

REPORT NUMBER: 201UI-CAL-08-01

**SAFETY COMPLIANCE TESTING FOR FMVSS 201  
OCCUPANT PROTECTION IN INTERIOR IMPACT  
UPPER INTERIOR HEAD IMPACT PROTECTION  
EVALUATION OF THE AP1 TARGET**

**GENERAL MOTORS DE MEXICO  
2007 CHEVROLET HHR**

NHTSA NUMBER: C70117

CALSPAN TEST NUMBER: 8851-01

CALSPAN  
TRANSPORTATION SCIENCES CENTER  
P.O. BOX 400



BUFFALO, NEW YORK 14225

Test Date: December 17, 2007

FINAL REPORT

PREPARED FOR:

U. S. DEPARTMENT OF TRANSPORTATION  
National Highway Traffic Safety Administration  
Enforcement  
Office of Vehicle Safety Compliance  
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NHTSA, Office of Vehicle Safety Compliance

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15. <i>Supplementary Notes</i>																	
16. <i>Abstract</i>  A compliance evaluation test was conducted on the subject vehicle, a 2007 Chevrolet HHR, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure TP-201U-01 for determination of FMVSS 201 compliance. Test failures identified were as follows in the table below:																	
<table border="1"> <thead> <tr> <th>Target Point</th> <th>Horizontal</th> <th>Vertical</th> <th>Velocity</th> <th>HIC</th> <th>HICd</th> </tr> </thead> <tbody> <tr> <td>AP1</td> <td>155°</td> <td>45°</td> <td>23.77</td> <td>1406.7</td> <td>1227.7</td> </tr> </tbody> </table>						Target Point	Horizontal	Vertical	Velocity	HIC	HICd	AP1	155°	45°	23.77	1406.7	1227.7
Target Point	Horizontal	Vertical	Velocity	HIC	HICd												
AP1	155°	45°	23.77	1406.7	1227.7												
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## **SECTION 1**

### **PURPOSE AND TEST PROCEDURE**

This head impact compliance test is part of the FMVSS 201 Upper Interior Head Impact Protection Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-04-C-01027. The purpose of this head impact compliance test was to determine whether the subject vehicle, a 2007 Chevrolet HHR, NHTSA No. C70117, meets the performance requirements of FMVSS 201, Occupant Protection in Interior Impact. The compliance test was conducted in accordance with the OVSC Laboratory Test Procedure No. TP-201U-01 dated April 03, 1998.

## SECTION 2

### SUMMARY OF UPPER INTERIOR HEAD IMPACTS

A 2007 Chevrolet HHR, NHTSA No. C70117, was tested at the right vehicle side AP1 location by a 4.54 kg 50<sup>th</sup> percentile headform. A total of one (1) impact was performed in this evaluation. The target area was evaluated due to a previous compliance failure at the AP1 location on the right vehicle side. A summary of the test results can be found on Data Sheet 2-1, Summary of Upper Interior Head Impact Tests.

The selected impact areas on the test vehicle appeared to comply with the performance requirements of FMVSS 201.

One Free Motion Headform (FMH) was used in this test series. The FMH was calibrated prior to and after the test series. Calibration information is included in Appendix B. The FMH weighed  $4.54 \pm 0.5$  kg and had an orthogonal tri-axis accelerometer pack mounted at the headform's center of gravity (c.g.).

A total of three (3) channels of data for each test were recorded on a Keyser-Threde data acquisition system. Data plots, along with still images, can be found in Section 3, Summary of Test Results and Data Plots.

To document the target area impact test, a Weinberger high-speed video camera was used to record the headform contact with the selected target area.

**DATA SHEET 2-1**

**SUMMARY OF UPPER INTERIOR HEAD IMPACT TESTS**

VEHICLE YEAR/MAKE/MODEL/STYLE:	2007 Chevrolet HHR
VIN:	3GNDA13D37S612013
DATE OF MANUFACTURE:	02/07(SEE CERTIFICATION LABEL)
COLOR:	Red

TARGET CODE	Target Coordinates						Approach Angles (degrees)		Velocity (kph)	FMH HIC	HIC(d)
	Driver Side			Passenger Side			Horizontal	Vertical			
	X(mm)	Y(mm)	Z(mm)	X(mm)	Y(mm)	Z(mm)					
AP1	-	-	-	2716.333	547.4617	1271.492	155°	45°	23.77	1406.7	1227.7

\*HIC(d)=0.75446(Free Motion Headform HIC)+166.4



**DATA SHEET 2-2**

**GENERAL TEST AND VEHICLE PARAMETER DATA**

<b>TEST VEHICLE INFORMATION:</b>									
Year/Make/Model/Body Style:				2007 Chevrolet HHR					
VIN:				3GNDA13D37S612013					
Month & Year of Manufacture:				02/07(SEE CERTIFICATION LABEL)					
Vehicle Body Color:				Red					
Engine Data:	4	Cylinders;	-	CID;	2.2	Liters;	-	cc	
Engine Placement:		x	Longitudinal;	or		-	Lateral		
Transmission:	5	Speed;	-	Manual;	X	Automatic;	-	Overdrive	
Final Drive:	-	Rear Wheel Drive;	x	Front Wheel Drive;	-	Four Wheel Drive			
Odometer Reading:		222	km						
Options:	x	A/C;	x	Power Steering;	x	Pwr.Brakes;	x	Pwr. Windows	
Interior Trim Information :									
1. Normal roof									
2. Adjustable seat belt anchorage on B-pillar. Non-adjustable seat belt anchorage on Other Pillar.									
3. No side rail grab handles on vehicle.									

<b>DATA FROM TIRE PLACARD:</b>									
Tire Pressure (at capacity);				210		kPa FRONT			
				210		kPa REAR			
Recommended Tire Size:				P215/55R16					
Tires on Test Vehicle:		P215/55R16		Manufacturer:		Firestone			
Vehicle Capacity Data:									
Number of Occupants:	2	Front;	3	Rear;	-	3rd Seat;	5	Total	
Type of Front Seats:	x	Bucket;	-	Bench;	-	Split Bench			
Type of Front Seat Back:	-	Fixed;	x	Adjustable with	x	Lever or	-	Knob	
Vehicle Capacity Weight (VCW)=				485		kg (A)			
No. of Occupants x 68 kg. =				340		kg (B)			
Rated Cargo/Luggage Weight (RCLW) =				136*		kg (A-B) *Max. RCLW = 136 kg.			

**DATA SHEET 2-2**

**GENERAL TEST AND VEHICLE PARAMETER DATA (cont.)**

<b>TEST VEHICLE DELIVERED WEIGHT WITH MAXIMUM FLUIDS:</b>					
Left Front =	<b>400</b>	<b>kg</b>	Left Rear =	<b>307.5</b>	<b>kg</b>
Right Front =	<b>419</b>	<b>kg</b>	Right Rear =	<b>299.5</b>	<b>kg</b>
TOTAL FRONT =	<b>819</b>	<b>kg</b>	TOTAL REAR =	<b>607</b>	<b>kg</b>
% of Total Weight =	<b>57.4</b>	<b>%</b>	% of Total Weight =	<b>42.6</b>	<b>%</b>
TOTAL WEIGHT =	<b>1426</b>		<b>kg</b>		

<b>CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:</b>		
Total Test Vehicle Delivered Weight=	<b>1426</b>	<b>kg (A)</b>
+ Rated Cargo/Luggage Weight =	<b>136</b>	<b>kg (B)</b>
TEST VEHICLE TARGET WEIGHT =	<b>1562</b>	<b>kg (A+B)</b>

<b>WEIGHT OF TEST VEHICLE (FULLY LOADED):</b>					
Left Front =	<b>390.5</b>	<b>kg</b>	Left Rear =	<b>378.5</b>	<b>kg</b>
Right Front =	<b>419</b>	<b>kg</b>	Right Rear =	<b>376</b>	<b>kg</b>
TOTAL FRONT =	<b>809.5</b>	<b>kg</b>	TOTAL REAR =	<b>754.5</b>	<b>kg</b>
% of Total Weight =	<b>51.7</b>	<b>%</b>	% of Total Weight =	<b>48.3</b>	<b>%</b>
TOTAL TEST WEIGHT =	<b>1564</b>				
Weight of vehicle secured in test vehicles cargo area =	<b>138</b>		<b>kg</b>		

<b>TEST VEHICLE ATTITUDE (all dimensions in millimeters):</b>				
AS DELIVERED:	Left Front	<b>703</b>	Left Rear	<b>705</b>
	Right Front	<b>703</b>	Right Rear	<b>731</b>
FULLY LOADED:	Left Front	<b>705</b>	Left Rear	<b>704</b>
	Right Front	<b>704</b>	Right Rear	<b>703</b>
Test Vehicle Wheelbase:	<b>2636</b>		millimeters	

<b>TEST VEHICLE PITCH AND ROLL ANGLES:</b>				
AS DELIVERED:	PITCH ANGLES		ROLL ANGLES	
	Left Door Sill	<b>↑0.1↓</b>	Front Bumper	<b>0.0</b>
	Right Door Sill	<b>↓0.1↑</b>	Rear Bumper	<b>↓0.4↑</b>
FULLY LOADED:	PITCH ANGLES		ROLL ANGLES	
	Left Door Sill	<b>↓0.6↑</b>	Front Bumper	<b>0.0</b>
	Right Door Sill	<b>↑0.4↓</b>	Rear Bumper	<b>↓0.4↑</b>
AS TESTED:	PITCH ANGLES		ROLL ANGLES	
	Left Door Sill	<b>0.0</b>	Front Bumper	<b>0.0</b>
	Right Door Sill	<b>↓0.1↑</b>	Rear Bumper	<b>↓0.4↑</b>

DATA SHEET 2-3

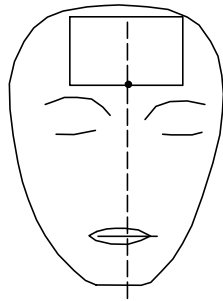
APPROACH ANGLE LIMITS

Left Side					Right Side				
Target Code	Horizontal Angles (deg.)		Vertical Angles (deg.)		Target Code	Horizontal Angles (deg.)		Vertical Angles (deg.)	
	Minimum	Maximum	Minimum	Maximum		Minimum	Maximum	Minimum	Maximum
AP1	-	-	-	-	AP1	114	159	-5	45

**DATA SHEET 2-4**

**SUMMARY TARGET IMPACT LOCATION ON FMH**

VEHICLE YEAR/MAKE/MODEL/STYLE:	2007 Chevrolet HHR
VIN:	3GNDA13D37S612013
DATE OF MANUFACTURE:	02/07(SEE CERTIFICATION LABEL)
COLOR:	Red



↻ RIGHT SIDE OF FACE

TARGET	Distance Above Point O (mm)	Distance Over From Pt. O (mm)
AP1	<b>30</b>	<b>8L</b>

### SECTION 3

#### SUMMARY OF TEST RESULTS AND DATA PLOTS

VEHICLE YEAR/MAKE/MODEL/STYLE:	2007 Chevrolet HHR
VIN:	3GNDA13D37S612013
DATE OF MANUFACTURE:	02/07(SEE CERTIFICATION LABEL)
COLOR:	Red

Test Number:	01
Test Date:	12/19/07
Target Location:	A-PILLAR
Target Code:	AP1
Horizontal Impact Angle:	155°
Vertical Impact Angle:	45°
Ambient Temperature:	19.3
Relative Humidity:	19.4
Time of Impact:	11:20
Headform Number:	0355

Impact Point Description (from lower midpoint on midsagittal line)						
On Centerline	8	□	mm right	□	x	mm left
On Centerline	30					mm up



POST-IMPACT AP1 HEADFORM

Free Motion HIC	1406.7
HIC(d)	1227.7
Impact Velocity (kph)	23.77
HIC T1 (msec)	4.4
HIC T2 (msec)	7.4

# FMVSS 201U 2007 Chevrolet HHR C70117 - AP1

FMH Headform 0355

Location: AP1

Test Date: December 17, 2007

Work File: AP1

## -----TEST RESULTS-----

Lab Temperature: 19.3 C

HICd: 1227.7

Lab Humidity: 19.4 %

HIC (36ms): 1406.7

Velocity at Impact: 23.77 KPH

t1: 4.4 msec

t2: 7.4 msec

Free Flight Distance: 222.98 mm

Duration: 3.0 msec

Average Acceleration: 9.7 g

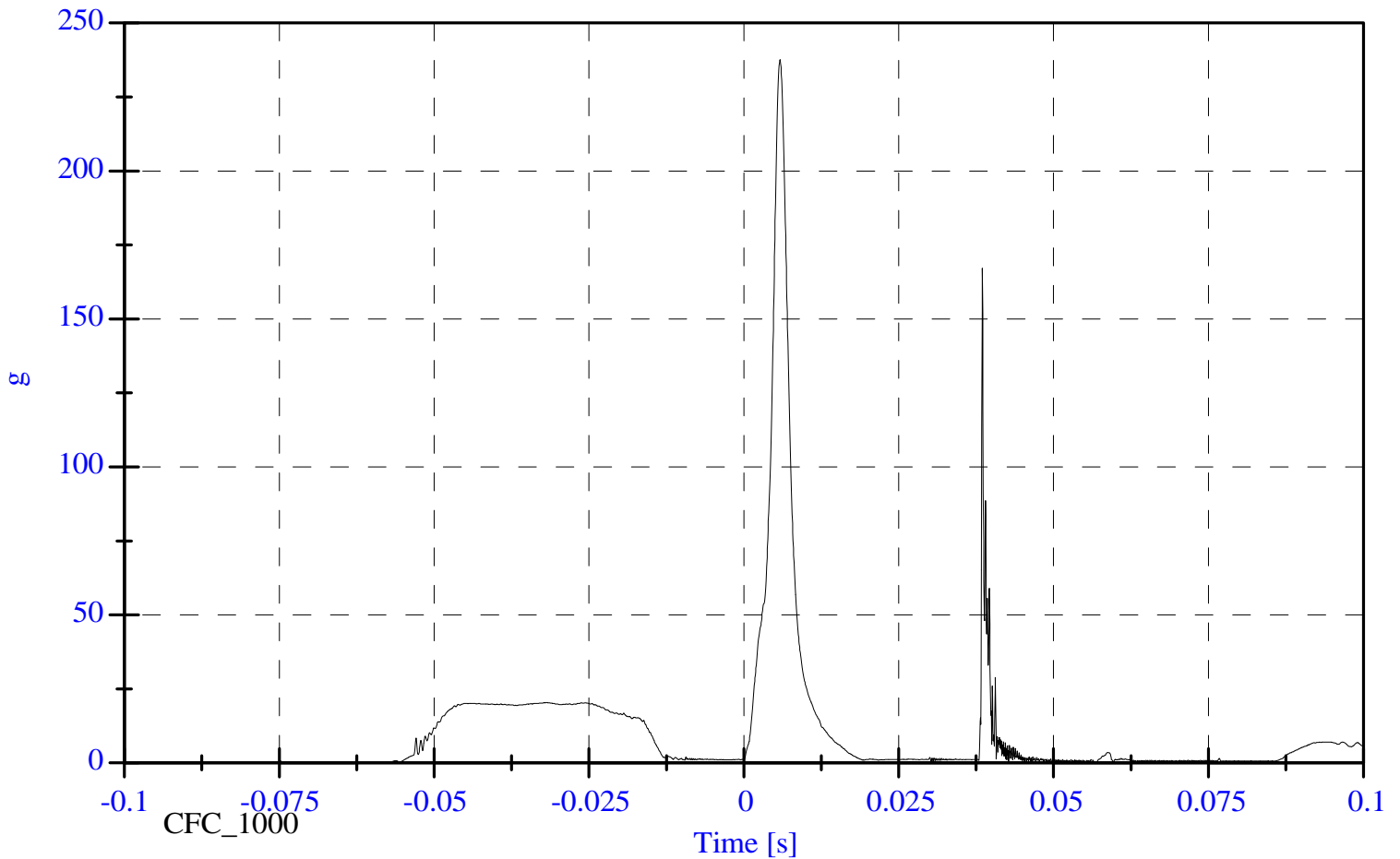
Maximum: 237.6 g

FMVSS 201U 2007 Chevrolet HHR

Headform Resultant

Max: 237.6 [g] at 0.006 [s]

Min: 0.0 [g] at -0.061 [s]



FMVSS 201U 2007 Chevrolet HHR

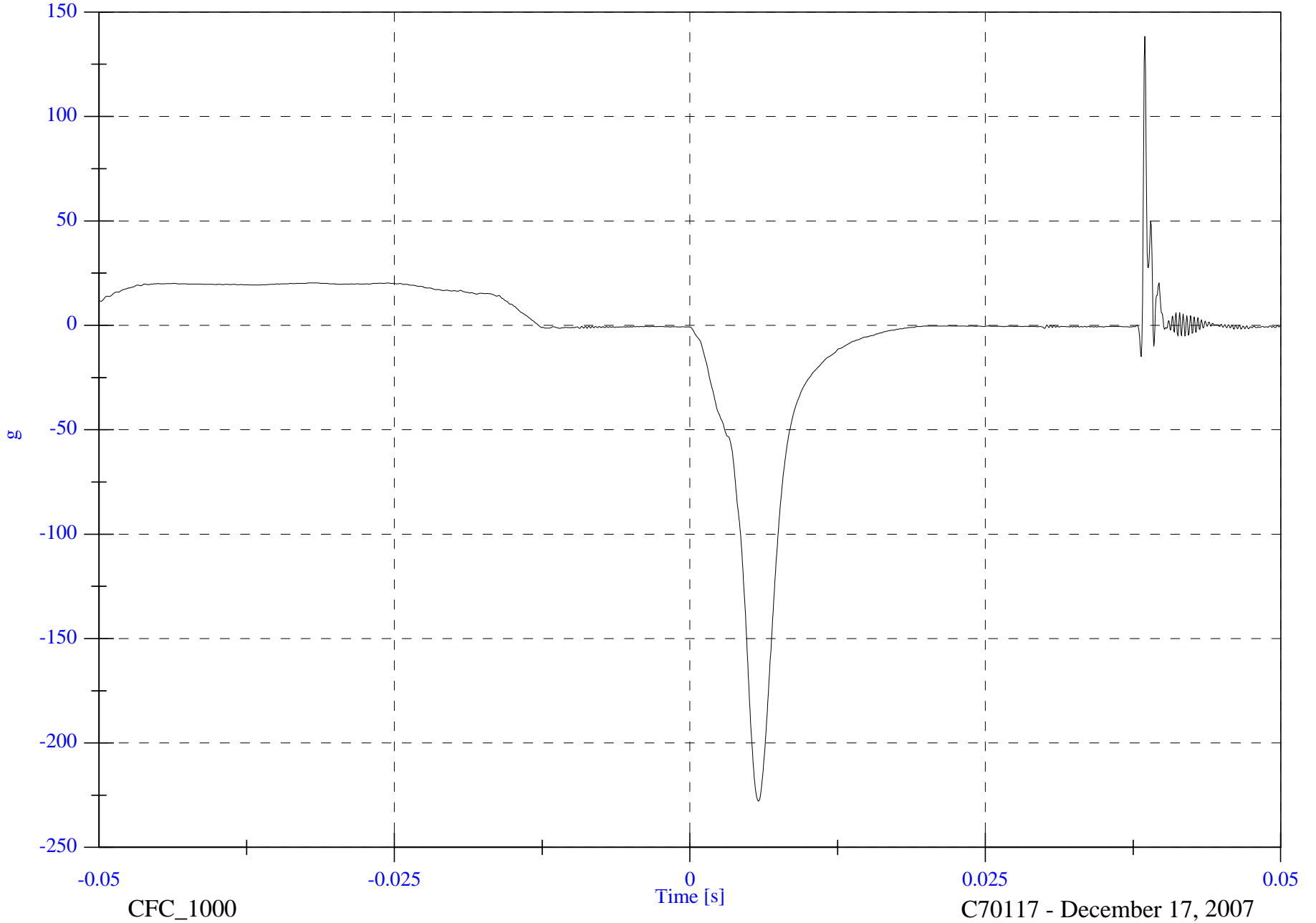
Headform X Acceleration

Max: 138.4 [g] at 0.039 [s]

Min: -227.9 [g] at 0.006 [s]

Passenger Side API IMPACT PLOT # 1

8851-01



CFC\_1000

C70117 - December 17, 2007

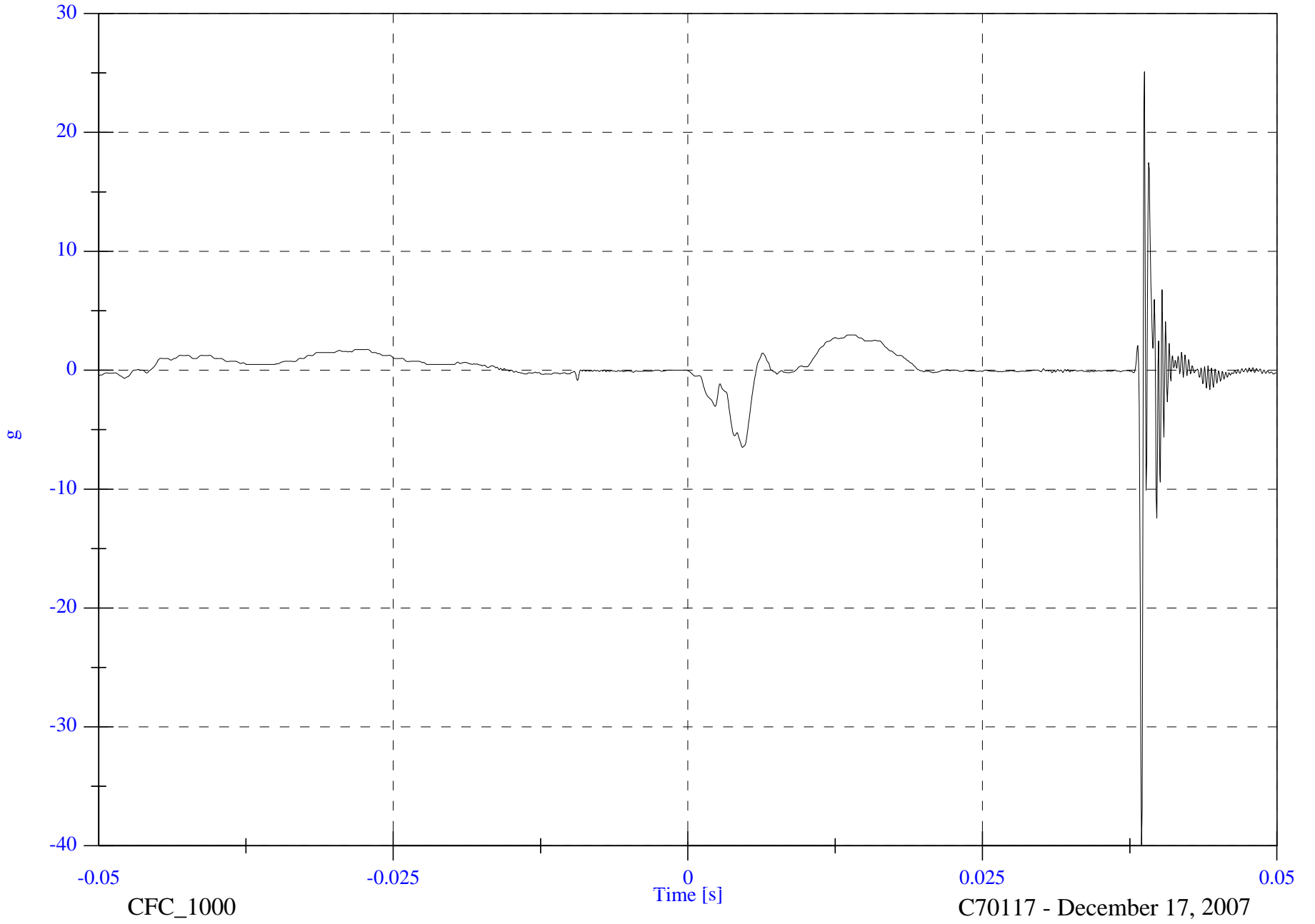
FMVSS 201U 2007 Chevrolet HHR

Headform Y Acceleration

Max: 25.1 [g] at 0.039 [s]

Min: -40.0 [g] at 0.039 [s]

Passenger Side API IMPACT PLOT # 2



8851-01

CFC\_1000

C70117 - December 17, 2007



FMVSS 201U 2007 Chevrolet HHR

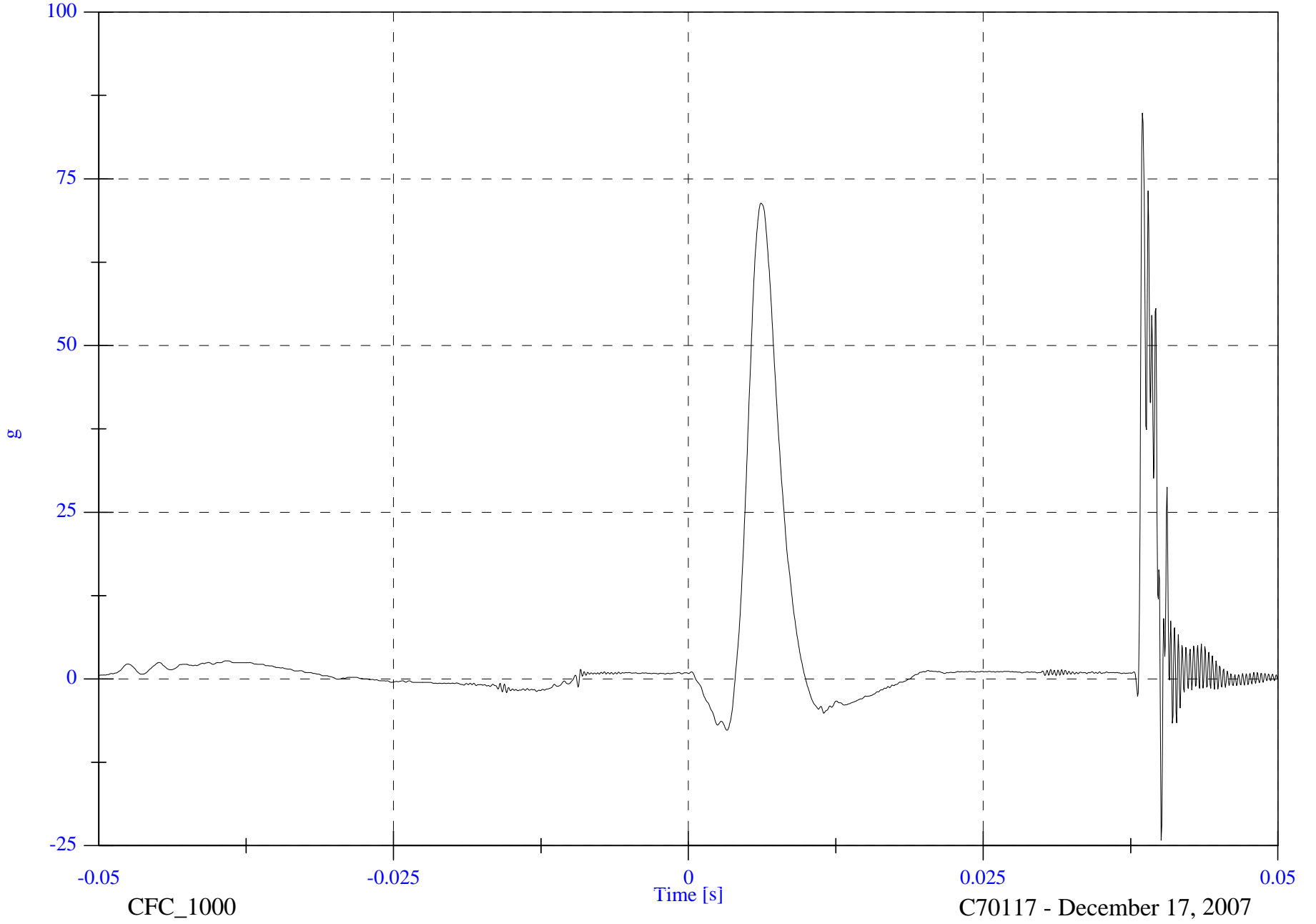
Headform Z Acceleration

Max: 84.9 [g] at 0.039 [s]

Min: -24.2 [g] at 0.040 [s]

Passenger Side AP1 IMPACT PLOT # 3

8851-01



CFC\_1000

C70117 - December 17, 2007

FMVSS 201U 2007 Chevrolet HHR

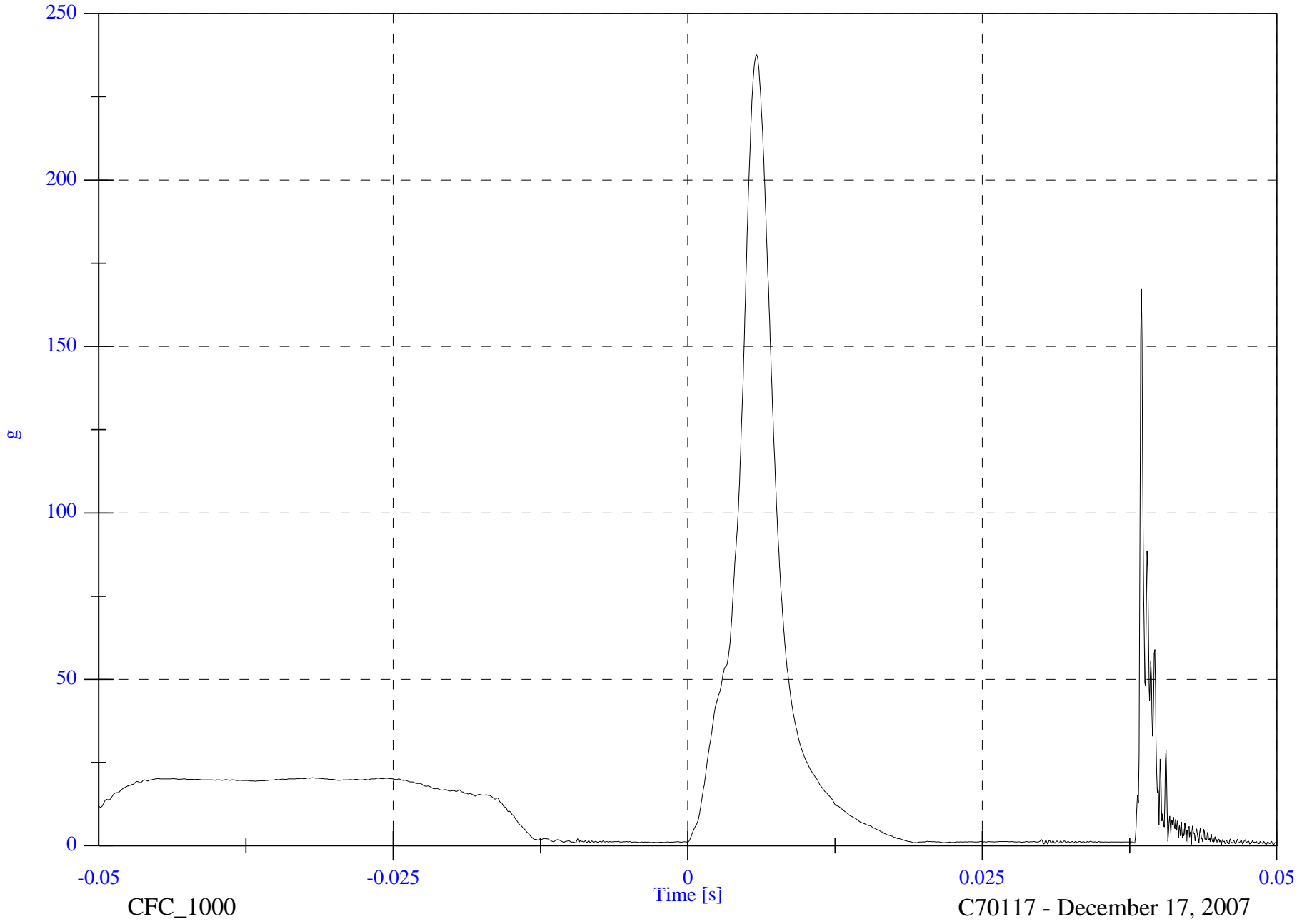
Headform Resultant

Max: 237.6 [g] at 0.006 [s]

Min: 0.3 [g] at 0.049 [s]

Passenger Side AP1 IMPACT PLOT # 4

8851-01

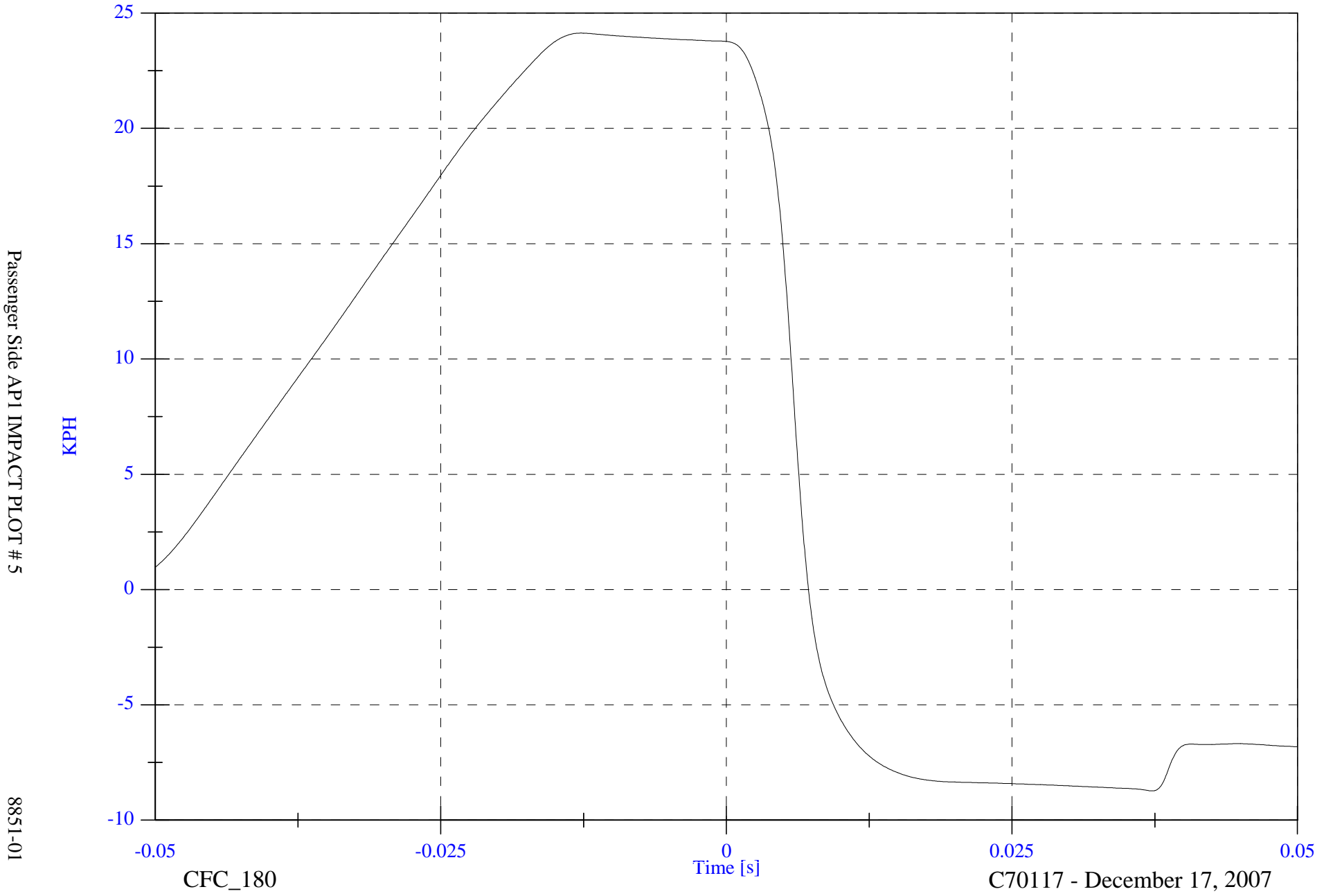


FMVSS 201U 2007 Chevrolet HHR

### Headform Velocity

Max: 24.1 [KPH] at -0.013 [s]

Min: -8.7 [KPH] at 0.037 [s]



Passenger Side AP1 IMPACT PLOT # 5

8851-01

CFC\_180

Time [s]

C70117 - December 17, 2007



PRE-IMPACT API



POST-IMPACT API

**APPENDIX A**

**PHOTOGRAPHS**

## PHOTOGRAPHS

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Figure A-1 : LEFT SIDE VIEW OF VEHICLE





Figure A-2 : RIGHT SIDE VIEW OF VEHICLE



Figure A-3 : 3/4 FRONTAL VIEW FROM RIGHT SIDE OF VEHICLE



Figure A-4 : 3/4 REAR VIEW FROM LEFT SIDE OF VEHICLE



Figure A-5 : VEHICLE'S CERTIFICATION LABEL

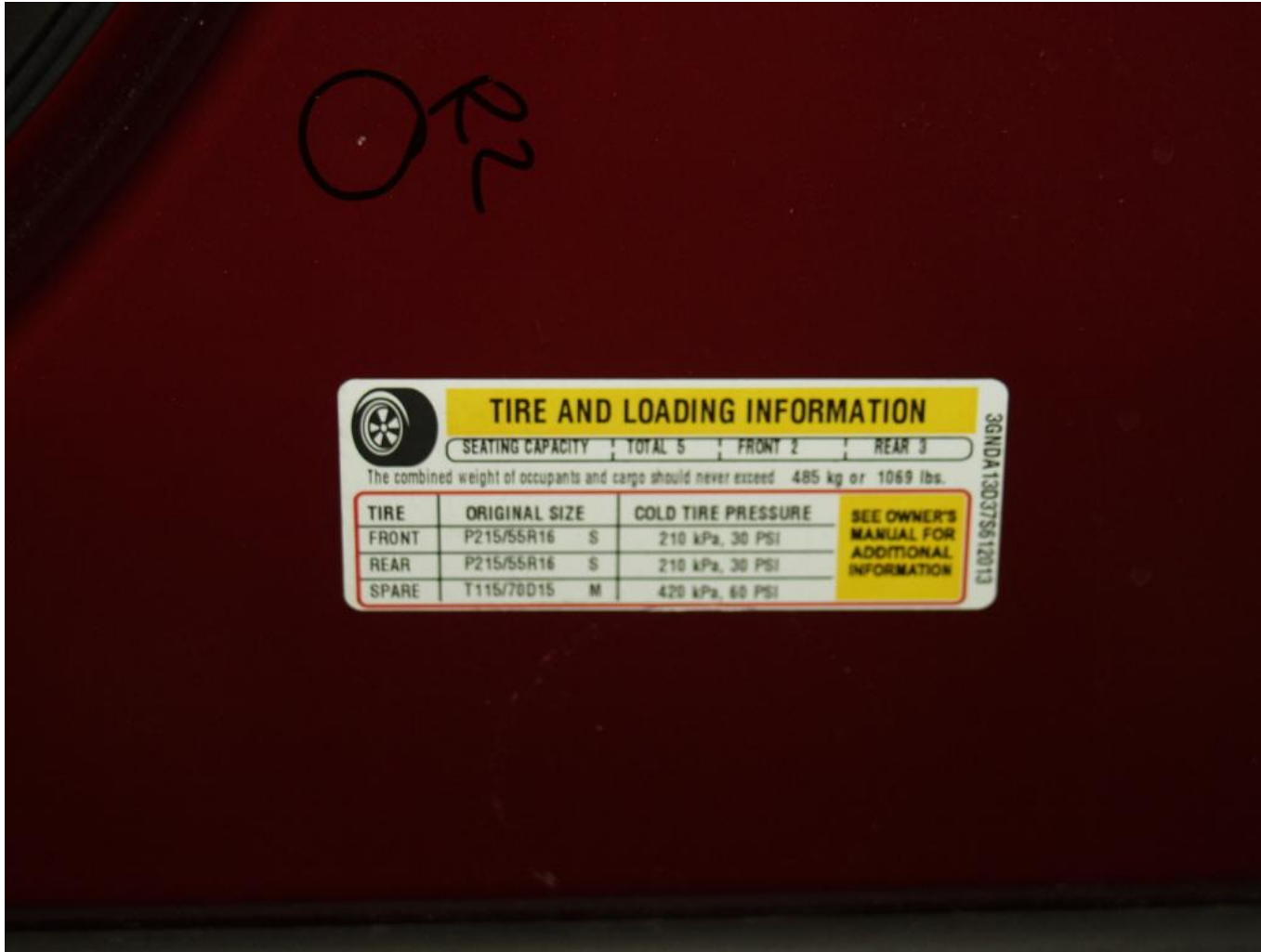


Figure A-6 : VEHICLE'S TIRE INFORMATION LABEL



Figure A-7 : PRE-TEST DRIVER SIDE A-PILLAR



Figure A-8 : PRE-TEST DRIVER SIDE FRONT HEADER



Figure A-9 : PRE-TEST DRIVER SIDE SIDE RAIL





Figure A-10 : PRE-TEST DRIVER SIDE B-PILLAR



Figure A-11 : PRE-TEST DRIVER SIDE OTHER PILLAR



Figure A-12 : PRE-TEST DRIVER SIDE REAR PILLAR



Figure A-13 : PRE-TEST PASSENGER SIDE A-PILLAR

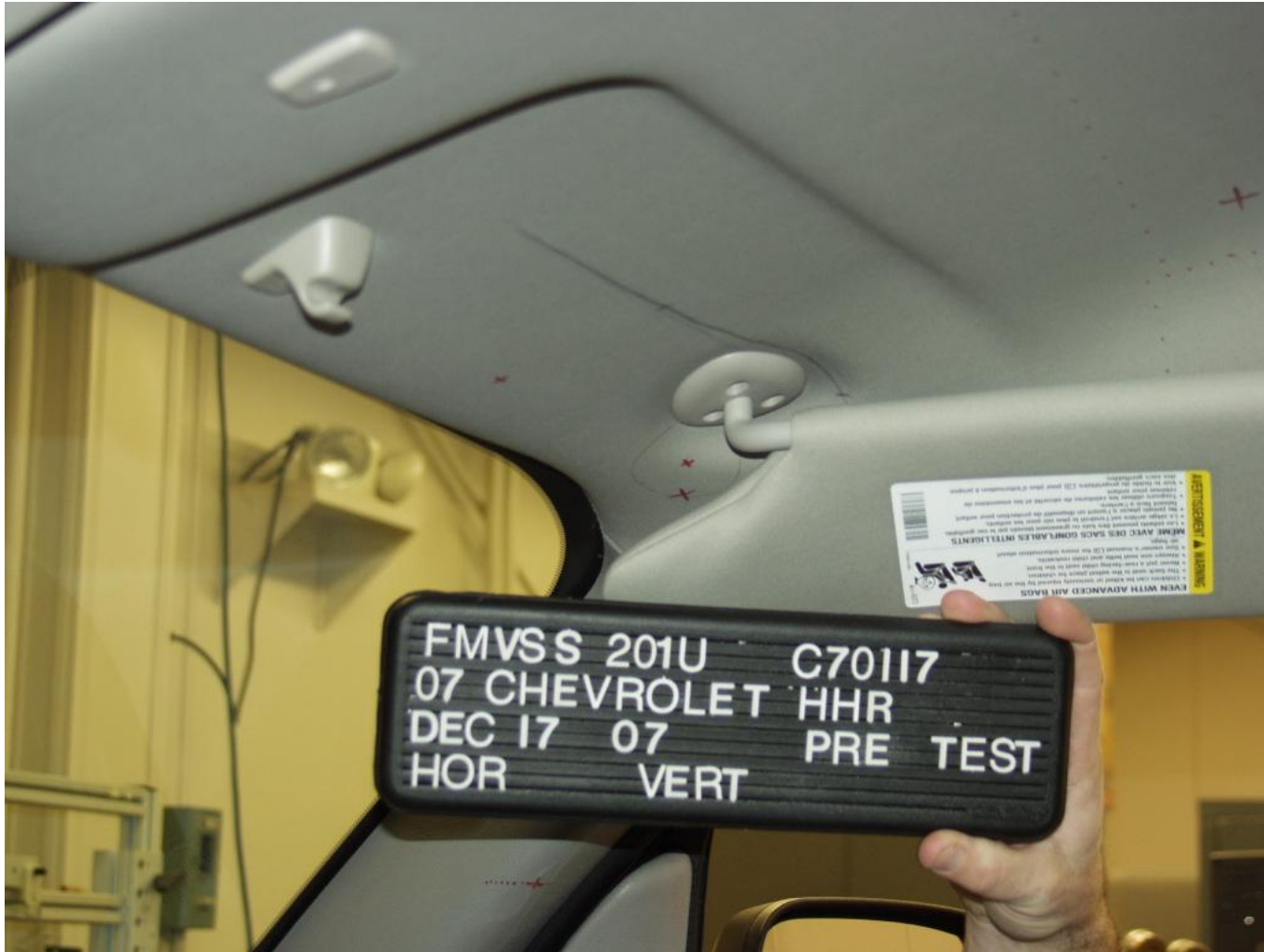


Figure A-14 : PRE-TEST PASSENGER SIDE FRONT HEADER



Figure A-15 : PRE-TEST PASSENGER SIDE SIDE RAIL



Figure A-16 : PRE-TEST PASSENGER SIDE B-PILLAR



Figure A-17 : PRE-TEST PASSENGER SIDE OTHER PILLAR





Figure A-18 : PRE-TEST PASSENGER SIDE REAR PILLAR



Figure A-19 : POST-TEST DRIVER SIDE A-PILLAR

## **APPENDIX B**

### **PART 572L PERFORMANCE CALIBRATION IN SUPPORT OF VEHICLE SAFETY COMPLIANCE TESTING FOR OCCUPANT PROTECTION IN INTERIOR IMPACT**

Appendix B contains the results from certification tests performed on the Free Motion Headform utilized in this test program. The results indicate that the headform meet all of the performance specifications given in 49 CFR Part 572 Subpart L.

The tests were conducted at the Dummy Certification Test Facility of Calspan Corporation. A summary of the test results are included in this Appendix.

**PART 572L  
HEAD DROP PRE-TEST**

<b>MANUFACTURER:</b>		<b>DENTON ATD INC.</b>	
<b>SERIAL NUMBER:</b>		<b>0355</b>	
<b>CALIBRATION DATE:</b>		<b>November 26, 2007</b>	
<b>TEST PARAMETER</b>	<b>SPECIFICATION</b>	<b>TEST RESULTS</b>	
<b>TEMPERATURE</b>	<b>19°C to 26°C</b>	<b>22.2</b>	
<b>RELATIVE HUMIDITY</b>	<b>10% to 70%</b>	<b>30.0</b>	
<b>PEAK RESULTANT ACCELERATION</b>	<b>225 Gs to 275 Gs</b>	<b>245.81</b>	
<b>PEAK LATERAL ACCELERATION</b>	<b>15 Gs Maximum</b>	<b>2.53</b>	
<b>IS ACCELERATION CURVE UNIMODAL?</b>	<b>YES</b>	<b>YES</b>	

**HEAD ACCELEROMETER CALIBRATION INFORMATION**

<b>I.D. NUMBER</b>	<b>MANUFACTURER</b>	<b>MODEL NUMBER</b>	<b>SERIAL NUMBER</b>	<b>DATE OF LAST CALIBRATION</b>	<b>DATE OF NEXT CALIBRATION</b>
<b>1 - LONGITUDINAL</b>	<b>ENDEVCO</b>	<b>7264-2000T</b>	<b>J28671</b>	<b>7/10/2007</b>	<b>1/10/08</b>
<b>2 - LATERAL</b>	<b>ENDEVCO</b>	<b>7264-2000T</b>	<b>J32779</b>	<b>7/10/2007</b>	<b>1/10/08</b>
<b>3 - VERTICAL</b>	<b>ENDEVCO</b>	<b>7264-2000T</b>	<b>J25854</b>	<b>7/10/2007</b>	<b>1/10/08</b>

**REMARKS**

# FMVSS 201U - Headform Calibration Drops

Part 572E Head Drop

Calibration Date: November 26, 2007

Serial No: 0355

Work File: Drop0355

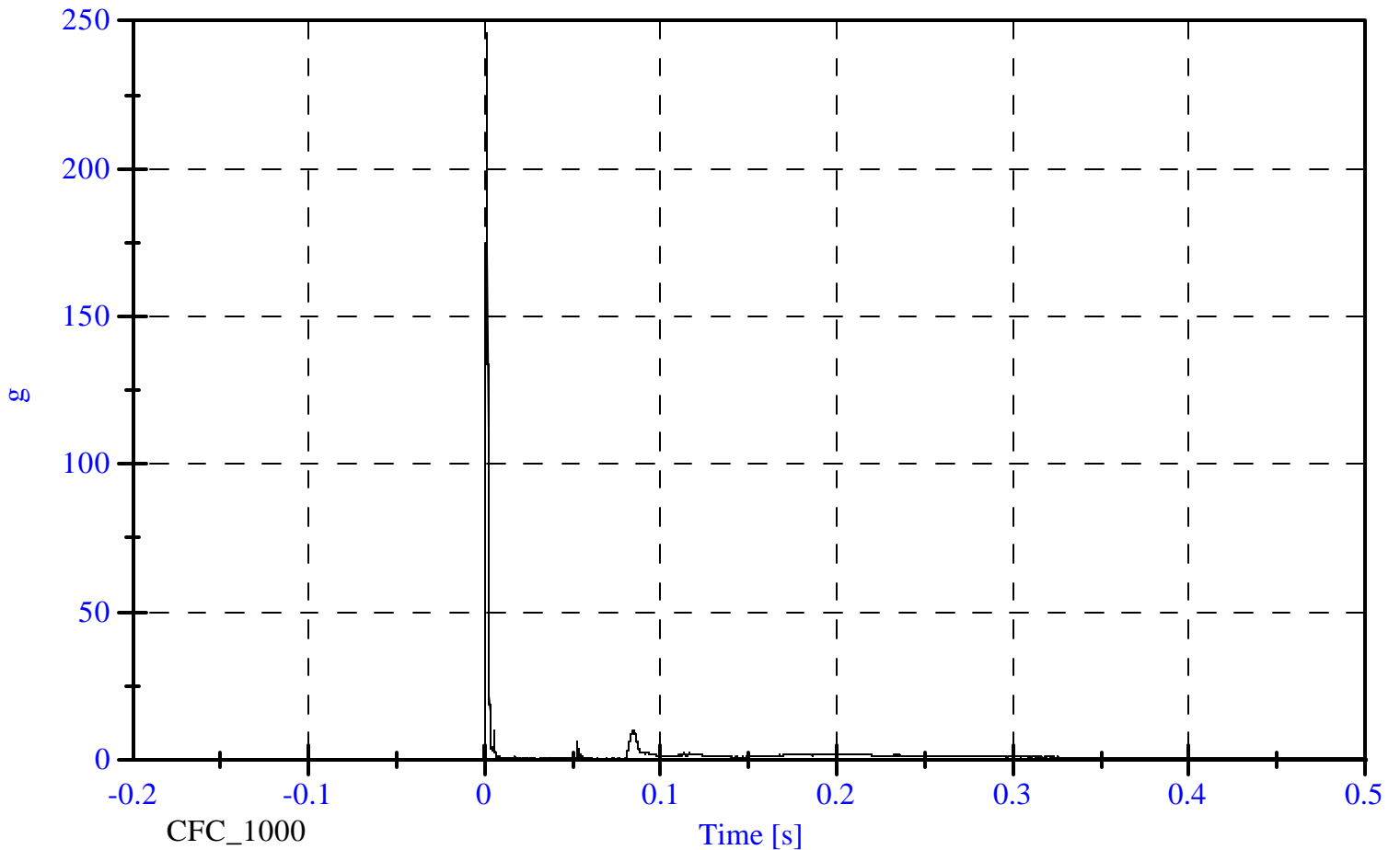
## -----TEST RESULTS-----

<u>TEST CONDITION</u>	<u>PARAMETERS</u>	<u>RESULTS</u>	<u>STATUS</u>
Lab Temperature:	66.0-78.0 F	72.0 F	Passed
Lab Humidity:	10-70 %	30.00 %	Passed
Peak Resultant Accel.:	225-275 Gs	245.81 Gs	Passed
Peak Lateral Accel.:	15 Gs Max	2.53 Gs	Passed
Curve PerCent NonModal:	< 10%	4.16 %	Passed

FMVSS 201U - Headform Calibration Drops Headform Resultant

Max: 245.8 [g] at 0.001 [s]

Min: 0.0 [g] at -0.004 [s]



**PART 572L  
HEAD DROP POST-TEST**

<b>MANUFACTURER:</b>		<b>DENTON ATD INC.</b>	
<b>SERIAL NUMBER:</b>		<b>0355</b>	
<b>CALIBRATION DATE:</b>		<b>December 17, 2007</b>	
<b>TEST PARAMETER</b>	<b>SPECIFICATION</b>	<b>TEST RESULTS</b>	
<b>TEMPERATURE</b>	<b>19°C to 26°C</b>	<b>20.0</b>	
<b>RELATIVE HUMIDITY</b>	<b>10% to 70%</b>	<b>20.0</b>	
<b>PEAK RESULTANT ACCELERATION</b>	<b>225 Gs to 275 Gs</b>	<b>258.96</b>	
<b>PEAK LATERAL ACCELERATION</b>	<b>15 Gs Maximum</b>	<b>6.84</b>	
<b>IS ACCELERATION CURVE UNIMODAL?</b>	<b>YES</b>	<b>YES</b>	

**HEAD ACCELEROMETER CALIBRATION INFORMATION**

<b>I.D. NUMBER</b>	<b>MANUFACTURER</b>	<b>MODEL NUMBER</b>	<b>SERIAL NUMBER</b>	<b>DATE OF LAST CALIBRATION</b>	<b>DATE OF NEXT CALIBRATION</b>
<b>1 - LONGITUDINAL</b>	<b>ENDEVCO</b>	<b>7264-2000T</b>	<b>J28671</b>	<b>7/10/2007</b>	<b>1/10/08</b>
<b>2 - LATERAL</b>	<b>ENDEVCO</b>	<b>7264-2000T</b>	<b>J32779</b>	<b>7/10/2007</b>	<b>1/10/08</b>
<b>3 - VERTICAL</b>	<b>ENDEVCO</b>	<b>7264-2000T</b>	<b>J25854</b>	<b>7/10/2007</b>	<b>1/10/08</b>

**REMARKS:**

# FMVSS 201U - Headform Calibration Drops

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