General Motors

CRASH TEST SPECIAL REPORT

I. Overview

A. General Description

Crash No.	C14934
Crash Mode:	40.0 kph Angular Right
Crash Date:	24 June 2004 (Data: 1 July 2004)
Platform:	GMX001
Build Level:	IVER
Target Deploy time:	Pretensioners: 30 ms Stage 1: 30 ms Stage 2: 45 ms 5"-30ms time: 36 ms

Vehicle Type:	Sedan
Engine Option:	L61
Drive Train Option:	Front Wheel Drive
Test Weight:	Front: Unk kg Rear: Unk kg Total: Unk kg
Occupants:	Driver and Passenger Hybrid III Dummies
Vehicle Number:	15AN4039

B. Module Description

Module Name	GM Epsilon SDM
Module Part Number	001101025474
PWB Level	Production; S/W: 0F01021104
Bracket Level	None
Algorithm Level	SFA v. 2.1
Algorithm Calibration	PFT3210A.par – SDM; GMX001_ECS_Beta.par - EFS
Safing Sensor Level	Production
Safing Sensor Type	SFT Trigger Switch
Siemens Subsystem Engineer	Douglas McConnell, front algorithm engineer

C. Summary

The purpose of this special report is to evaluate an anomaly noted in the test data on this event. It was noted that the EFS and both SIS's were powered down 170ms from t0. The SDM accels did not power down. This appeared to be indicative of an ignition cycle, because the satellites were powered down but not the SDM accels, and EDR still wrote completely to EEPROM.

The same results were reproduced on the bench with simulation of the sending of an SDM Power Off GMLan message in combination with the ILL transition during the simulated crash. It is believed that the Ignition Logic Level voltage dropped out during the event, causing the body controller to send an SDM Power Off message over GMLan, which resulted in the ignition cycle by the SDM.

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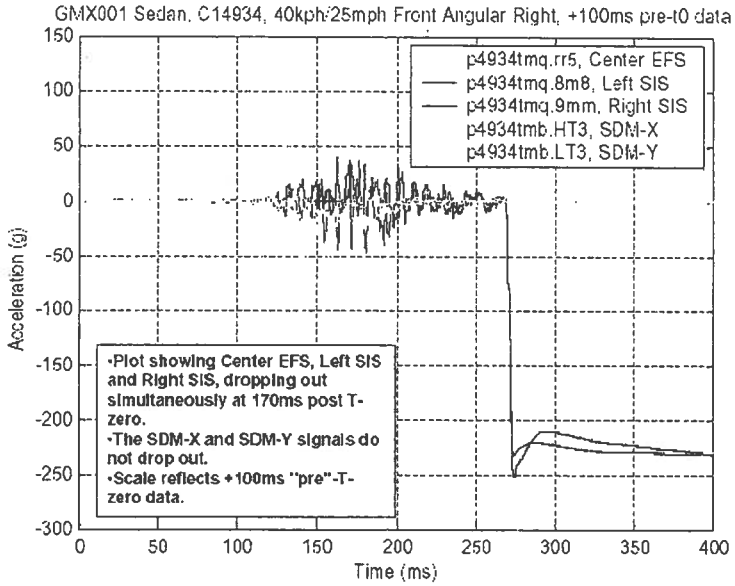
II. Analysis and Discussion

Below is a plot showing the accelerometer 't apped' signals for event C14934, 40kph righ angular. Siemens provides a voltage output from the accelerometers to compare with reference accelerometers and to determine the viability of location in the engine compartment or door.



23JULY2004 gmx001_c14934_rr5_8m8_9mm_ht3_lt3_plots.ppt 1

As the plot shows, all satellites were shut down simultaneously during the event. Battery voltage was monitored and did not drop out. This differs from the case where a battery loss condition is qualified at the SDM. In the battery loss case the SIS's are shut down immediat ely while the EFS's are powered for an additional 60ms.
Reviewing the frontal and side crashes for GMX001, this phenomenon was noted on the following events:

Event	Mode	EFS Off Time	SIS's Installed?	SIS Off Time	Stg 1 / Stg 2	EDR RunTime
C14607	64kph Offs et Deformable Barrier (Sedan)	65ms	Yes	134ms	29ms / 130ms	232ms
C14702	40kph Angular Right (Sedan)	169ms	Yes	169ms	46ms / 60ms	152ms
C14934	40kph Angular Right (Sedan)	170ms	Yes	170ms	41ms / 57ms	152ms
C14846	40kph Offset Deformable Barrier (Coupe)	85ms	Yes	144ms	40ms / 141ms	180ms

The GMX295 Beta events were reviewed and this phenomenon was not present in any severe event.

II. Analysis and Discussion (cont'd)

After discussion with Siemens VDO hardware and software engineers, it was decided to set up tests in the Lab to reproduce the results. A vehicle virtual car was modified to change its GMLan messages from SDM Run to SDM Off when relays controlled by CrashSim were activated. This provided precise activation of the condition relative to the crash event. A scope was used to capture the Power Mode change, crash t0, and the EFS C and SIS L supply voltages. Several tests were run, and results are shown in the table below:

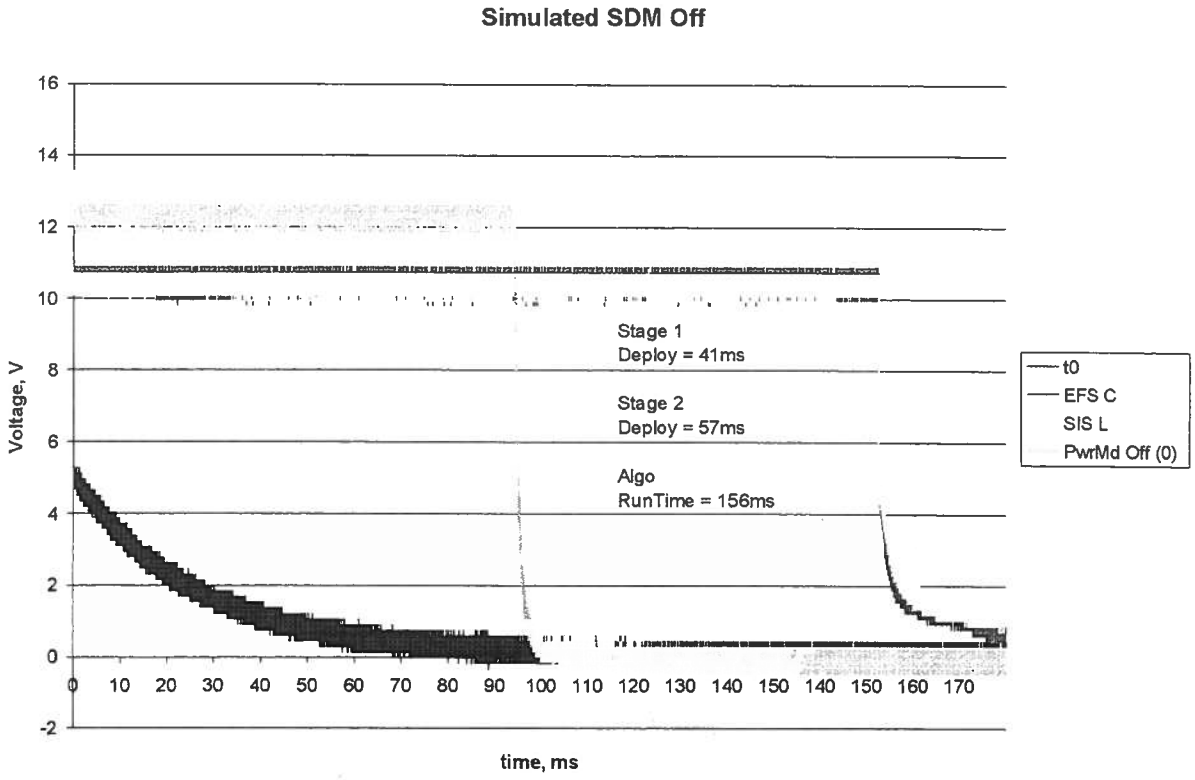
Note: all runs except the ND had EDR runtime of 156ms from algorithm wakeup. Note also that all times in the table are relative to t0.

Run	Pwr Mode Off (CS)	Pwr Mode Off (scope)	EFS/SIS shutdown	Deploy (Stg 1/Stg 2)
1	20ms	42ms	120ms	41ms / 57 ms
2	80ms	95ms	174ms	41ms / 57 ms
3	10ms	34ms	116ms	41ms / 57 ms
4	0ms	20ms	91ms	41ms / 57 ms
5	-10ms	7ms	90ms	51ms / 67 ms
6	-20ms	2ms	70ms	61ms / 77 ms
7	-40ms	-16ms	63ms	81ms / 97 ms
8	100ms	118ms	186ms	41ms / 57ms
9	-100ms	-80ms	-15ms	NT
	2 EFS Setup:			
10	20ms	42ms	115ms	20ms / 22ms
	1 EFS,	**Stage 2 Disposal :**		
11	-20ms	5ms	70ms	70ms / 171ms

This table shows the relationship between when the request for SDM power down occurs (Pwr Mode Off (scope)) and when the SDM actually shuts off the satellites (EFS/SIS shutdown). This is consistent with the way the software operates: when the ignition voltage drops off, the software qualifies the ILL state change over a 60ms window. The SDM Off GMLan message should be received during this time to prevent mismatch faults from being considered. The SDM does not drop out of Phase 4 (Normal Run Mode) at this time, because the algorithm is still active or squibs still need to deploy. After the algorithm resets or squibs have deployed, the SDM completes the ignition cycle by running re - initialization routines for many of the software mo dules. If only ILL or a GMLAN power -mode messages were received, it would NOT cause this behavior. This behavior is only consistent with both being received for the SDM to act upon the power-mode transition. The testing above is consistent with the soft ware code flow explanation.

II. Analysis and Discussion (cont'd)

The plot below graphically shows the voltages of the SDM power mode and the EFS and SIS as well as t0 indication (Run 2):



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III. Recommendations

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It is recommended that future severe crashes have ignition voltage and GMLan messages monitored to determine the root cause of the SDM Power Off issue.

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