

From: [REDACTED]
To: Paul.Simmons@dot.gov
Cc: nathan.ong@dot.gov; Brian.Smith@dot.gov; Scott.Yon@dot.gov; [REDACTED]
Subject: RE: Hyundai EOS
Date: Wednesday, May 8, 2019 1:54:19 PM
Attachments: [REDACTED]

Paul,
Below is the EOS bench test set-up and results.

We can discuss in today's meeting

On June 8 – June 12, 2018 Design Research Engineering performed negative transient testing on (3) TRW-ACUs applicable to the 2011 Hyundai Sonata.

Below is a summary of DRE's test

Equipment;

- (3) TRW ACUs procured from a salvage yard.
- (1) In-line prototype wireharness that contained Schottky diodes on the front left and front right impact sensor inputs
- (1) 2011 Hyundai Sonata
- (1) External power supply (to provide negative voltages)
- (1) External relay (to control negative voltage pulse duration)
- (1) Waveform generator (to turn external relay on and off)
- (1) Oscilloscope (to monitor impact sensor signals)
- (1) OBD Scan Tool

Test Summary;

With the vehicle ignition switch in the on/run position negative voltage pulses with a duration of 2 milliseconds were delivered to the ACU via the front left impact sensor low-side wire.

Module 1:

46 pulses ranging from 0.0V to -15.0V (0.0V to -3.0V in increments of -0.1V, -3.0V to -6.0V in increments of -0.5V and -6.0V to -15.0V in increments of -1.0V)

Module 2:

5 pulses. -0.1V, -1.0V, -5.0V, -10.0V, and -15.0V

Module 3:

1 pulse of -15.0V

In each test the left front sensor low-side signal was flat-lined for ~1.2 to 1.3 seconds then recovered back to normal. The ACUs continued to communicate with the scan tool after each test and no fault codes were set. Post testing measurements of the ACU internal circuitry were consistent with normal (pre-test) ACU measurements.

Module 3 (re-test):

The in-line prototype wireharness was removed from the third module.

A single -15.0V negative pulse with a duration of 2 milliseconds was delivered to the third ACU via the front left impact sensor low-side wire.

The test resulted in sustained abnormal signals for both the front left and front right impact sensors and 9 fault codes including B1620 (Internal Fault) were set.

Visual damage to the DS84 ASIC was observed.

Internal ACU electrical measurements were inconsistent with normal (pre-test) measurements.

Conclusion (from Design Research Engineering)

Testing of three SRS control modules found that the addition of the prototype inline harness with Schottky diodes provided additional protection of the module to negative voltage transients introduced on the front impact sensor wiring. There were no indications of failure of any of the three tested SRS control modules due to negative voltage transients when tested with the prototype inline harness installed.

Images of the in-line wireharness installation location.

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Wayne, as you know, ODI has an open investigation EA19-001 regarding non-airbag deployments. I would like to get a test report and setup used to during Hyundai's bench testing to verify system robustness and transient suppression.

Please let me know if you have any questions.

Regards,

Paul Simmons

Chief, Vehicle Defects Division C

US DOT, NHTSA

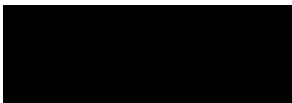
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