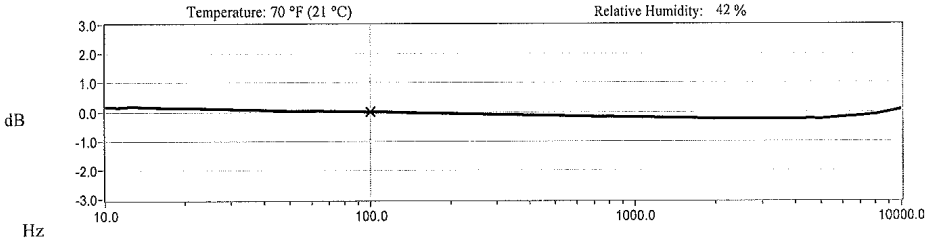
Manufacturer: PCB

Calibration Data

Sensitivity @ 100.0 Hz	**10.11**	**mV/g**	Output Bias	11.4	VDC
	(1.031	**mV/m/s²)**	Transverse Sensitivity	0.6	%
Discharge Time Constant	1.7	seconds	Resonant Frequency	57.2	kHz

Sensitivity Plot

Temperature: 70 °F (21 °C) Relative Humidity: 42 %



Data Points

Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)
10.0	1.9	300.0	-1.1	7000.0	-1.7
15.0	1.7	500.0	-1.6	10000.0	0.9
30.0	1.0	1000.0	-2.3		
50.0	0.3	3000.0	-3.0		
REF. FREQ.	0.0	5000.0	-2.9		

Mounting Surface: Stainless Steel w/Silicone Grease Coating Fastener: Stud Mount Fixture Orientation: Vertical
Acceleration Level (rms)[1]: 10.0 g (98.1 m/s²)
[1]The acceleration level may be limited by shaker displacement at low frequencies. If the listed level cannot be obtained, the calibration system uses the following formula to set the vibration amplitude: Acceleration Level (g) = 0.010 x (freq)².
[2]The gravitational constant used for calculations by the calibration system is: 1 g = 9.80665 m/s².

Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

Notes

1. Calibration is NIST Traceable thru Project 822/274086 and PTB Traceable thru Project 1060.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NCSL Z540-1-1994 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Measurement uncertainty (95% confidence level with coverage factor of 2) for frequency ranges tested during calibration are as follows: 5-9 Hz; +/- 2.0%, 10-99 Hz; +/- 1.5%, 100-1999 Hz; +/- 1.0%, 2-10 kHz; +/- 2.5%.

Technician: Susan Lyon Date: 07/31/08

ACCREDITED
CALIBRATION CERT #1862.02

PCB PIEZOTRONICS
VIBRATION DIVISION
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