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ENVIRONMENTAL TEST REPORT

RockAIR

Tracking/Messaging Device

Chris Hinch
TracPlus Global Ltd.
Level 1
286 Princes Street
PO Box 1466
Dunedin 9054 New Zealand

PROJECT #:	17CA038
DATE TESTING STARTED:	05/10/2017
DATE TESTING COMPLETED:	06/08/2017
EUT(s) SUBMITTED:	Quantity: Two (2) Part Number: RockAIR Serial Numbers: JJA-RQN-A & RGL-EYQ-A FR3010 BLK Housing Material & Elastosil LR 3003/70 A&B (See Test Results Summary Table for details)

Prepared by: Blair Gannegan - Test Engineer

Signature: Blair Gannegan

Reviewed By: Jim Scocchera

Signature: Jim Scocchera

Tests Conducted By: Blair Gannegan & Jim Scocchera

Signature: Blair Gannegan Jim Scocchera

Approved By: Doug Harris

Signature: Doug Harris

Date: 06/30/2017

Revision Level: Initial

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REFERENCE DOCUMENTS

- RTCA DO-160G, Environmental Conditions and Test Procedures for Airborne Equipment, hereafter referred to as RTCA DO-160G

INTRODUCTION

TracPlus Global contracted test services for environmental testing with DLS CA. This report documents the preparations, set-up and methods for testing of the EUT (Equipment Under Test) described in the table below.

Testing was performed between 05/10/2017 and 06/08/2017. The tests that were performed are listed in the table below. All testing was performed at and under the control of DLS Conformity Assessment, Inc., 200 E. Marquardt Drive, Wheeling, IL 60090. DLS is an ISO/IEC 17025:2005 accredited test lab.

TEST FACILITY

Testing was performed by DLS CA at its laboratory facility located at 200 E. Marquardt Drive, Wheeling, IL 60090.

TEST ITEMS

DLS CA received two (2) EUTs, blank housing material and Elastosil sleeving material described in the table below. The test units were received at DLS CA on or before 05/10/2017. The EUTs were examined visually prior to testing and were found to have no visible defects.

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TEST RESULTS SUMMARY

Test Name	EUT	Test Summary	Test Result
Ground Survival & Operating Low Temperature	Quantity: One (1) Tracking/Messaging Unit Part Number: RockAIR Serial Number: JJA-RQN-A	RTCA DO-160G, Section 4.5.1 -55°C EUT Unpowered for Three (3) Hrs, Section 4.5.2 EUT Powered for Two (2) Hrs	Conforms
Ground Survival & Operating High Temperature	Quantity: One (1) Tracking/Messaging Unit Part Number: RockAIR Serial Number: JJA-RQN-A	RTCA DO-160G, Section 4.5.3 -55°C EUT Unpowered for Three (3) Hrs, Section 4.5.4 EUT Powered for Two (2) Hrs	Conforms
Altitude	Quantity: One (1) Tracking/Messaging Unit Part Number: RockAIR Serial Number: JJA-RQN-A	RTCA DO-160G, Section 4.6.1 25,000 Ft. For Two (2) Hrs, EUT Powered	Conforms
Vibration	Quantity: Two (2) Tracking/Messaging Units Part Number: RockAIR Serial Numbers: JJA-RQN-A & RGL-EYQ-A	RTCA DO-160G, Section 8.8.1, EUT Powered, Cat R, Curve G Performance / Endurance Tests	EUT JJA-RQN-A lost 24 Vdc function in vertical axis; EUT RGL-EYQ-A is conforming
Operational Shock	Quantity: One (1) Tracking/Messaging Unit Part Number: RockAIR Serial Number: RGL-EYQ-A	RTCA DO-160G, Section 7.2.1 Six (6) Sawtooth Pulses of Six (6) g's, 11 msec in Each of Three (3) Axes	Conforms
Crash Safety (Impulse)	Quantity: One (1) Tracking/Messaging Unit Part Number: RockAIR Serial Number: RGL-EYQ-A	RTCA DO-160G, Section 7.3.1 Two (2) Sawtooth Pulses of Twenty (20) g's, 11 msec in Each of Three (3) Axes	Conforms
Crash Safety (Sustained)	Quantity: One (1) Tracking/Messaging Unit Part Number: RockAIR Serial Number: RGL-EYQ-A	RTCA DO-160G, Section 7.3.3, Table 7-1, Aircraft Type 5, Test Type F (Known Frequency) Acceleration for Three (3) Seconds in Each of Six (6) Orientations	Conforms
Flammability	Quantity: One (1) Tracking/Messaging Unit Part Number: RockAIR Serial Number: RGL-EYQ-A Quantity: nine (9) Pieces FR3010 BLK Housing Material & brackets Quantity: Three (3) Pieces Elastosil LR 3003/70 A&B Sleeves	RTCA DO-160G, Section 26, Category C, Vertical Method for RockAIR EUT & Housing Material, Horizontal Method for Elastosil LR 3003/70 A&B Sleeves	Conforms

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TEST REQUIREMENTS – (Applicable Documents)

Testing of the EUT items were conducted in accordance to:

1) RTCA DO-160G

If applicable, the Customer provided data sheets and instructions for recording of operational testing throughout the testing.

☐ Yes (Customer provided documents - See Appendix A)

☒ No (No documents provided by Customer)

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GROUND SURVIVAL & OPERATING LOW TEMPERATURE

TEST DATES
05/10/2017 & 05/12/2017

EQUIPMENT UNDER TEST (EUT)
Quantity: One (1) Tracking / Messaging Unit
Part Number: RockAIR
Serial Number: JJA-RQN-A

TEST SPECIFICATION(s)
RTCA DO-160G, Sections 4.5.1 & 4.5.2

REQUIREMENTS
The EUT shall undergo ground survival low temperature testing per RTCA DO-160G, Section 4.5.1, and operating low temperature per RTCA DO-160G, Section 4.5.2. Category B2 parameters shall be used for both tests. The EUT shall withstand exposure to low temperatures for extended periods of time as indicated. There shall be no physical or electrical failures that prevent the EUT from being operated per customers post-test requirements, nor shall the EUT sustain physical damage.

PROCEDURE (Ground Survival Low Temperature)

RTCA DO-160G, Section 4.5.1

1. Place the EUT in the environmental chamber.
2. Attach a thermocouple to the EUT on the top surface approximately in the center.
3. Connect a dc power supply capable of delivering a maximum of 24 Vdc to the EUT, at the 24 Vdc power input connector.
4. Perform a pre-environment functional test on the EUT per customer requirements.
5. At ambient temperature and pressure, and with the EUT not operating, adjust the chamber temperature to −55 °C.
6. Maintain the −55 °C temperature for three (3) hours minimum, then proceed immediately to the procedure below.

PROCEDURE (Operating Low Temperature)

RTCA DO-160G, Section 4.5.2

1. Adjust the chamber to -45°C and energize the EUT to 24 Vdc.
2. Maintain the -45°C temperature for two (2) hours minimum,with the EUT continuously energized at 24 Vdc.

3. Return the chamber temperature to ambient conditions and perfom a post-environment functional test on the EUT per the customer requirements.
4. Inspect the EUT visually and report any damage observed.
5. De-energize the EUT. Disconnect the power input leads from the 24 Vdc input connector of the EUT.
6. Adjust the power supply to 5 Vdc. Connect the leads the the 5 V USB input connector of the EUT.
7. Repeat both the ground survival and operating low temperature tests described above. The EUT is to be energized to 5 Vdc for the operating low temperature test.

TEST RESULTS

Testing proceeded immediately from ground survival low temperature to operating low temperature, with no break in between in each operating mode.

The EUT successfully passed 3 hours of testing at -55°C and 2 hours of testing at -45°C in both the 24 Vdc and 5 Vdc USB modes. Following the test, a post-test functional check and a visual examination were performed. The EUT performed satisfactorily, and no damage was observed.

EQUIPMENT USED

Equipment	Manufacturer	DLS Lab Number	Model#	Date Calibrated	Calibration Due Date
Environmental Chamber	Test Equity	281	3007C	N/A	Verified w/Calibrated Data Acquisition Unit
Data Acquisition Unit	Agilent	222	34970A	12/27/2016	12/27/2017
Digital Multimeter (DMM)	Fluke	262	87 V	10/24/2016	10/24/2017
DC Power Supply	Yescom	260	DCP-3010D	N/A	Verified w/Calibrated DMM

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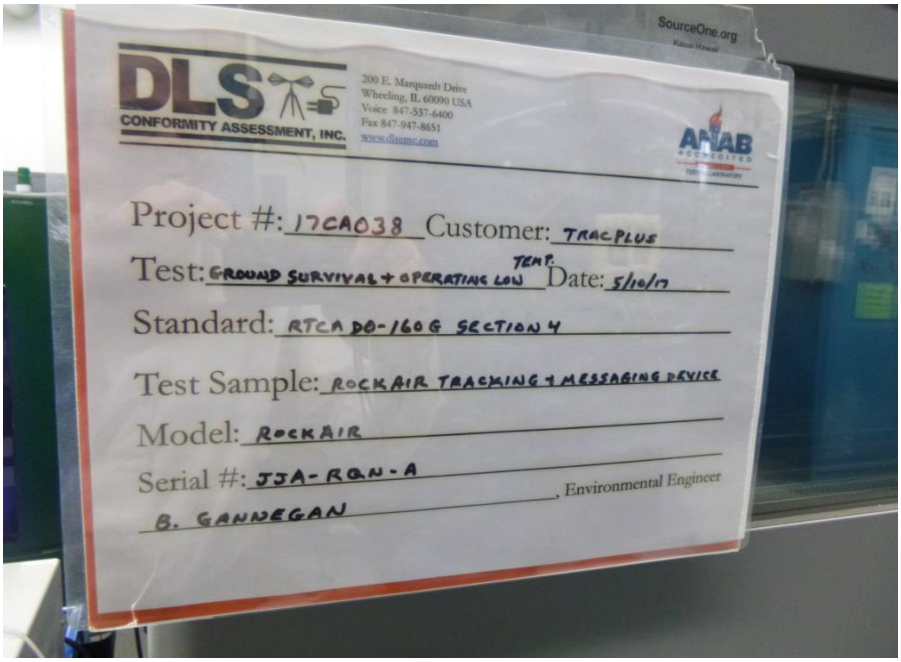
PHOTOS



Test Title

Test Environmental Chamber

EUT inside Chamber

External Test Setup

EUT After Ground Survival and Operating Low Temperature Tests in 24 Vdc Mode

EUT After Ground Survival and Operating Low Temperature Tests in 5 Vdc USB Mode

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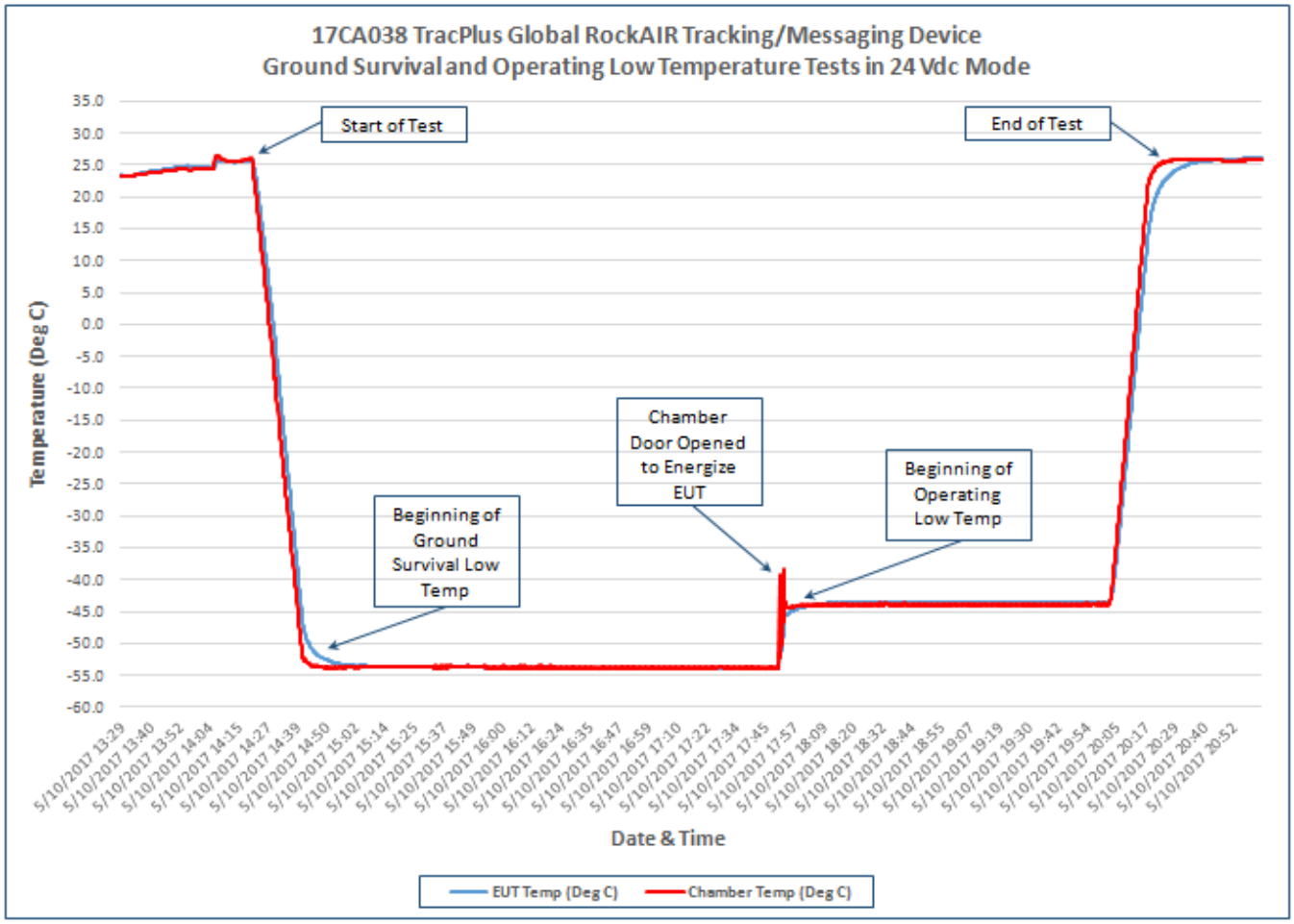
TEST DATA



Ground Survival & Operating Low Temperature Profile in 24 Vdc Mode

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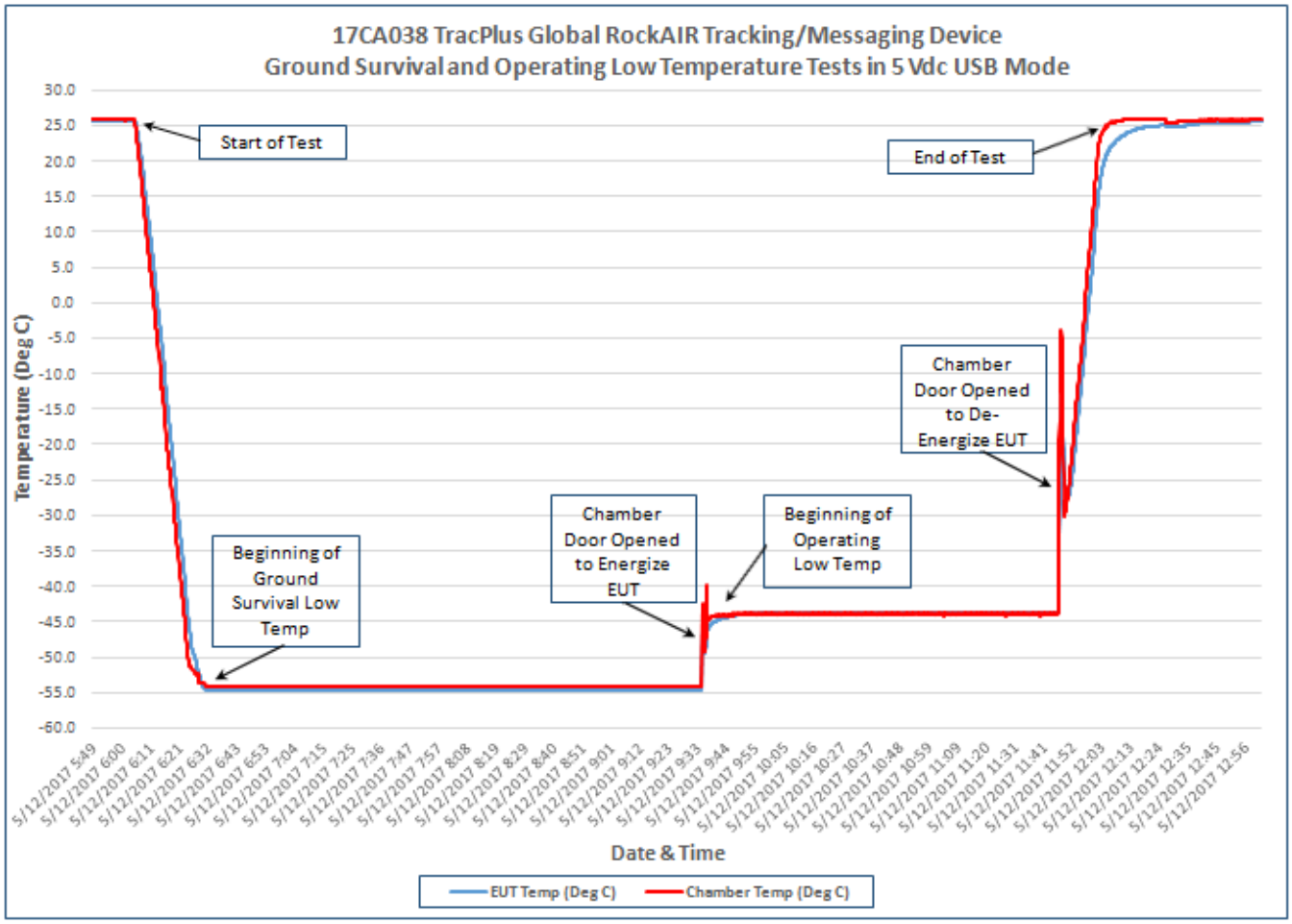

Ground Survival & Operating Low Temperature Profile in 5 Vdc USB Mode

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GROUND SURVIVAL & OPERATING HIGH TEMPERATURE

TEST DATES
05/11/2017, 05/12/2017 & 05/15/2017

EQUIPMENT UNDER TEST (EUT)
Quantity: One (1) Tracking / Messaging Unit
Part Number: RockAIR
Serial Number: JJA-RQN-A

TEST SPECIFICATION(s)
RTCA DO-160G, Sections 4.5.3 & 4.5.4

REQUIREMENTS
The EUT shall undergo ground survival high temperature testing per RTCA DO-160G, Section 4.5.3, and operating high temperature per RTCA DO-160G, Section 4.5.4. Category B2 parameters shall be used for both tests. The EUT shall withstand exposure to high temperatures for extended periods of time as indicated. There shall be no physical or electrical failures that prevent the EUT from being operated per customers post-test requirements, nor shall the EUT sustain physical damage.

PROCEDURE (Ground Survival High Temperature)

RTCA DO-160G, Section 4.5.3

1. Place the EUT in the environmental chamber.
2. Attach a thermocouple to the EUT on the top surface approximately in the center.
3. Connect a dc power supply capable of delivering a maximum of 24 Vdc to the EUT, at the 24 Vdc power input connector.
4. Perform a pre-environment functional test on the EUT per customer requirements.
5. At ambient temperature and pressure, and with the EUT not operating, adjust the chamber temperature to +85°C.
6. Maintain the +85°C temperature for three (3) hours minimum, then proceed immediately to the procedure below.

PROCEDURE (Operating High Temperature)

RTCA DO-160G, Section 4.5.4

1. Adjust the chamber to +70°C and energize the EUT to 24 Vdc.
2. Maintain the +70°C temperature for two (2) hours minimum,with the EUT continuously energized at 24 Vdc.

3. Return the chamber temperature to ambient conditions and perfom a post-environment functional test on the EUT per the customer requirements.
4. Inspect the EUT visually and report any damage observed.
5. De-energize the EUT. Disconnect the power input leads from the 24 Vdc input connector of the EUT.
6. Adjust the power supply to 5 Vdc. Connect the leads the the 5 V USB input connector of the EUT.
7. Repeat both the ground survival and operating high temperature tests described above. The EUT is to be energized to 5 Vdc for the operating high temperature test.

TEST RESULTS

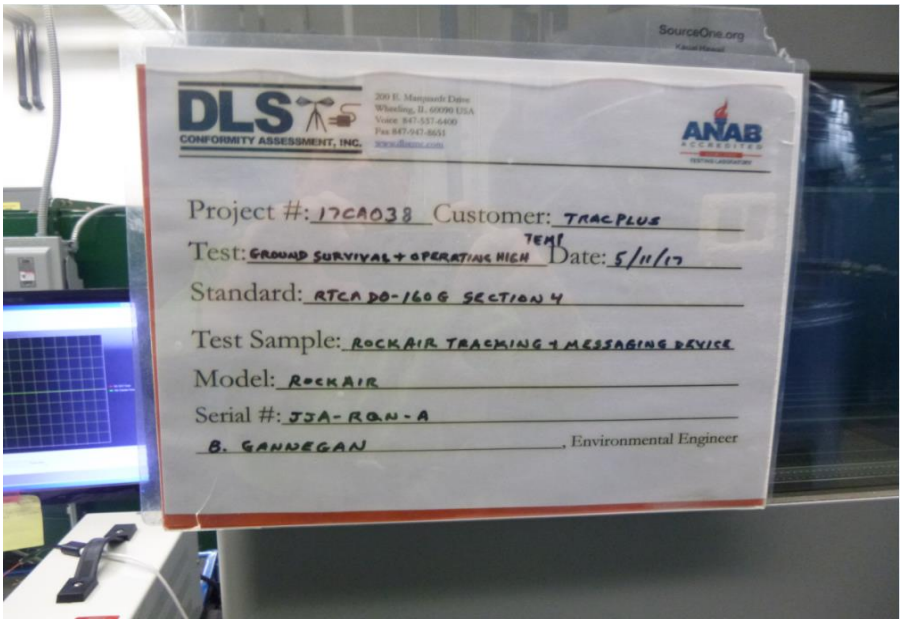
Testing proceeded immediately from ground survival high temperature to operating high temperature, with no break in between in the 24 Vdc operating mode. Due to timing of the tests, the EUT was allowed to return to ambient temperature on conclusion of the ground survival high temperature test in the 5 Vdc USB operating mode. Testing was resumed the following day for operating high temperature in the same mode.

The EUT successfully passed 3 hours of testing at +85°C and 2 hours of testing at +70°C in both the 24 Vdc and 5 Vdc USB modes. Following the test, a post-test functional check and a visual examination were performed. The EUT performed satisfactorily, and no damage was observed.

EQUIPMENT USED

Equipment	Manufacturer	DLS Lab Number	Model#	Date Calibrated	Calibration Due Date
Environmental Chamber	Test Equity	281	3007C	N/A	Verified w/Calibrated Data Acquisition Unit
Data Acquisition Unit	Agilent	222	34970A	12/27/2016	12/27/2017
Digital Multimeter (DMM)	Fluke	262	87 V	10/24/2016	10/24/2017
DC Power Supply	Yescom	260	DCP-3010D	N/A	Verified w/Calibrated DMM

PHOTOS



Test Title

See Ground Survival Low Temperature Section for Test Setup Photos

EUT After Ground Survival and Operating High Temperature Tests in 24 Vdc Mode

EUT After Ground Survival and Operating High Temperature Tests in 5 Vdc USB Mode

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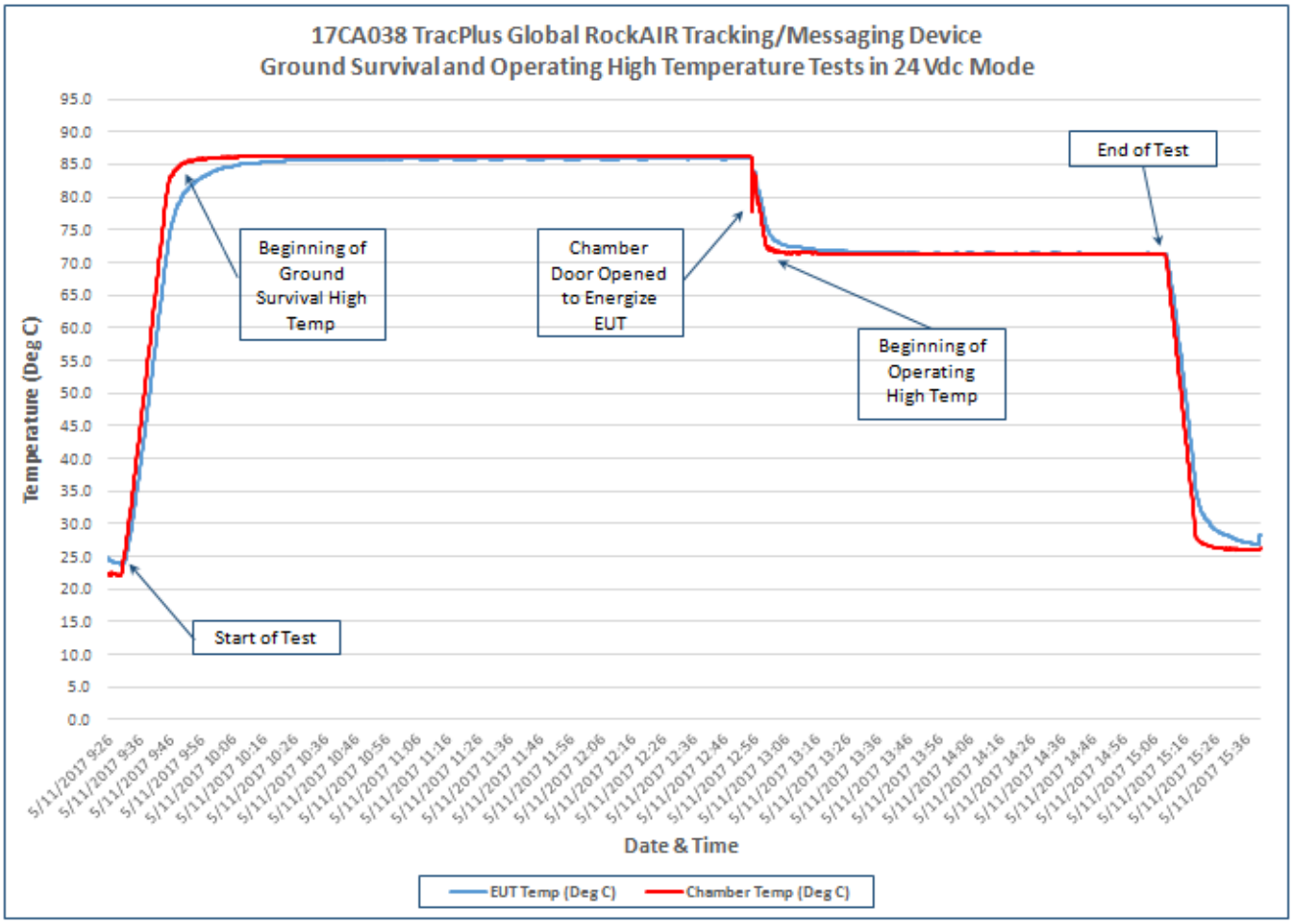
TEST DATA



Ground Survival & Operating High Temperature Profile in 24 Vdc Mode

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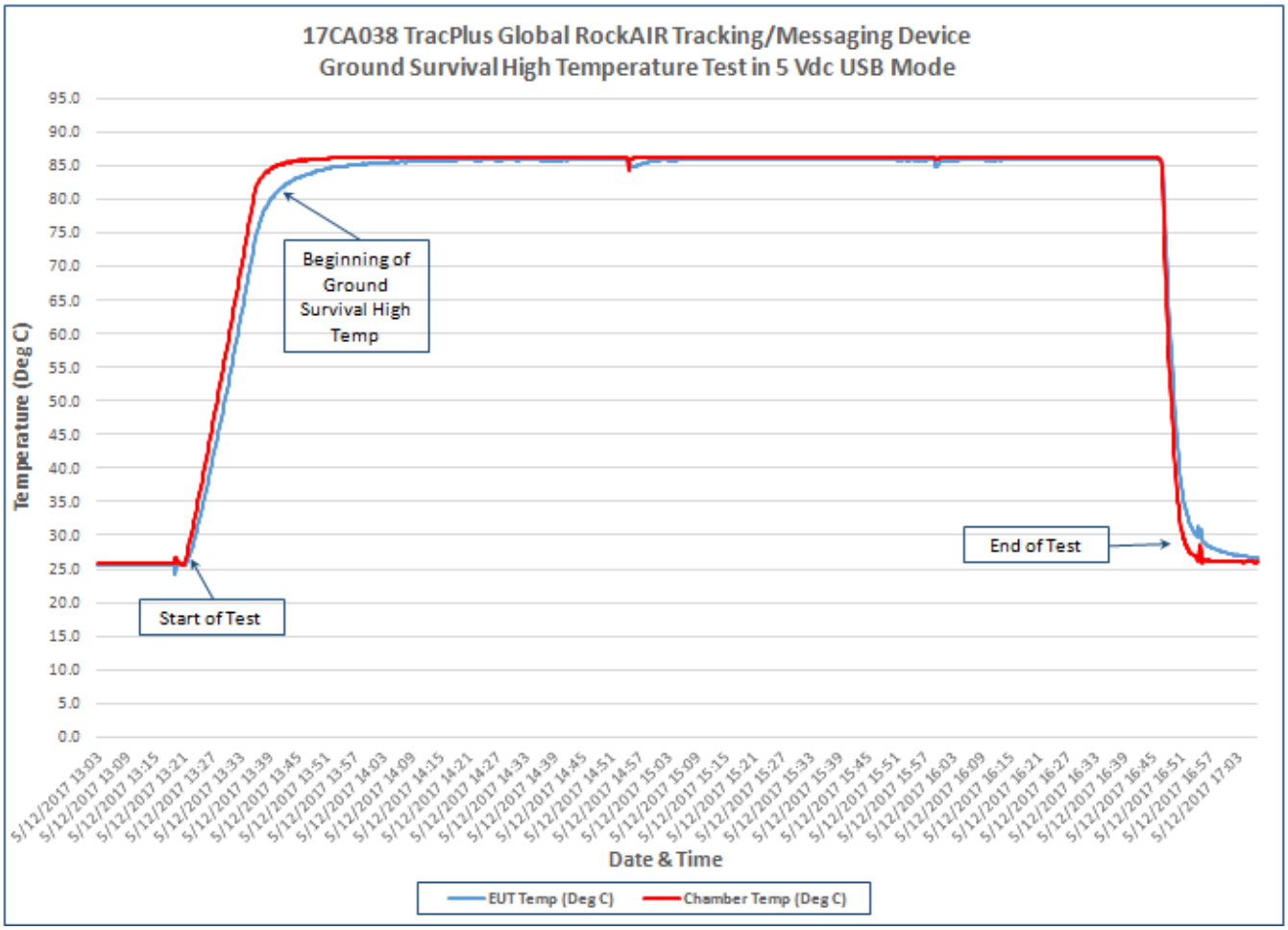
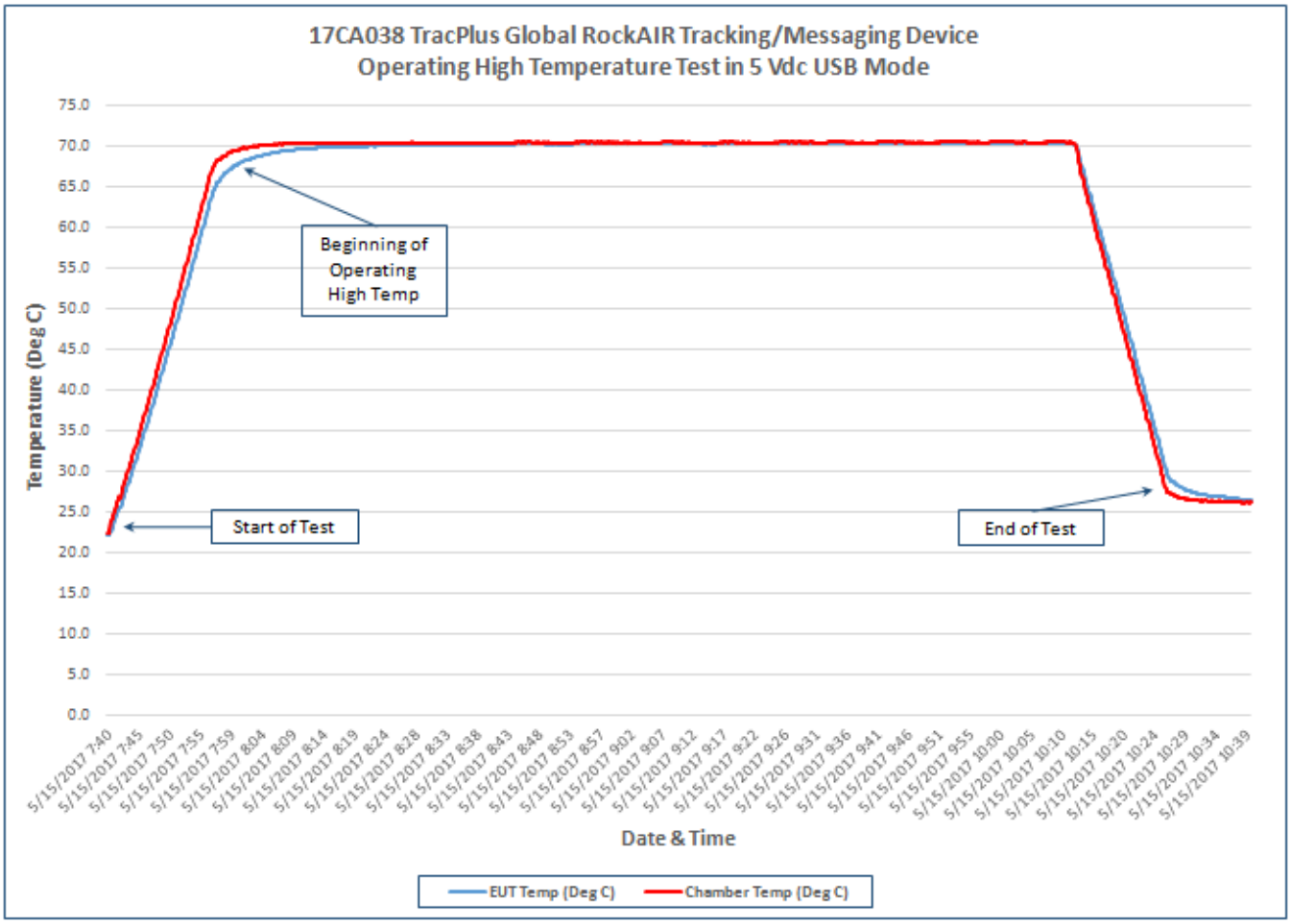


Ground Survival High Temperature Profile in 5 Vdc USB Mode



Operating High Temperature Profile in 5 Vdc USB Mode

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ALTITUDE

TEST DATES
05/15/2017

EQUIPMENT UNDER TEST (EUT)
Quantity: One (1) Tracking / Messaging Unit
Part Number: RockAIR
Serial Number: JJA-RQN-A

TEST SPECIFICATION(s)
RTCA DO-160G, Section 4.6.1

REQUIREMENTS
The EUT shall undergo altitude testing per RTCA DO-160G, Section 4.6.1, Category B2. The EUT shall withstand altitudes up to 25,000 ft or 37.66 kPa. (282.5 Torr) for a period of two (2) hours. The EUT will be operated during testing. There shall be no physical or electrical failures that prevent the EUT from being operated per customers post-test requirements, nor shall the EUT sustain physical damage.

PROCEDURE

RTCA DO-160G, Section 4.6.1 Category

1. Place the EUT in the environmental chamber.
2. Attach a thermocouple to the EUT on the top surface approximately in the center.
3. Connect a dc power supply capable of delivering a maximum of 24 Vdc to the EUT, at the 24 Vdc power input connector.
4. Perform a pre-environment functional test on the EUT per customer requirements.
5. At ambient temperature and pressure, apply 24 Vdc to the EUT.
6. Adjust the chamber pressure to 37.66 kPa (+25,000 feet) and allow the EUT to stabilize.
7. Maintain the 37.66 kPa (+25,000 feet) pressure for two (2) hours minimum.
8. Adjust the chamber pressure to ambient conditions.
9. Allow EUT to stabilize and perfom a post-environment functional test on the EUT per customer requirements.
10. Inspect the EUT visually and report any damage observed.
11. De-energize the EUT. Disconnect the power input leads from the 24 Vdc input connector of the EUT.
12. Adjust the power supply to 5 Vdc. Connect the leads the the 5 V USB input connector of the EUT.
13. Repeat the 25,000 ft. altitude test described above, with the EUT energized to 5 Vdc. Allow the EUT to stabilize and perfom a post-environment functional test on the EUT per the customer requirements.
14. Inspect the EUT visually and report any damage observed.

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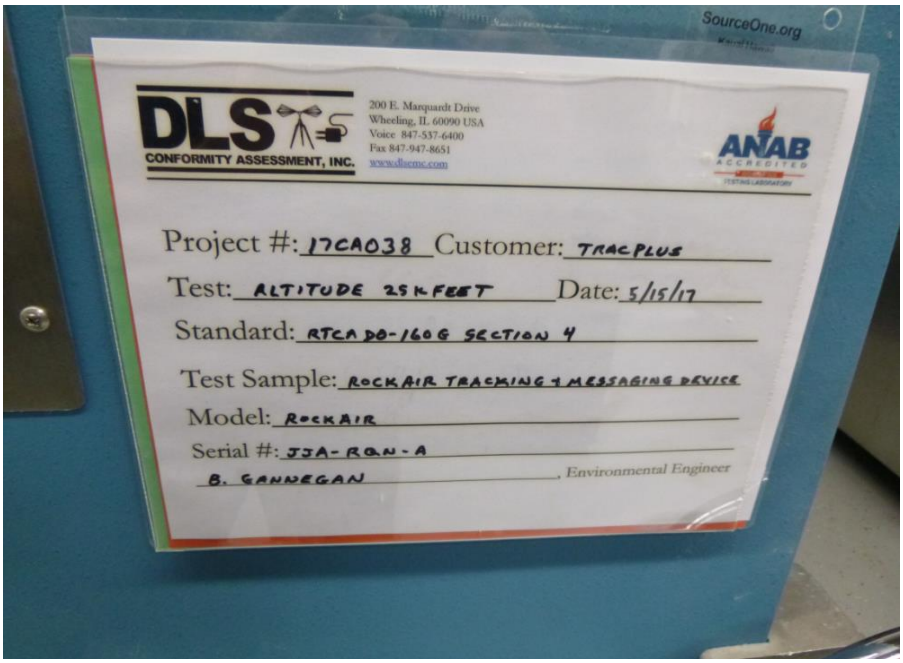
TEST RESULTS

The EUT successfully passed 2 hours of testing at 25,000 ft. in each of the 24 Vdc and 5 Vdc USB modes. Following the tests, a post-test functional check and a visual examination were performed. The EUT performed satisfactorily, and no damage was observed after testing in each operating mode.

EQUIPMENT USED

Equipment	Manufacturer	DLS Lab Number	Model#	Date Calibrated	Calibration Due Date
Altitude Chamber	Tenney	187	15.6ST	N/A	Verified w/Calibrated Chart Recorder
Chart Recorder	Honeywell	200	DR45AT	10/25/2016	10/25/2017
Data Acquisition Unit	Agilent	222	34970A	12/27/2016	12/27/2017
Digital Multimeter (DMM)	Fluke	262	87 V	10/24/2016	10/24/2017
DC Power Supply	Yescom	260	DCP3010D	N/A	Verified w/Calibrated DMM

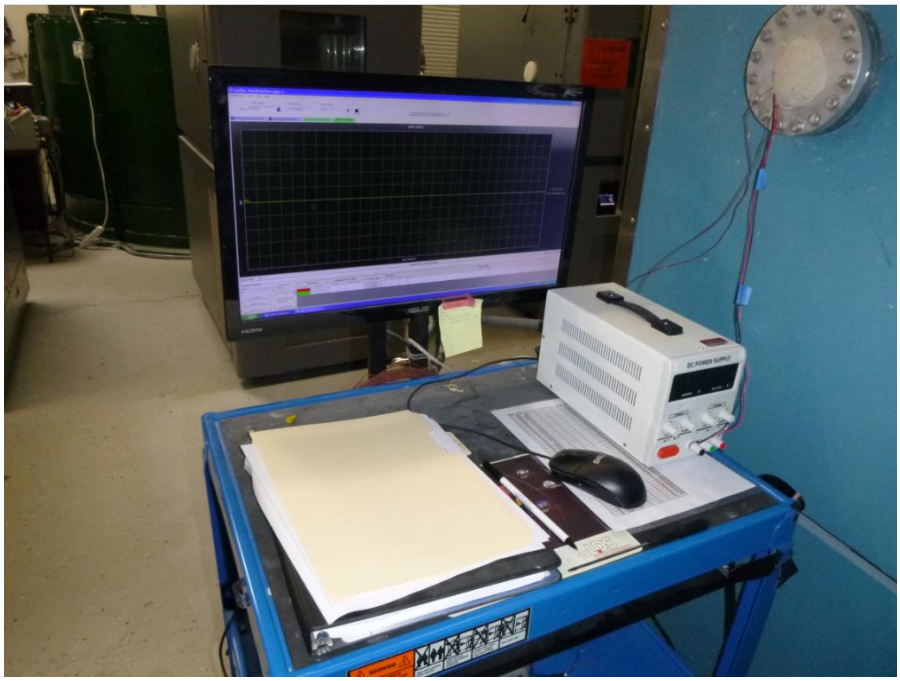
PHOTOS



Test Title

Altitude Chamber

EUT in the Altitude Chamber



External Test Setup

EUT After Altitude Testing in 24 Vdc Mode

EUT After Altitude Testing in 5 Vdc USB Mode

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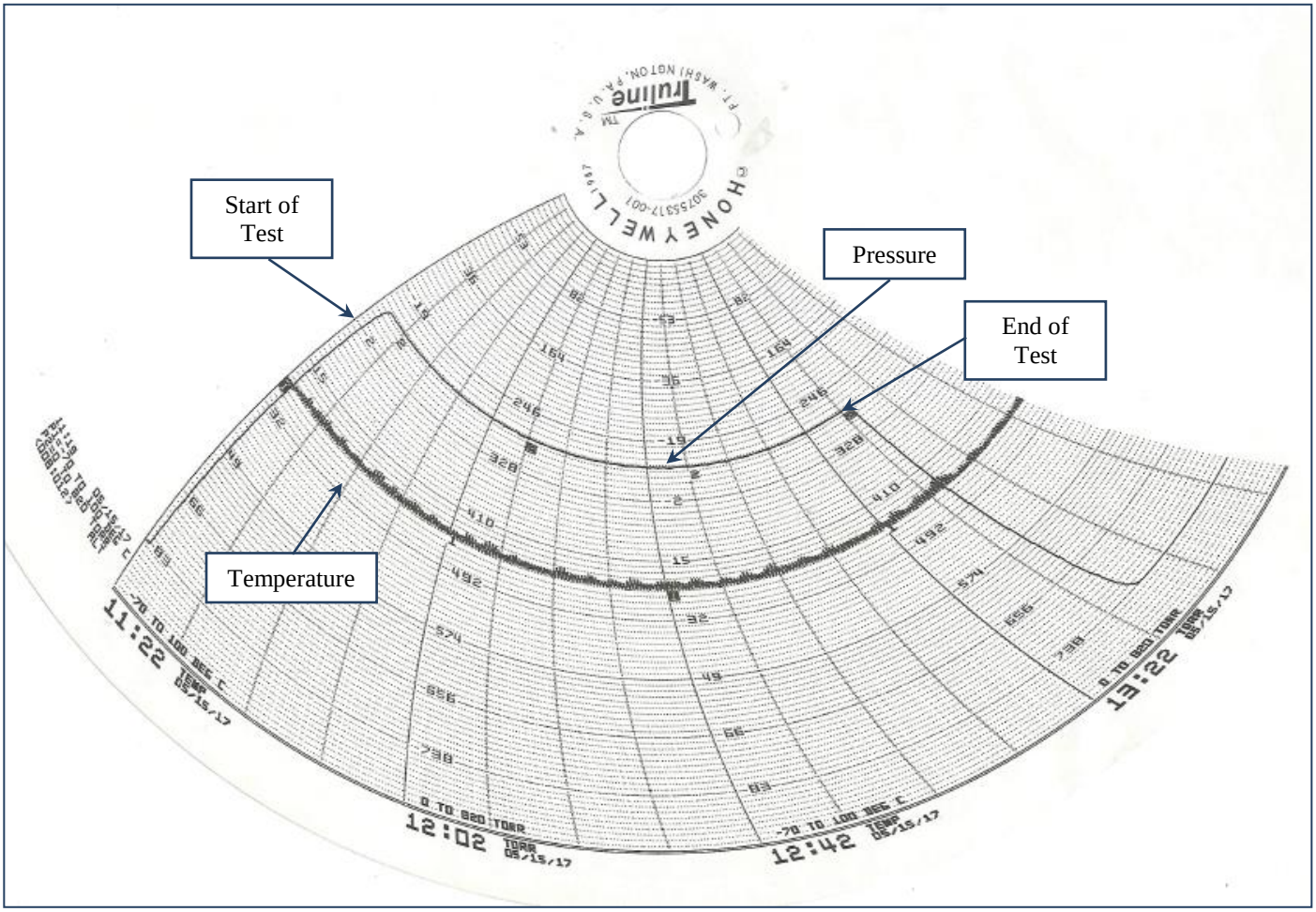
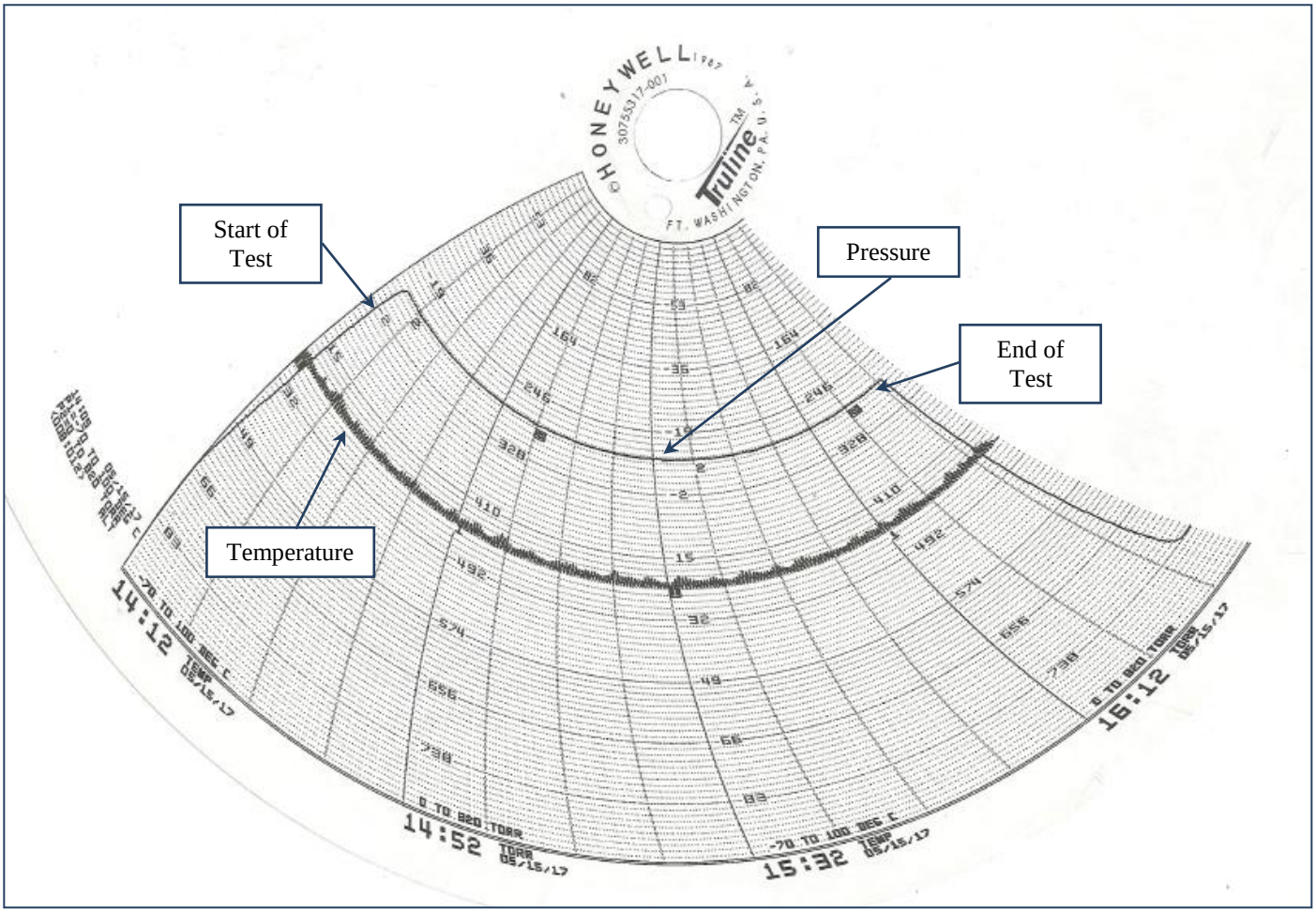
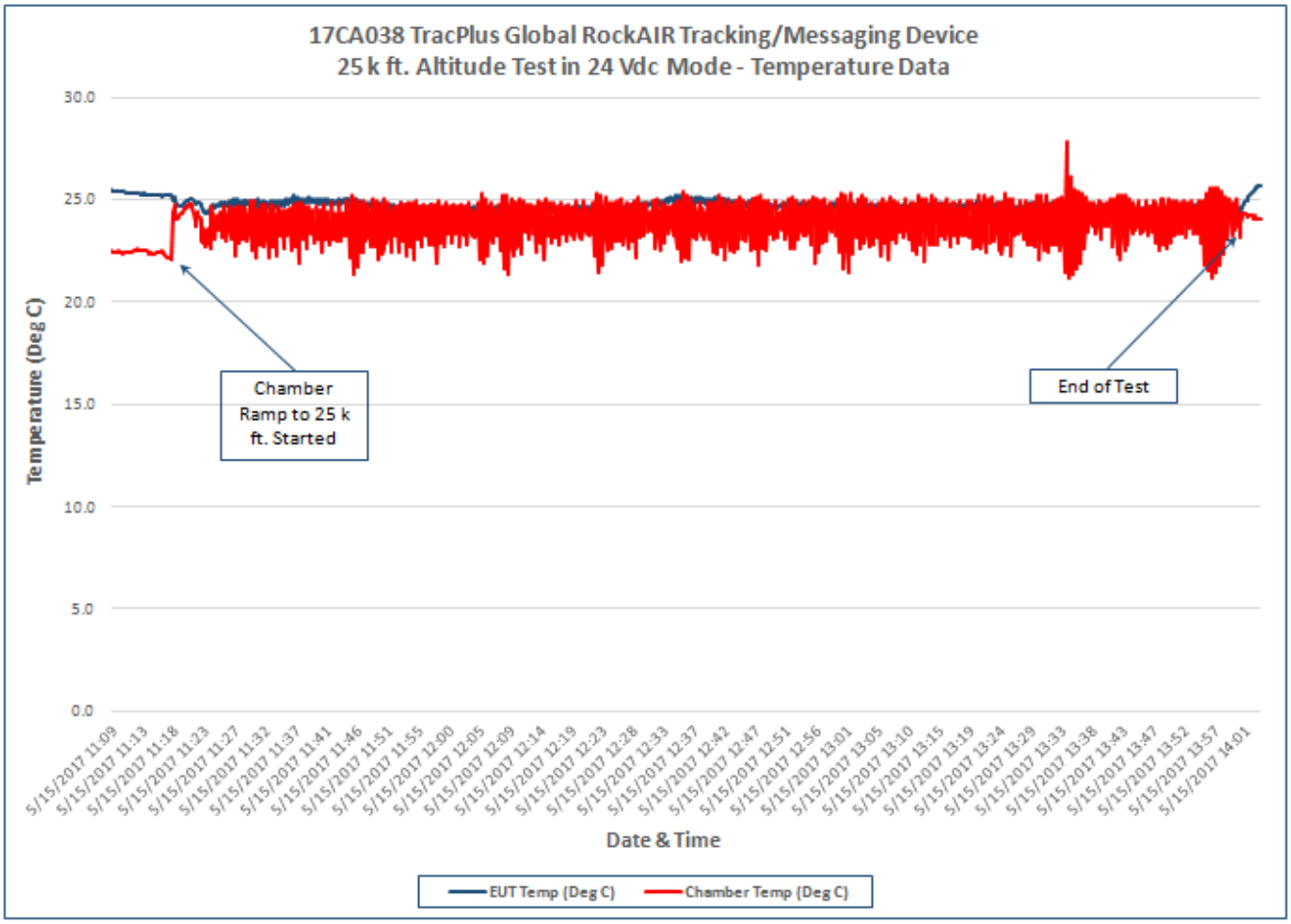
TEST DATA



Altitude Profile, EUT in 24 Vdc Mode



Altitude Profile, EUT in 5 Vdc USB Mode



Temperature Profile During Altitude Test, EUT in 24 Vdc Mode

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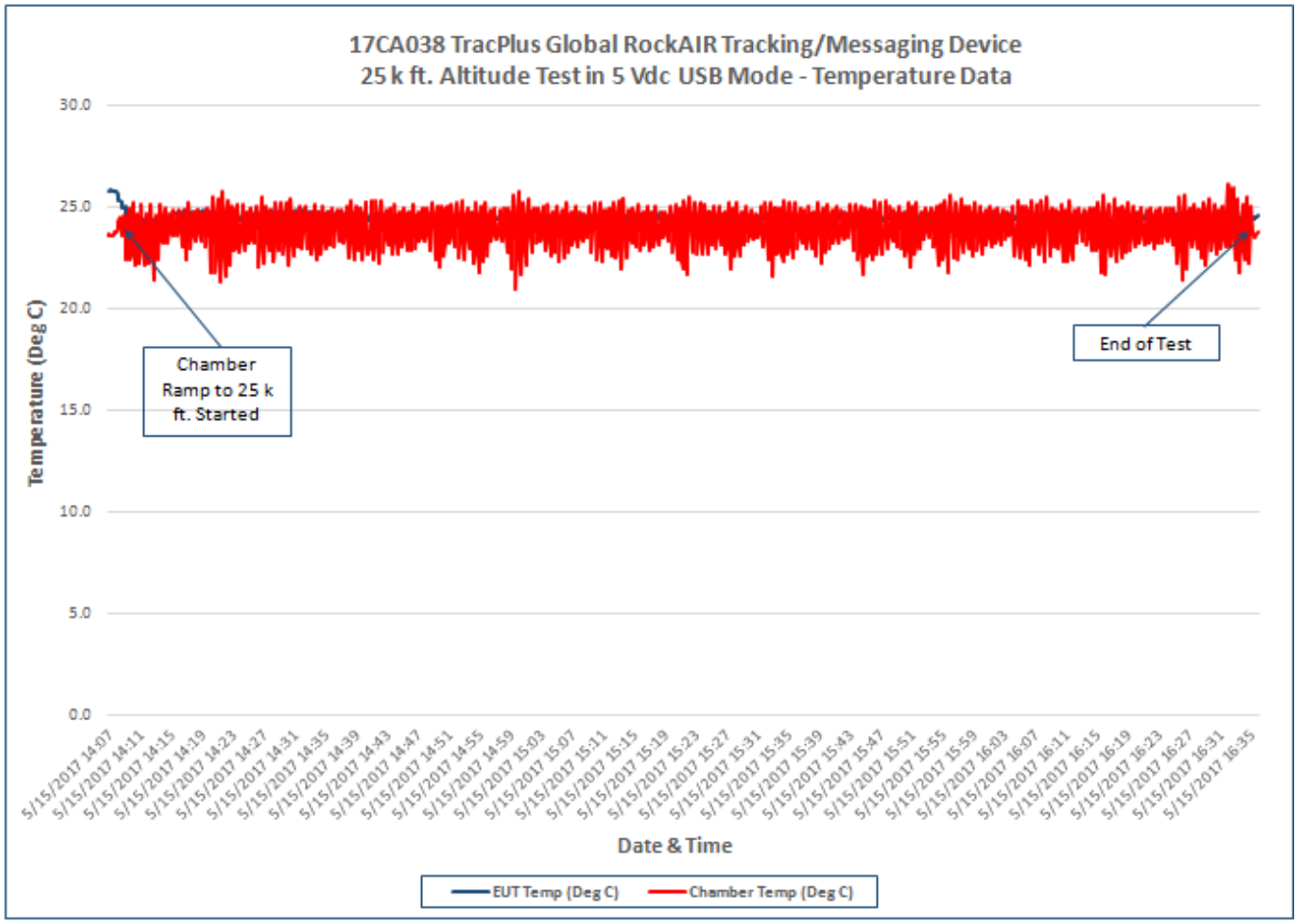

Temperature Profile During Altitude Test, EUT in 5 Vdc USB Mode

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VIBRATION

TEST DATES
05/17/2017 – 05/19/2017, 06/01/2017, 06/02/2017, 06/05/2017 & 06/06/2017

EQUIPMENT UNDER TEST (EUT)
Quantity: Two (2) Tracking / Messaging Unit
Part Number: RockAIR
Serial Number: JJA-RQN-A & RGL-EYQ-A

TEST SPECIFICATION(s)
RTCA DO-160G, Section 8.8.1

REQUIREMENTS
The EUT shall undergo sine on random vibration testing per RTCA DO-160G, Section 8.8.1 Category R, Zone 2, Curve G. The EUT shall withstand 10 minutes in each of three (3) mutually perpendicular axes of Performance Level, Curve G. This will be followed by Endurance Level (Curve G) vibration for two (2) hours minimum. The EUT will be operated during testing. There shall be no physical or electrical failures that prevent the EUT from being operated per customers post-test requirements, nor shall the EUT sustain physical damage.

PROCEDURE

RTCA DO-160G, Section 8.8.1

1. Attach the EUT test fixture to the vibration table in the axis to be tested.
2. Attach the EUT to the test fixture.
3. Attach a response accelerometer to the EUT in the axis of vibration.
4. Attach a control accelerometer to the shaker table in the axis of vibration.
5. Connect a dc power supply capable of delivering a maximum of 24 Vdc to the EUT, at the 24 Vdc power input connector.
6. Perform a pre-environment functional test on the EUT per customer requirements.
7. With the EUT not operating, perform a 0.5 g-PK sinusoidal scan from 10 Hz to 2000 Hz at a sweep rate not exceeding 1.0 octave / minute.
8. Record plots of the response accelerometers at the selected positions on the EUT to determine resonant frequencies and amplification factors. Resonant frequencies are defined as response peaks that are greater than twice the input acceleration amplitude.
9. Apply 24 Vdc to the EUT.
10. Apply Performance Level (Curve G) vibration for ten (10) minutes minimum. Testing is done in accordance with Tables 8-2a & 8-2b of RTCA DO-160G. The sine on random profile is in accordance with Figure 8-6. The specific parameters (helicopter rotor frequency and number of rotor blades) are obtained from the

customer. Profile includes dwells at the resonant frequencies observed during the pre-test sinusoidal sweep. During the vibration period, perform a power spectral density analysis of the vibration response measurements on the EUT during the test.

11. Record the results of the functional monitoring.
12. Apply Endurance Level Curve G vibration as shown in the tables and figures described above for two (2) hours minimum. The specific parameters (helicopter rotor frequency and number of rotor blades) are obtained from the customer. Profile includes dwells at the resonant frequencies observed during the pre-test sinusoidal sweep. Perform a power spectral density analysis of the vibration response measurements on the EUT during the test.
13. Stop the functional monitoring and remove power from the EUT. Record the results of the functional monitoring.
14. Repeat the Performance test of Step 10 above, with the EUT energized to 24 Vdc.
15. Perform a 0.5 g-PK sinusoidal scan from 10 Hz to 2000 Hz at a sweep rate not exceeding 1.0 octave / minute. Record any changes in vibration resonant frequencies.
16. Perfom a post-environment functional test on the EUT per the customer requirements.
17. Inspect the EUT visually and report any damage observed.
18. De-energize the EUT. Disconnect the power input leads from the 24 Vdc input connector of the EUT.
19. Adjust the power supply to 5 Vdc. Connect the leads the the 5 V USB input connector of the EUT.
20. Repeat the sequence of tests described above, with the EUT energized to 5 Vdc.
    Allow the EUT to stabilize and perfom a post-environment functional test on the EUT per the customer requirements.
21. Inspect the EUT visually and report any damage observed.

TEST RESULTS

Testing was conducted in each of three axes, X, Y and Z and were tested in that sequence for EUT # JJA-RQN-A (see Photos Section for description of each axis). There was no evidence of damage or loss of function in either the X and Y axes. Testing in the Z axis was suspended after it was discovered that the EUT was no longer energized at 24 Vdc on conclusion of the initial Performance test. A visual examination revealed that the 24 Vdc connector on the EUT was broken and no longer electrically connected to the EUT. The EUT could still be energized in the 5 Vdc mode, using the USB connector. The EUT successfully passed all operational checks after Performance testing in the Z axis, while energized in the 5 Vdc mode. Testing on this sample was terminated, and unit EUT # RGL-EYQ-A was substituted. Per the customer, testing would resume from the point at which the above anomaly occurred.

Testing on the RGL-EYQ-A sample was performed in each of the three axes, Z, Y and X in that order. The Z axis test in the 24 Vdc move was performed on this sample, as this was the axis and mode in which the anomaly occurred on the original part. The RGL-EYQ-A successfully passed this test, with no sign of damage or loss of function. All subsequent vibration testing was done on this sample.

Testing was repeated in the Z axis, this time in the 5 Vdc USB mode. The unit completed testing, with no loss of function. No damage was noted, except for what appeared to be signs of arcing around the USB port on the device (see the photo section below). The customer was informed, and the test resumed.

Testing in the 5 Vdc USB mode was continued for both the Y and X axes in that order. There was no damage or loss of function to the device in either axis.

EQUIPMENT USED

Equipment	Manufacturer	DLS Lab Number	Model#	Date Calibrated	Calibration Due Date
Accelerometer	Dytran	153	3225F1T	07/05/2016	07/05/2017
Accelerometer	Dytran	163	3049E1	06/14/2016	06/14/2017
Accelerometer	Dytran	169	3049E3	08/24/2016	08/24/2017
Electrodynamic Shaker	ETS	182	M748A/GT 1200M	N/A	Verified w/Calibrated Accelerometers
Signal Generator	Vibration Research	147	VR9500	11/04/2016	11/04/2017
Digital Multimeter (DMM)	Fluke	263	87V	10/24/2016	10/24/2017
DC Power Supply	Yescom	260	DCP3010D	N/A	Verified w/Calibrated DMM

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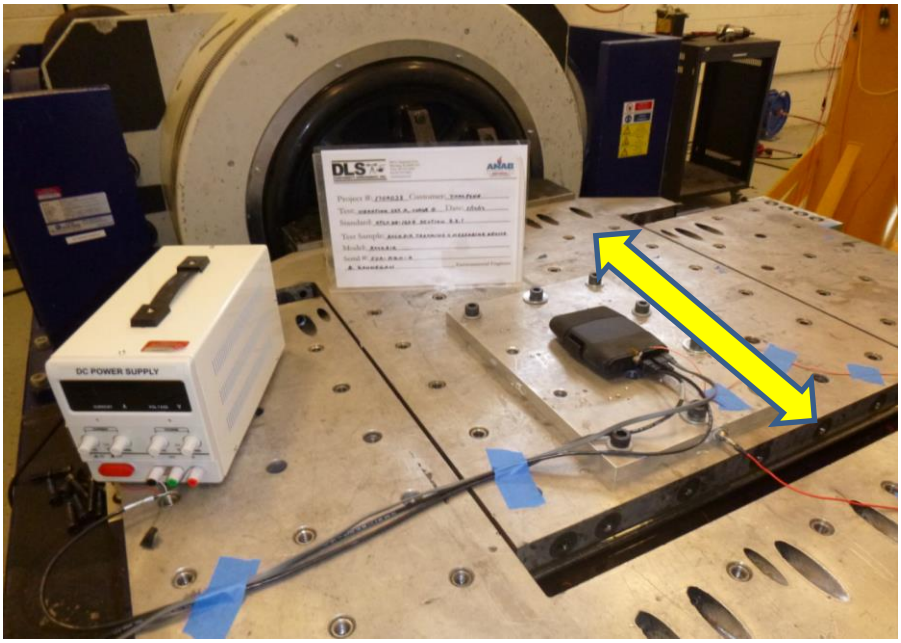
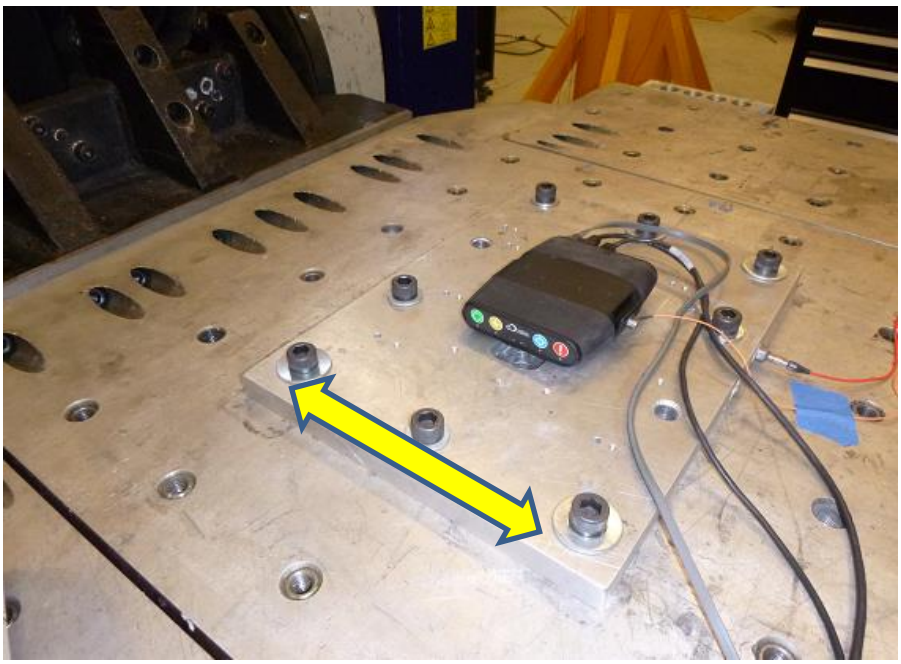
PHOTOS

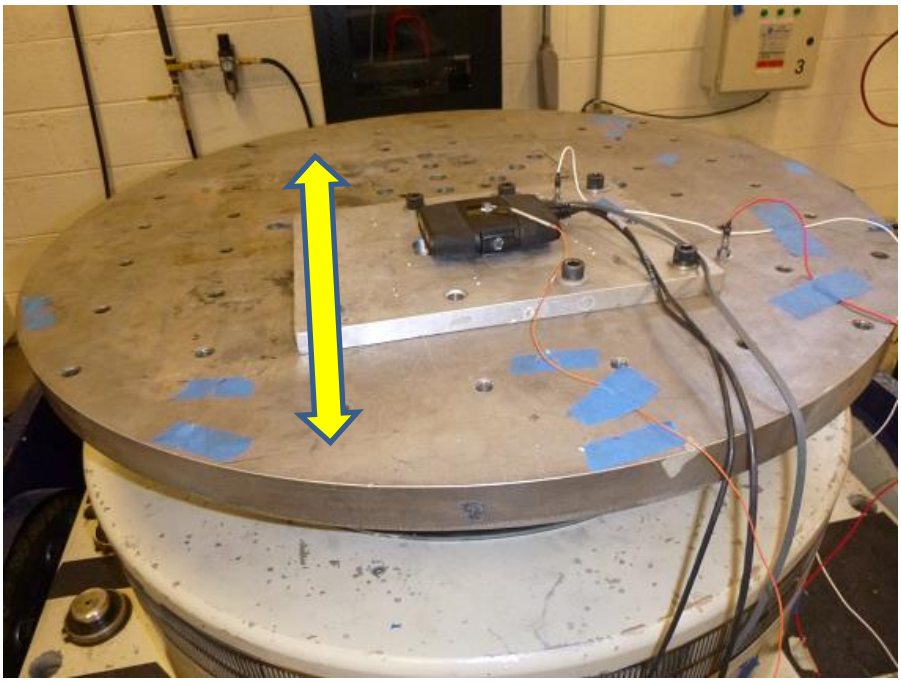
Test Title



Vibration in X Axis



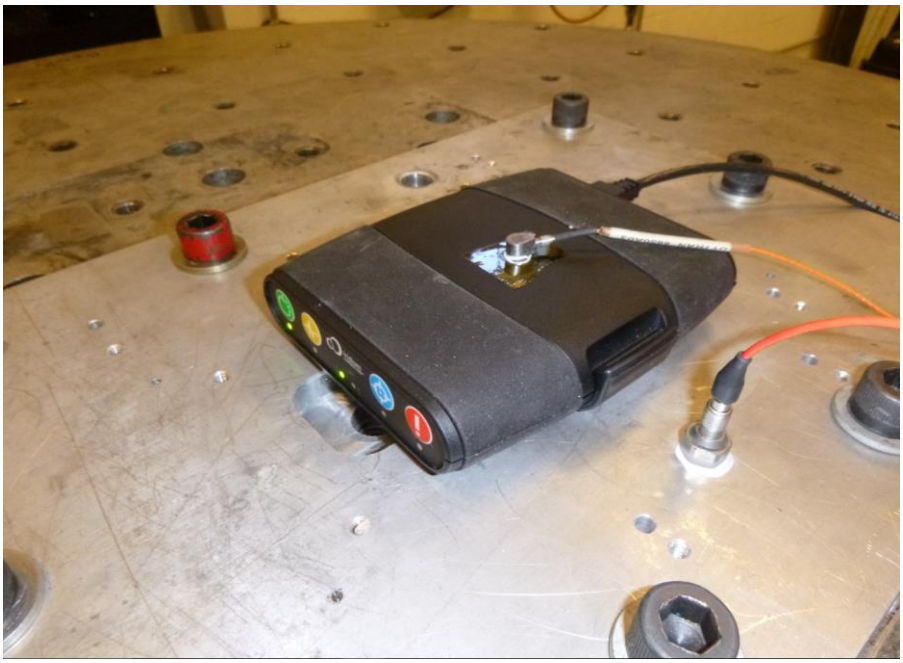
Vibration in Y Axis



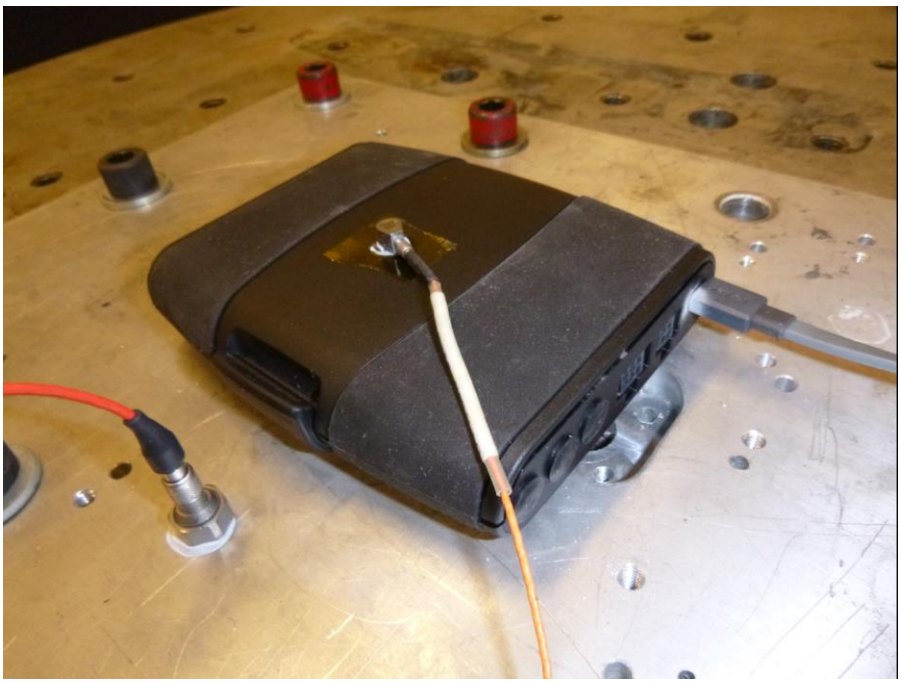
Vibration in Z Axis

EUT # JJA-RQN-A After Testing in the Z Axis, 24 Vdc Mode, Showing Loose Connector

EUT # RGL-EYQ-A After Z Axis in 5 Vdc USB Mode, Showing Possible Arcing



EUT # RGL-EYQ-A After Completion of Vibration Testing (View 1)



EUT # RGL-EYQ-A After Completion of Vibration Testing (View 2)

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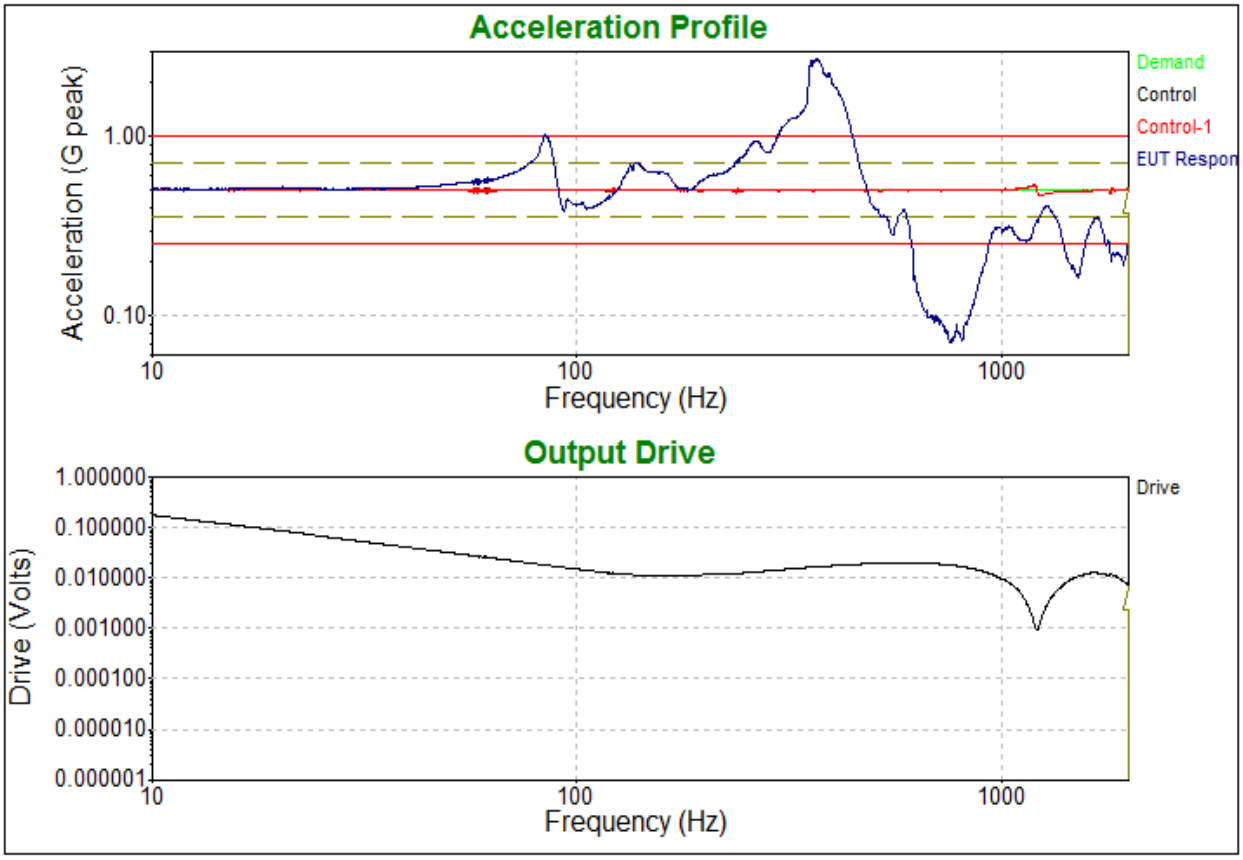
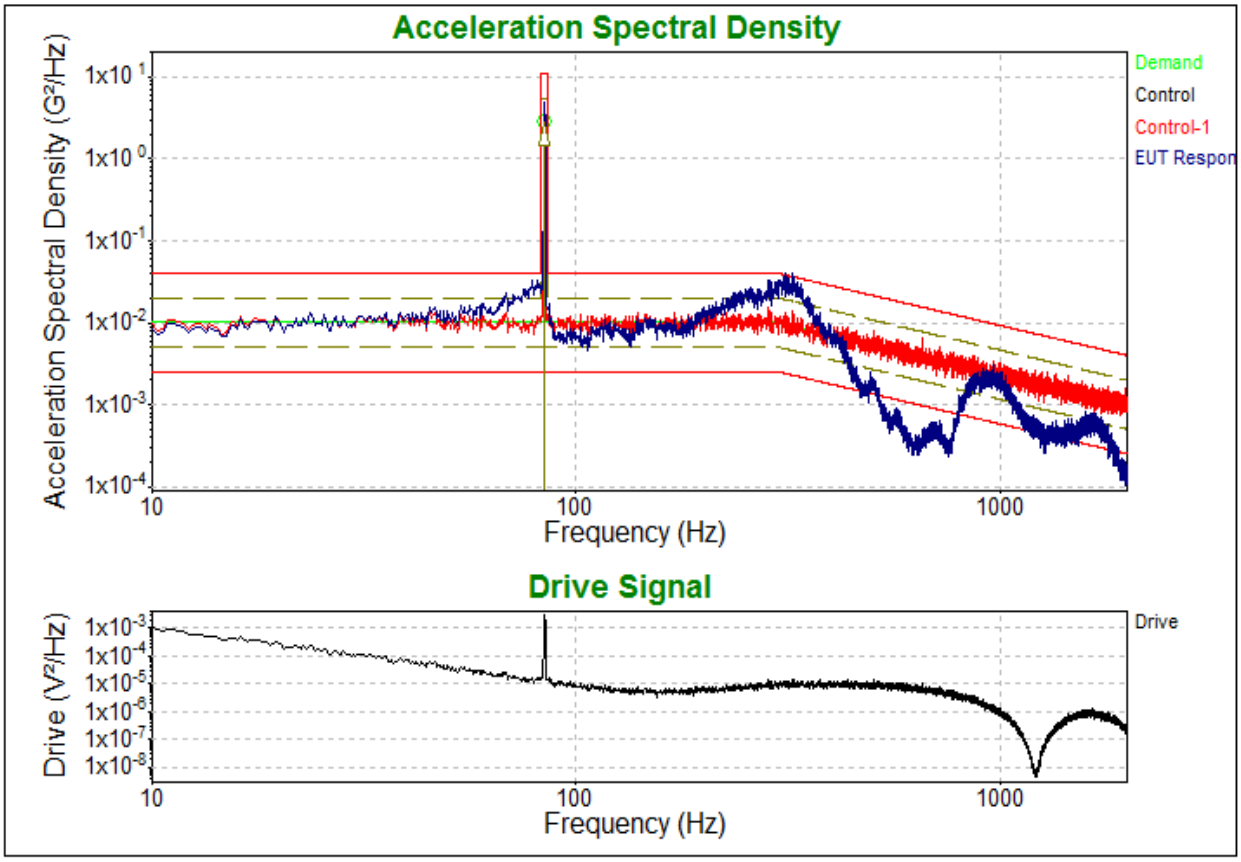
TEST DATA



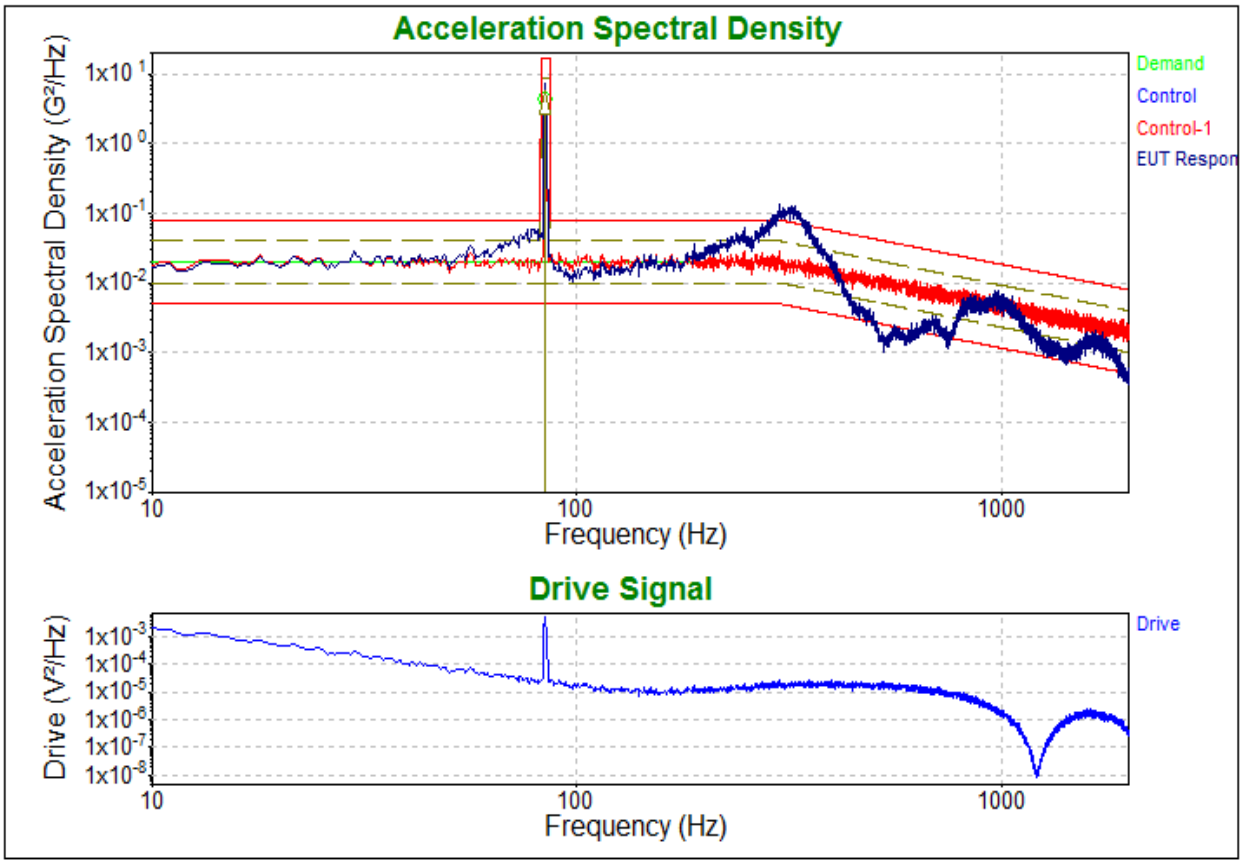
X Axis Initial Sine Sweep Resonance Check, EUT # JJA-RQN-A

One applicable resonance peak was detected at 84.46 Hz. This frequency was applied to the Performance and Endurance tests that followed.



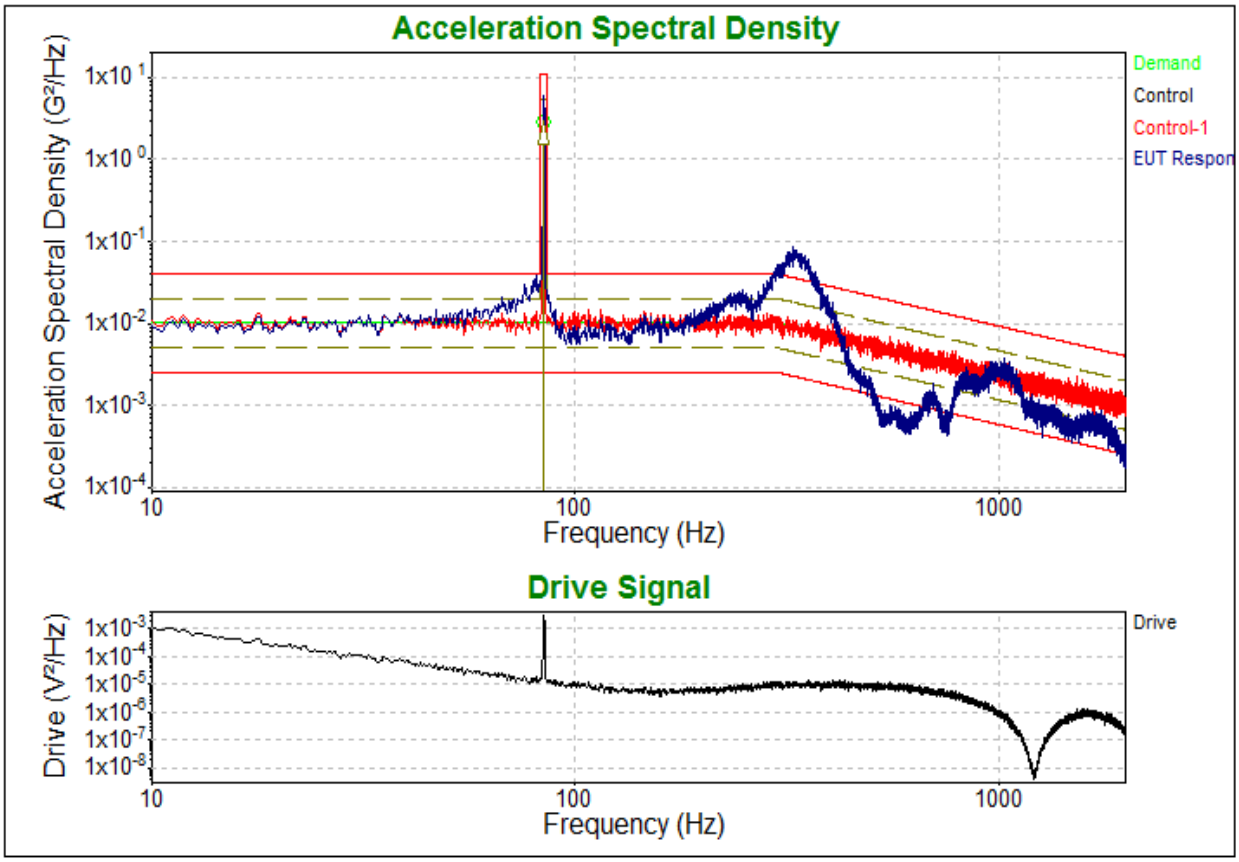
X Axis Initial Cat R Zone 2 Curve G Performance Level SOR Vibration in 24 Vdc mode, EUT # JJA-RQN-A

Dwell performed at 84.46 Hz, as determined from initial sine sweep.



X Axis Cat R Zone 2 Curve G Endurance Level SOR Vibration in 24 Vdc mode, EUT # JJA-RQN-A

Dwell performed at 84.46 Hz, as determined from initial sine sweep.



X Axis Final Cat R Zone 2 Curve G Performance Level SOR Vibration in 24 Vdc mode, EUT # JJA-RQN-A

Dwell performed at 84.46 Hz, as determined from initial sine sweep.

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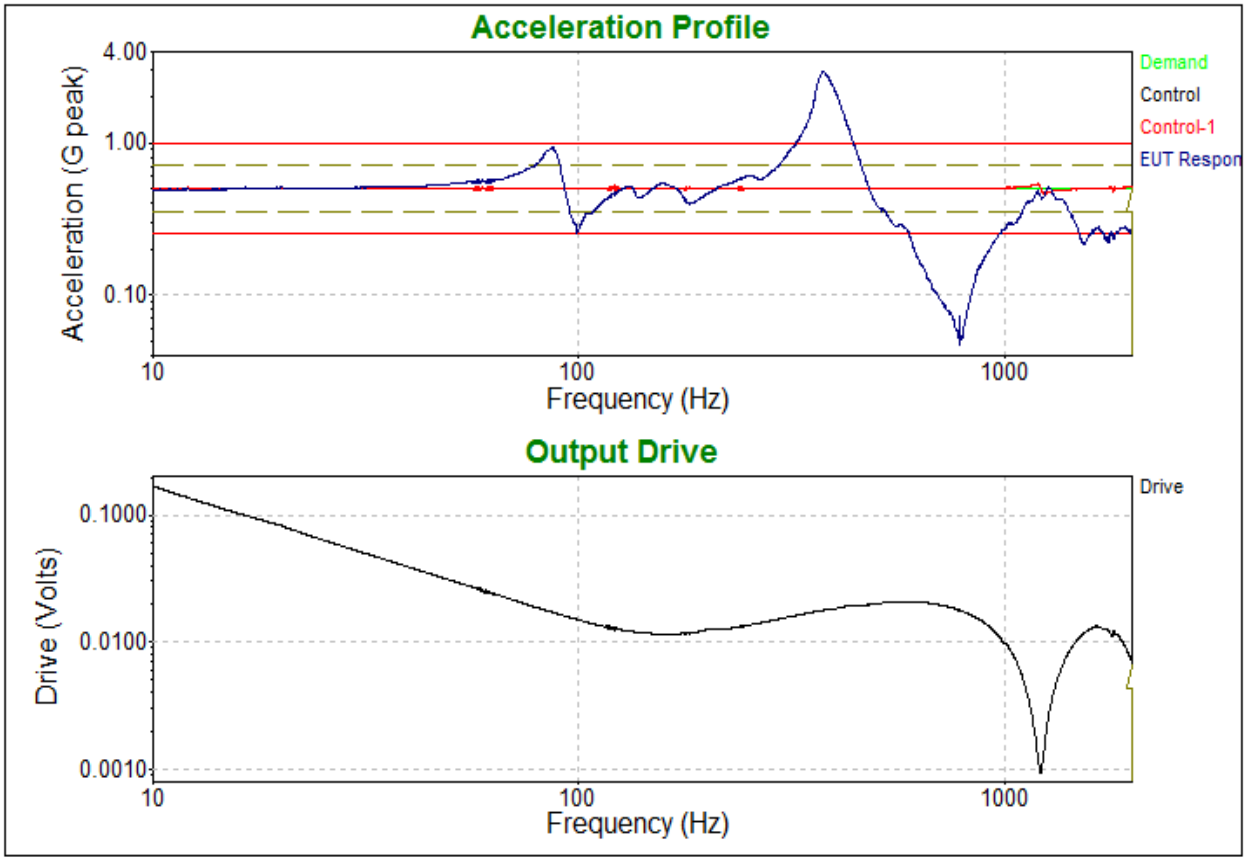
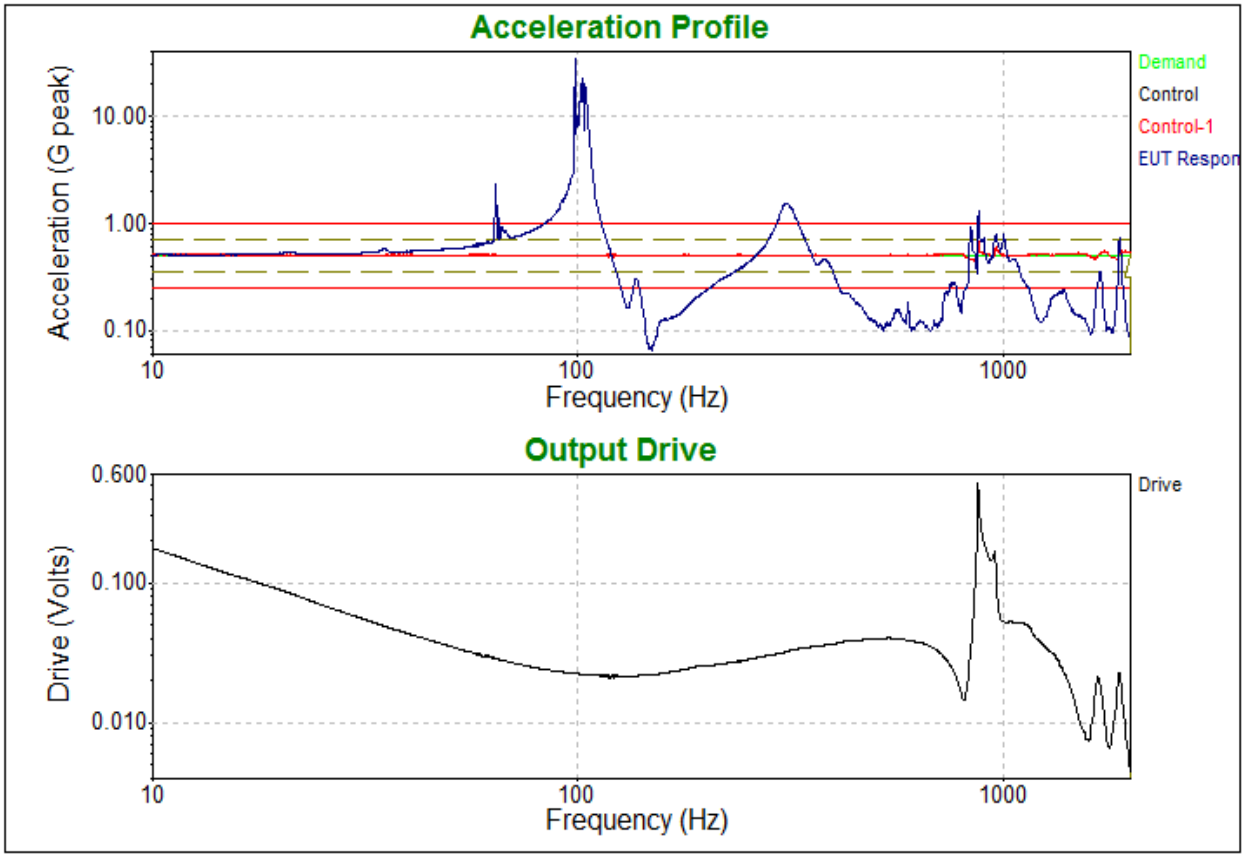
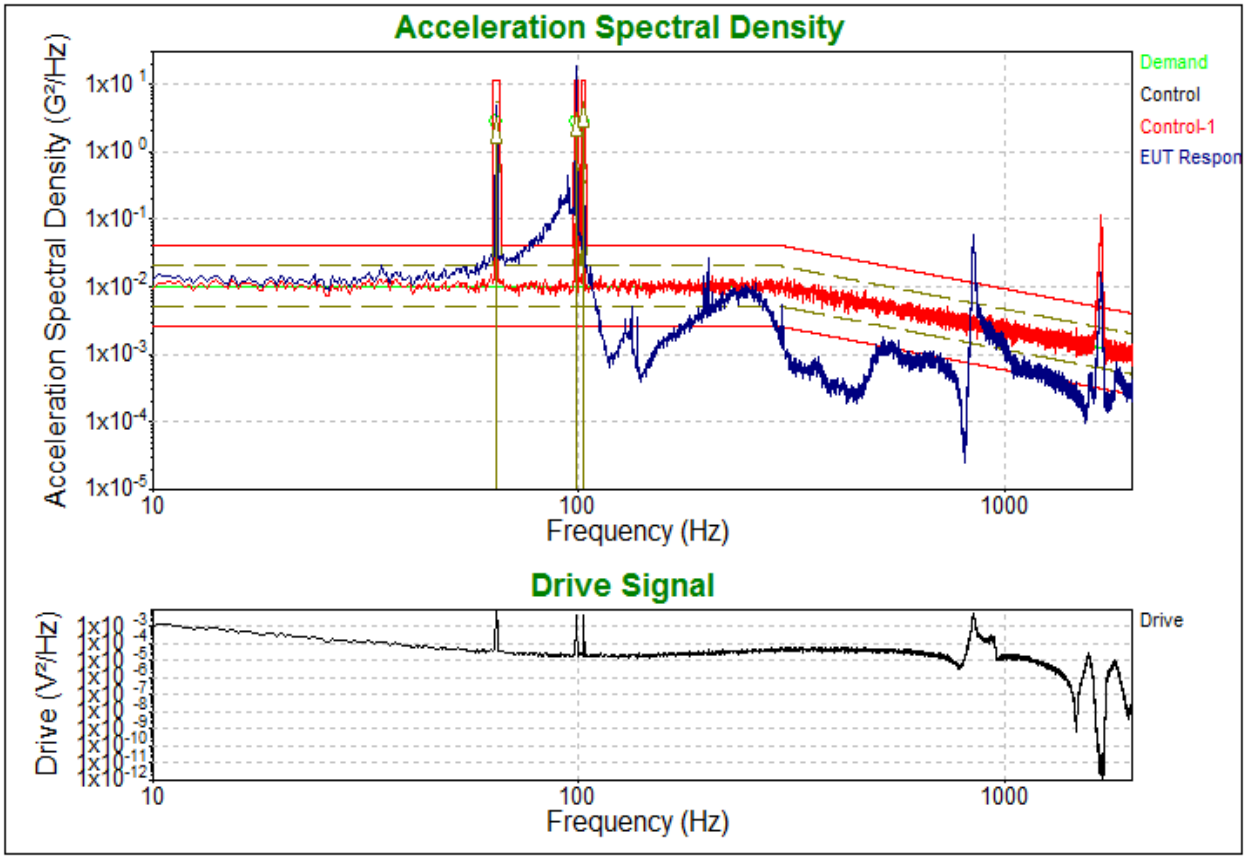


X Axis Final Sine Sweep Resonance Check, EUT # JJA-RQN-A



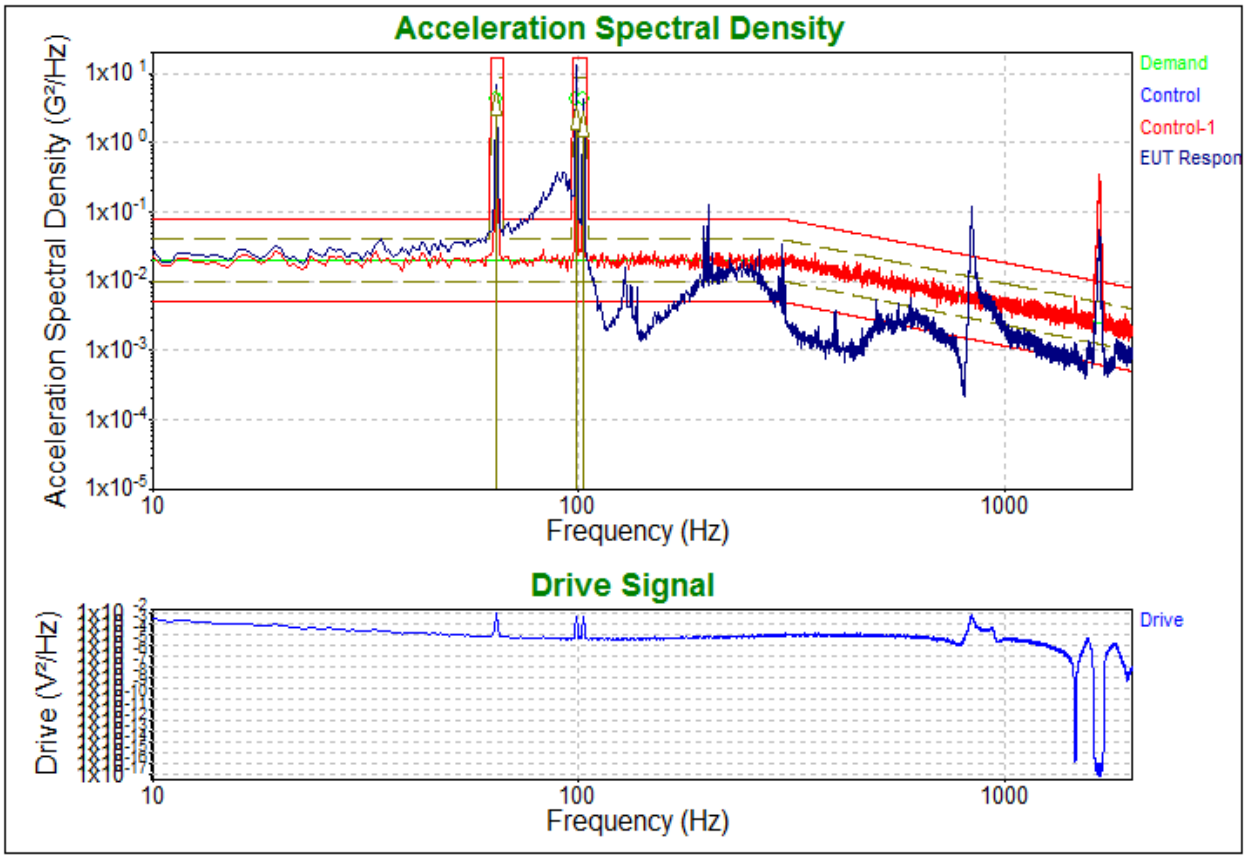
Y Axis Initial Sine Sweep Resonance Check, EUT # JJA-RQN-A

Applicable resonance peaks were detected at 64.28, 98.75 & 102.8 Hz. These frequencies were applied to the Performance and Endurance tests that followed.



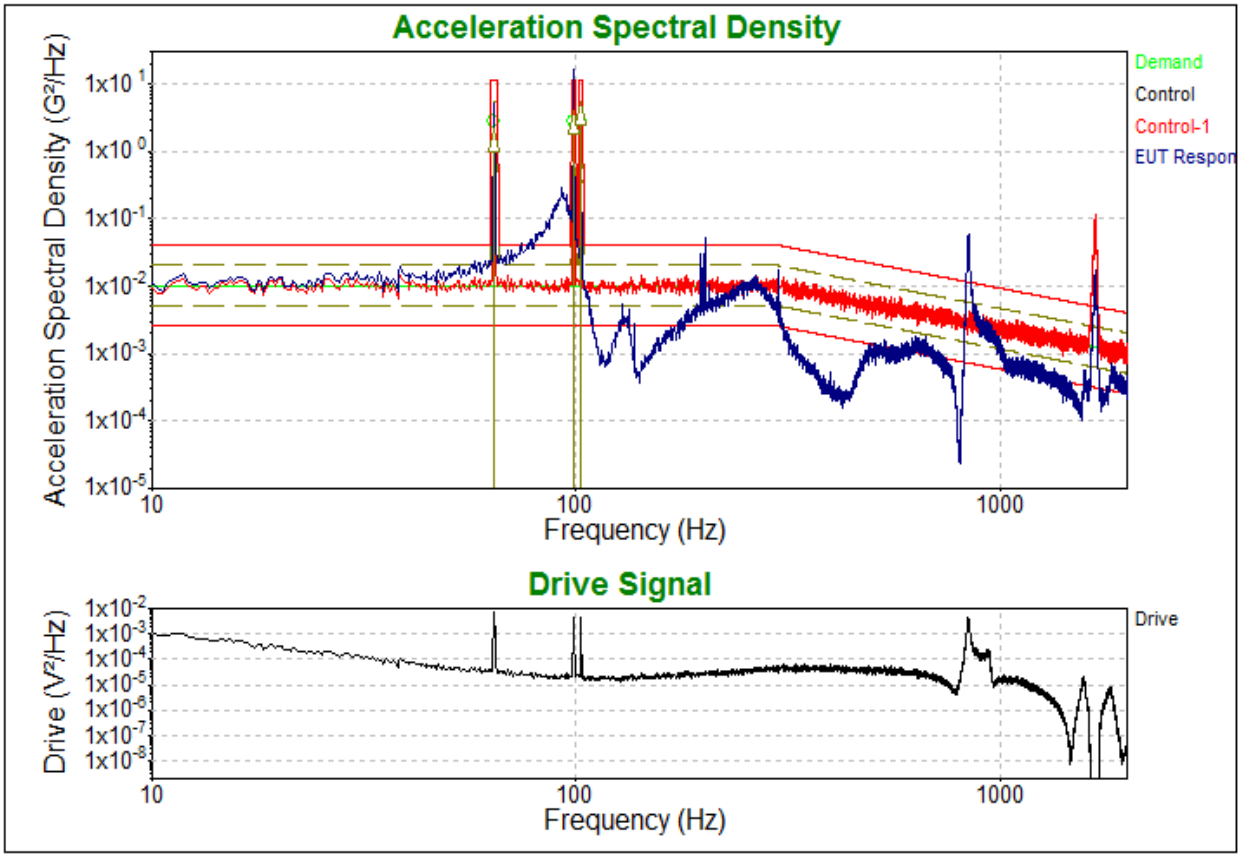
Y Axis Initial Cat R Zone 2 Curve G Performance Level SOR Vibration in 24 Vdc mode, EUT # JJA-RQN-A

Dwells performed at 64.28, 98.75 & 102.8 Hz, as determined from initial sine sweep.



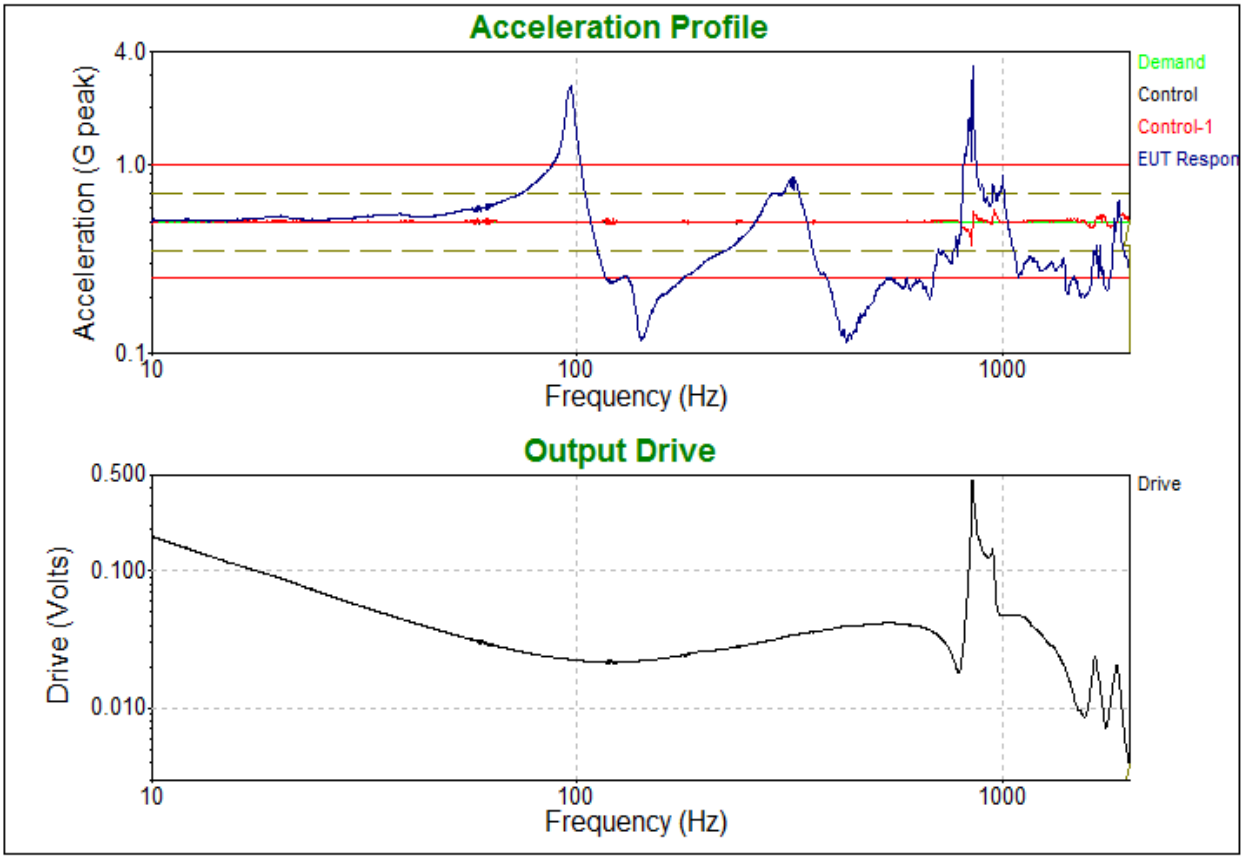
Y Axis Cat R Zone 2 Curve G Endurance Level SOR Vibration in 24 Vdc mode, EUT # JJA-RQN-A

Dwells performed at 64.28, 98.75 & 102.8 Hz, as determined from initial sine sweep.

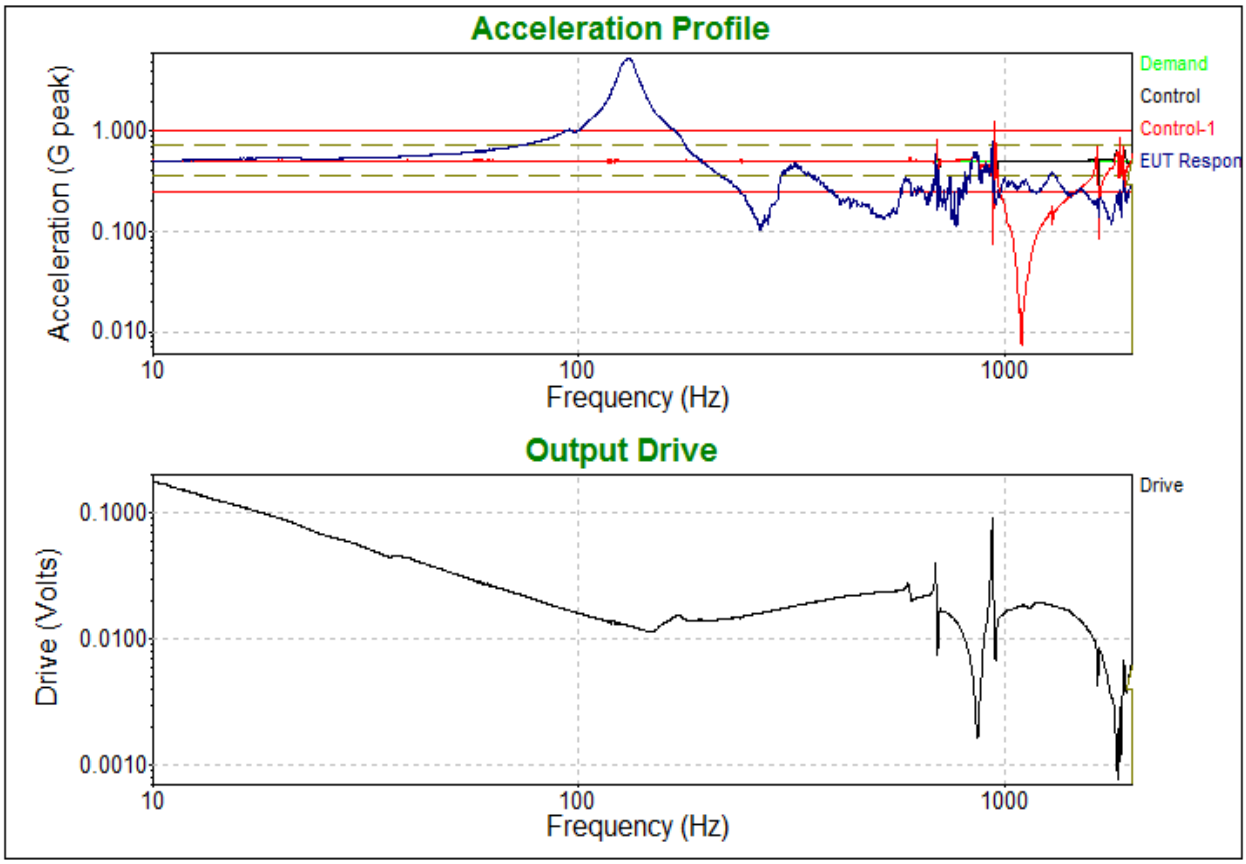


Y Axis Final Cat R Zone 2 Curve G Performance Level SOR Vibration in 24 Vdc mode, EUT # JJA-RQN-A

Dwells performed at 64.28, 98.75 & 102.8 Hz, as determined from initial sine sweep.

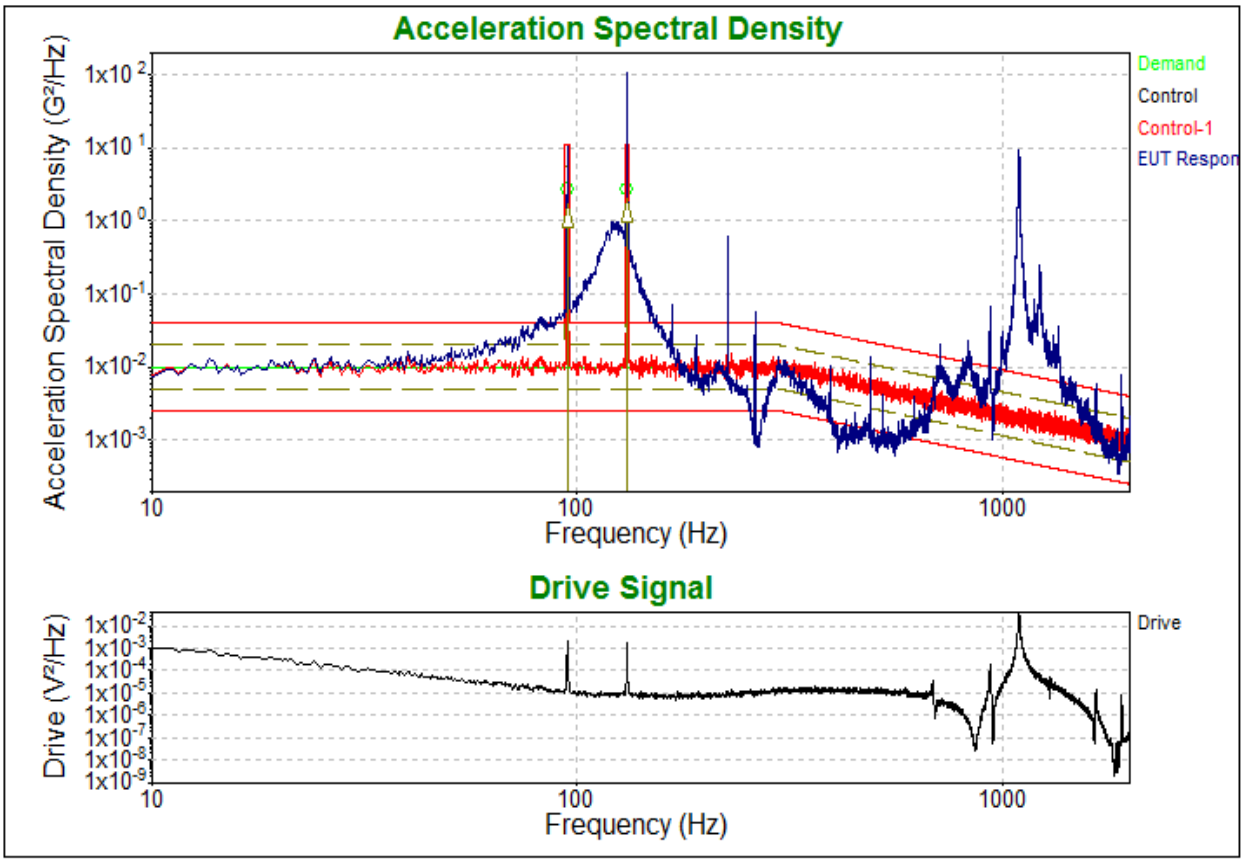


Y Axis Final Sine Sweep Resonance Check, EUT # JJA-RQN-A



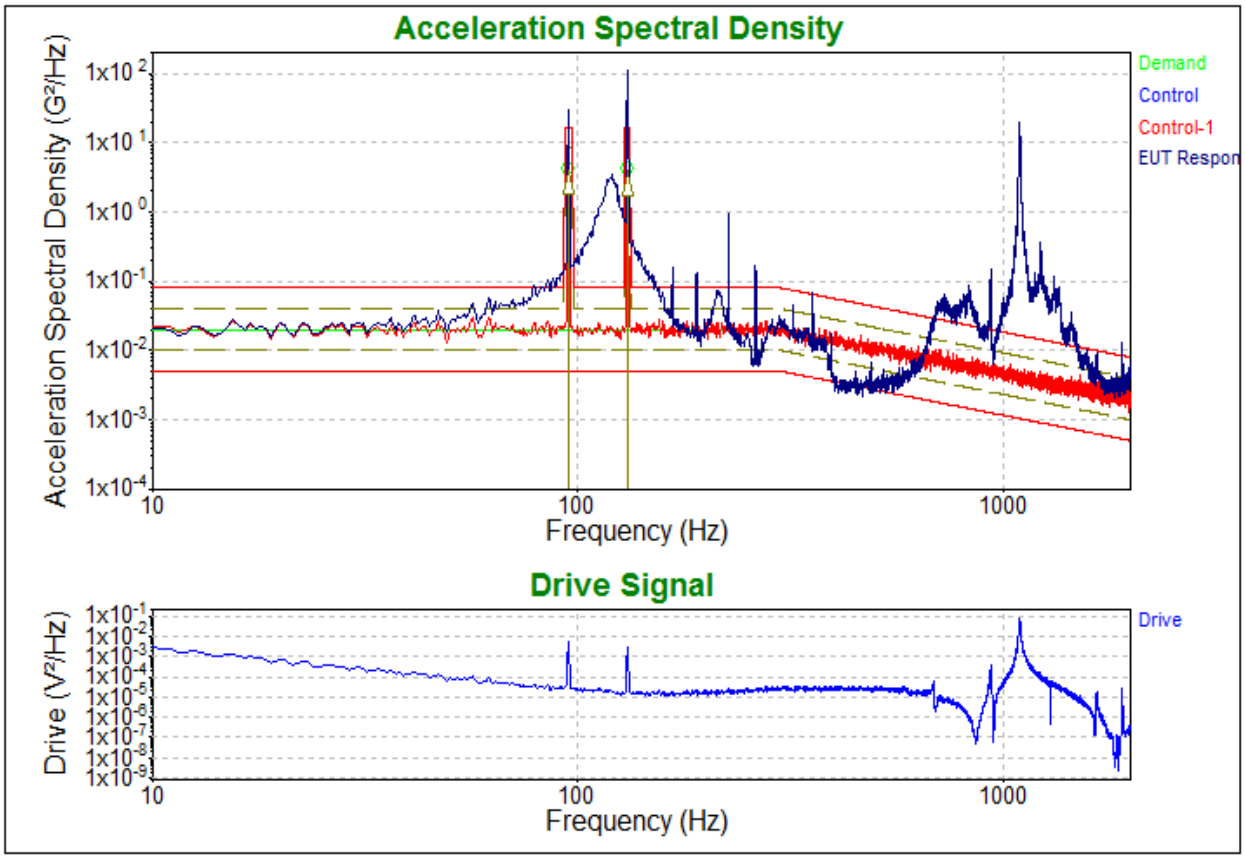
Z Axis Initial Sine Sweep Resonance Check, EUT # JJA-RQN-A

Applicable resonance peaks were detected at 95.15 & 131.1 Hz. These frequencies were applied to the Performance and Endurance tests that followed.



Z Axis Initial Cat R Zone 2 Curve G Performance Level SOR Vibration in 24 Vdc mode, EUT # JJA-RQN-A

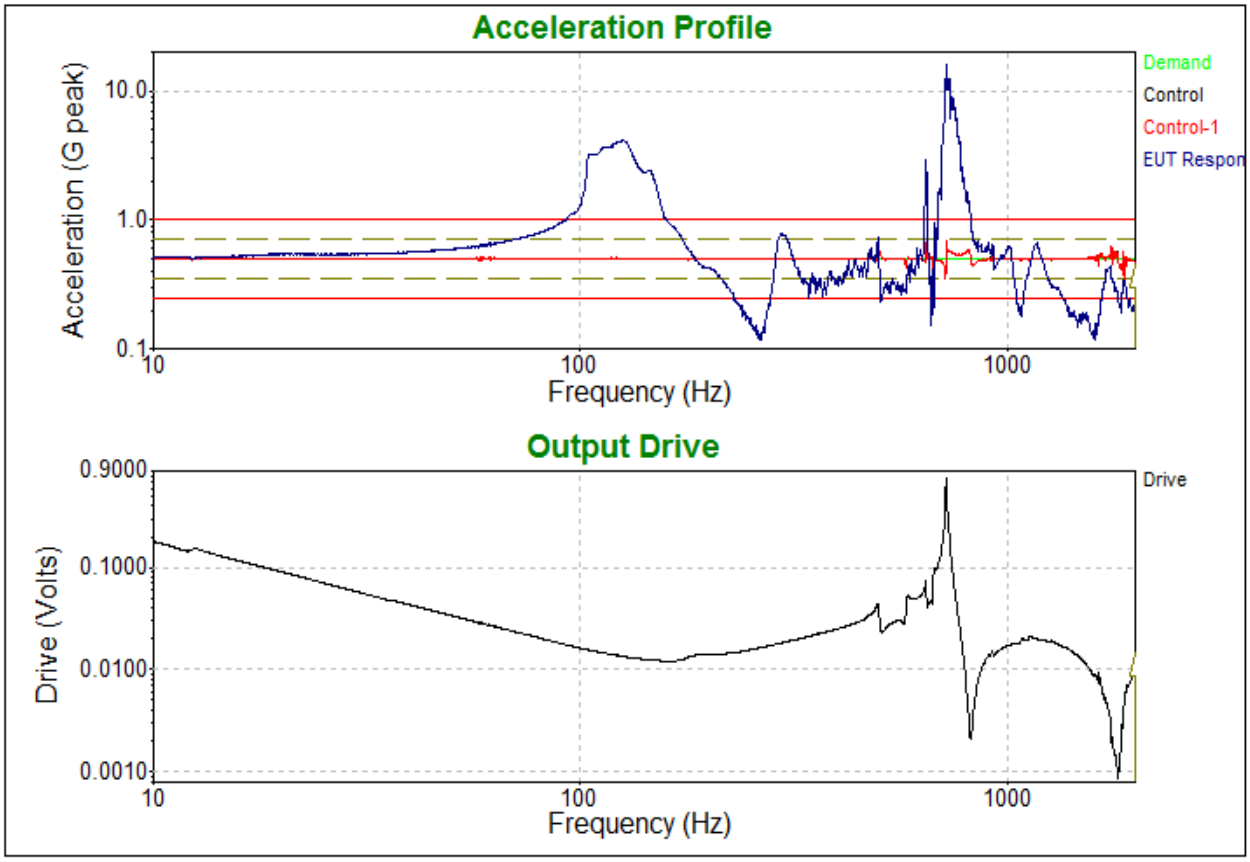
Dwells performed at 95.15 & 131.1 Hz, as determined from initial sine sweep.



Z Axis Cat R Zone 2 Curve G Endurance Level SOR Vibration in 24 Vdc mode, EUT # JJA-RQN-A

Dwells performed at 95.15 & 131.1 Hz, as determined from initial sine sweep. At end of endurance testing, the EUT was no longer energized – 24 Vdc input connector broken (see Test Results Section above for details). Testing terminated for this part.

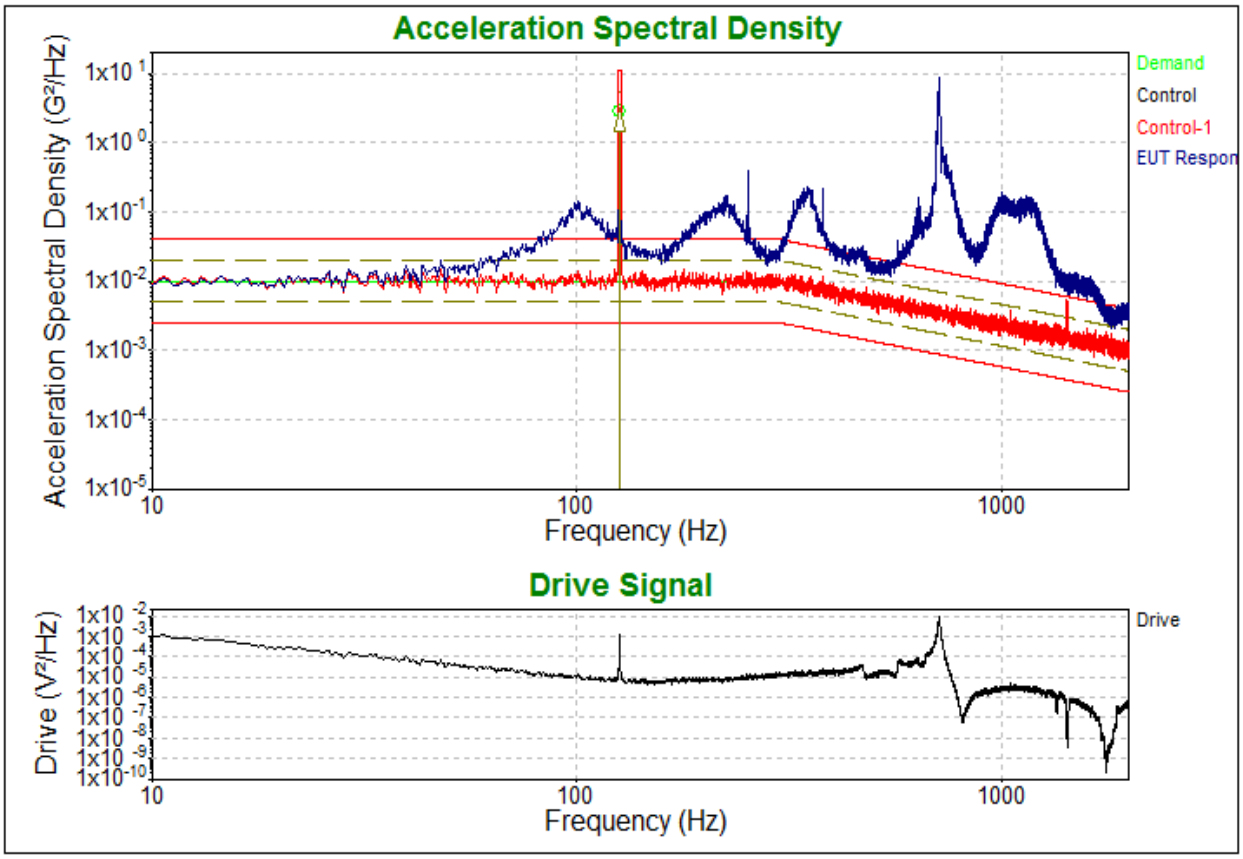
Per the customer, a new unit was to be substituted for the failed unit above, and the test was to be continued.



Z Axis Initial Sine Sweep Resonance Check in 24 Vdc mode, EUT # RGL-EYQ-A

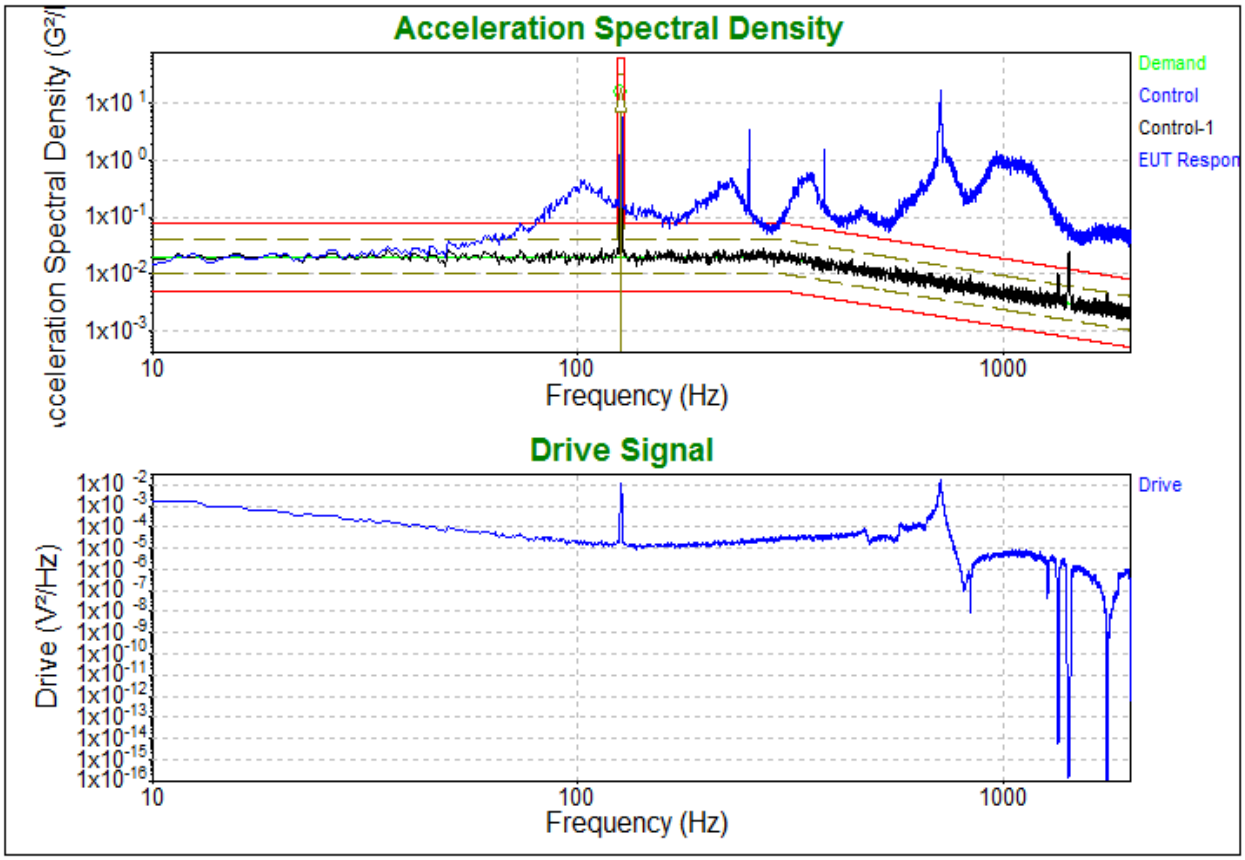
One applicable resonance peak was detected at 126.4 Hz. This frequency was applied to the Performance and Endurance tests that followed.

Note: From this point on, all vibration traces will be for the replacement sample EUT # RGL-EYQ-A.



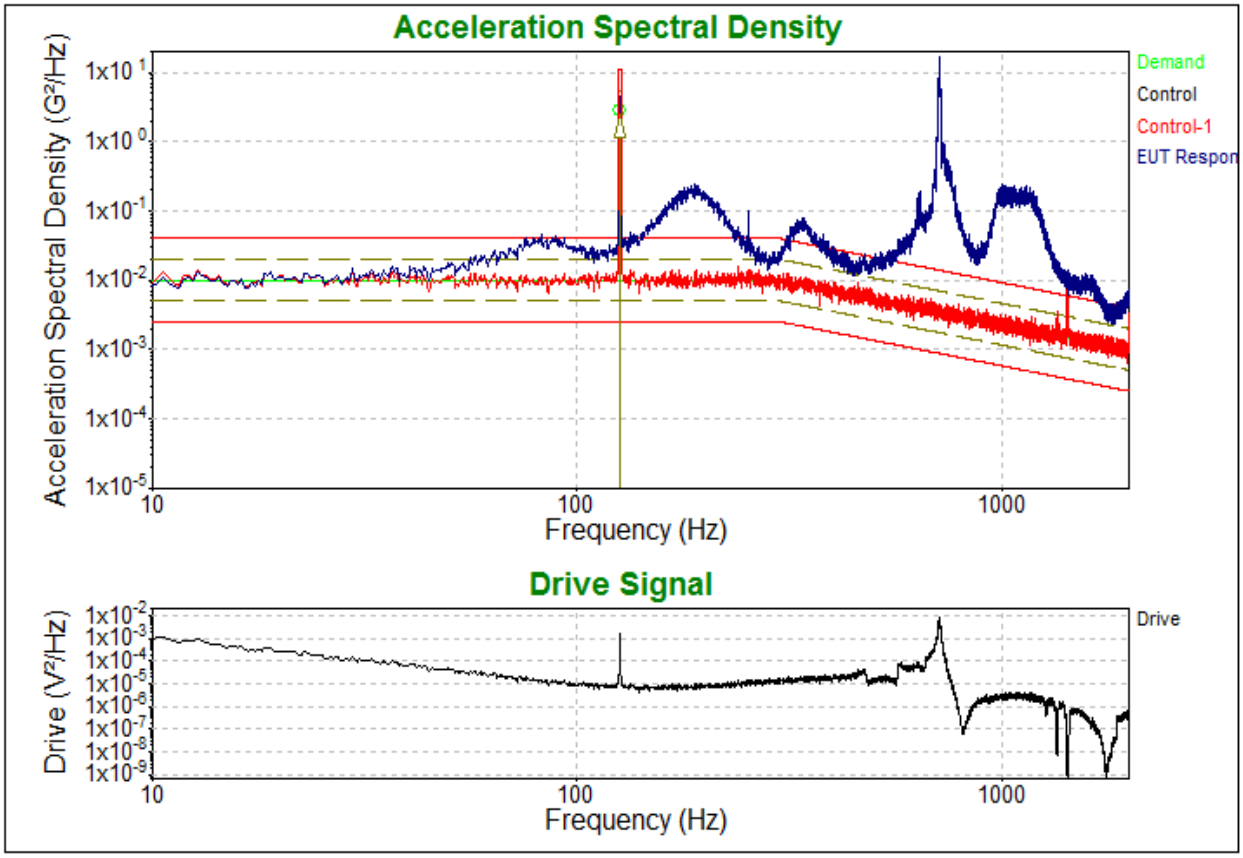
Z Axis Initial Cat R Zone 2 Curve G Performance Level SOR Vibration in 24 Vdc mode, EUT # RGL-EYQ-A

Dwell performed at 126.4 Hz, as determined from initial sine sweep.



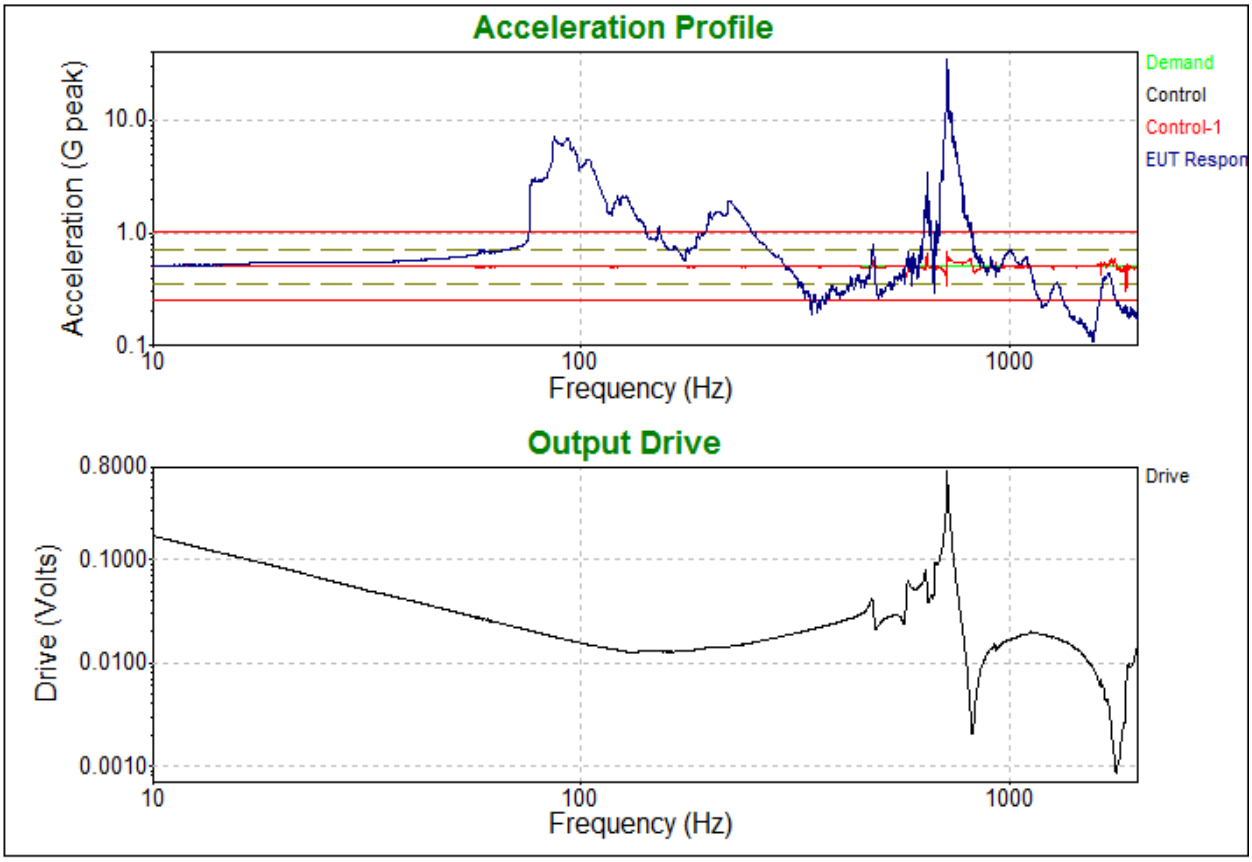
Z Axis Cat R Zone 2 Curve G Endurance Level SOR Vibration in 24 Vdc mode, EUT # RGL-EYQ-A

Dwell performed at 126.4 Hz, as determined from initial sine sweep.

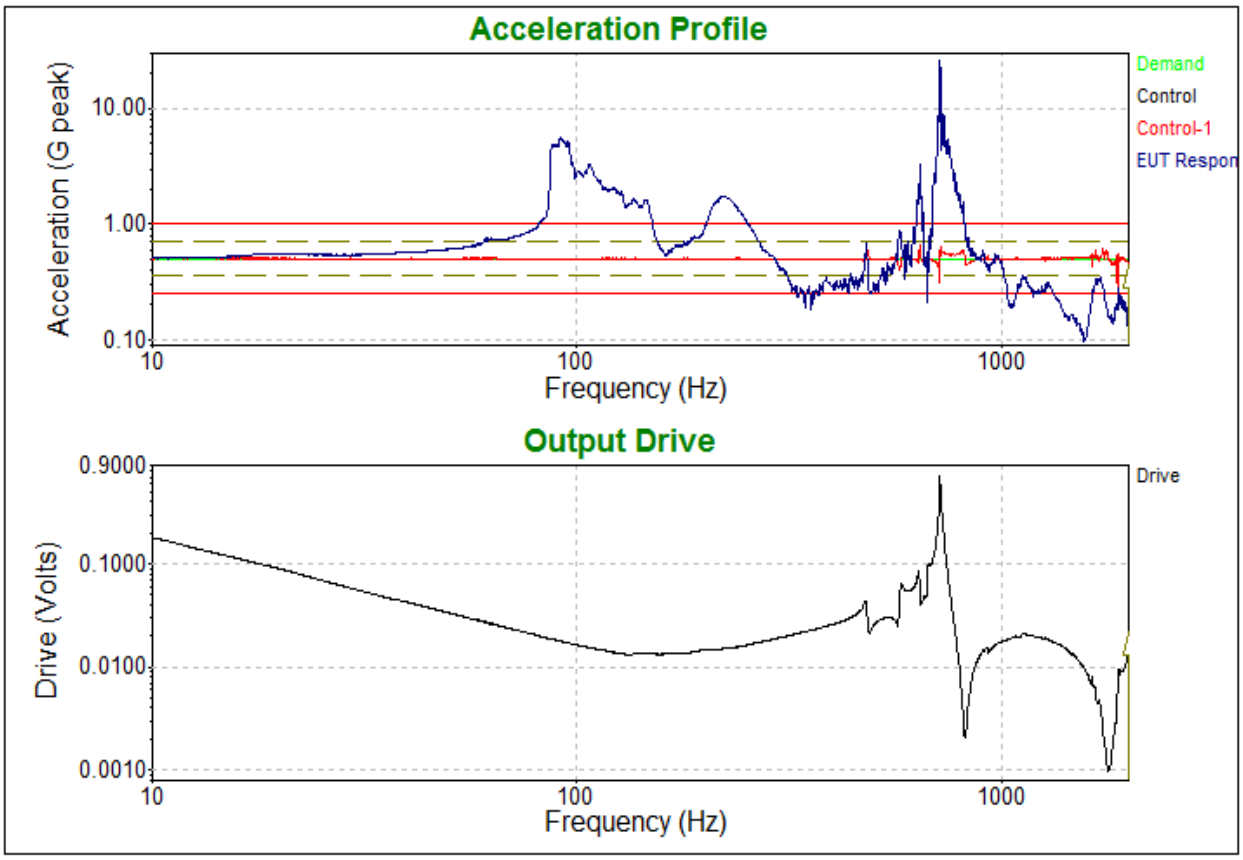


Z Axis Final Cat R Zone 2 Curve G Performance Level SOR Vibration in 24 Vdc mode, EUT # RGL-EYQ-A

Dwell performed at 126.4 Hz, as determined from initial sine sweep.



Z Axis Final Sine Sweep Resonance Check, EUT # RGL-EYQ-A in 24 Vdc mode



Z Axis Initial Sine Sweep Resonance Check in 5 Vdc mode, EUT # RGL-EYQ-A

One applicable resonance peak was detected at 91.45 Hz. This frequency was applied to the Performance and Endurance tests that followed.

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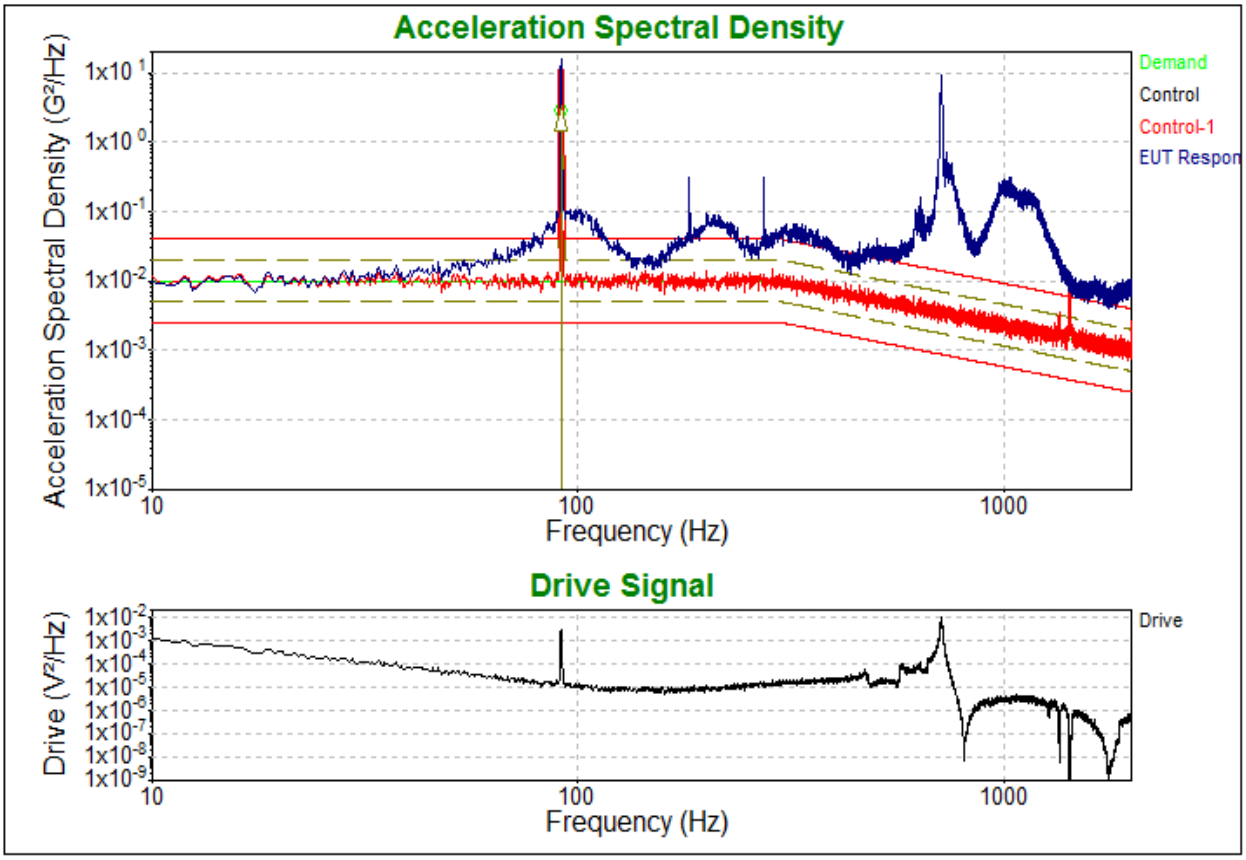
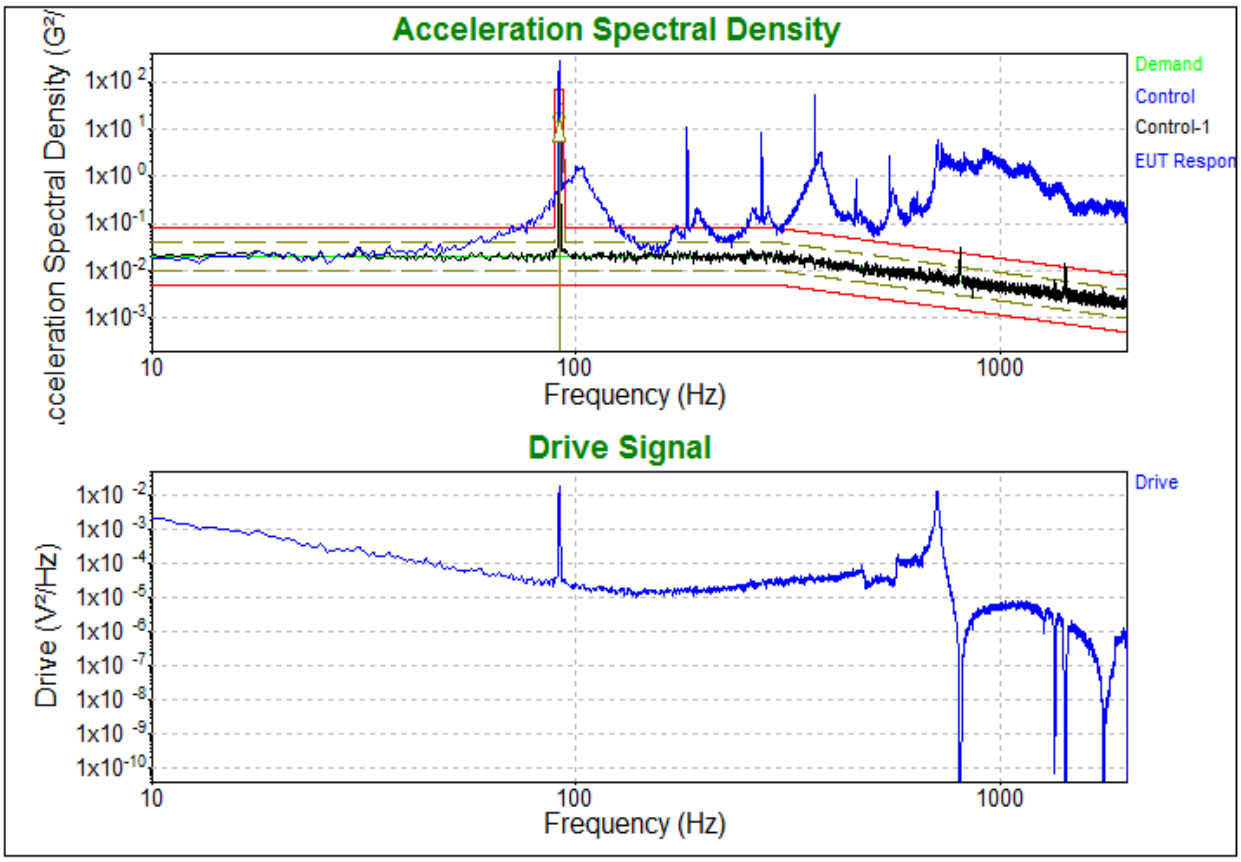


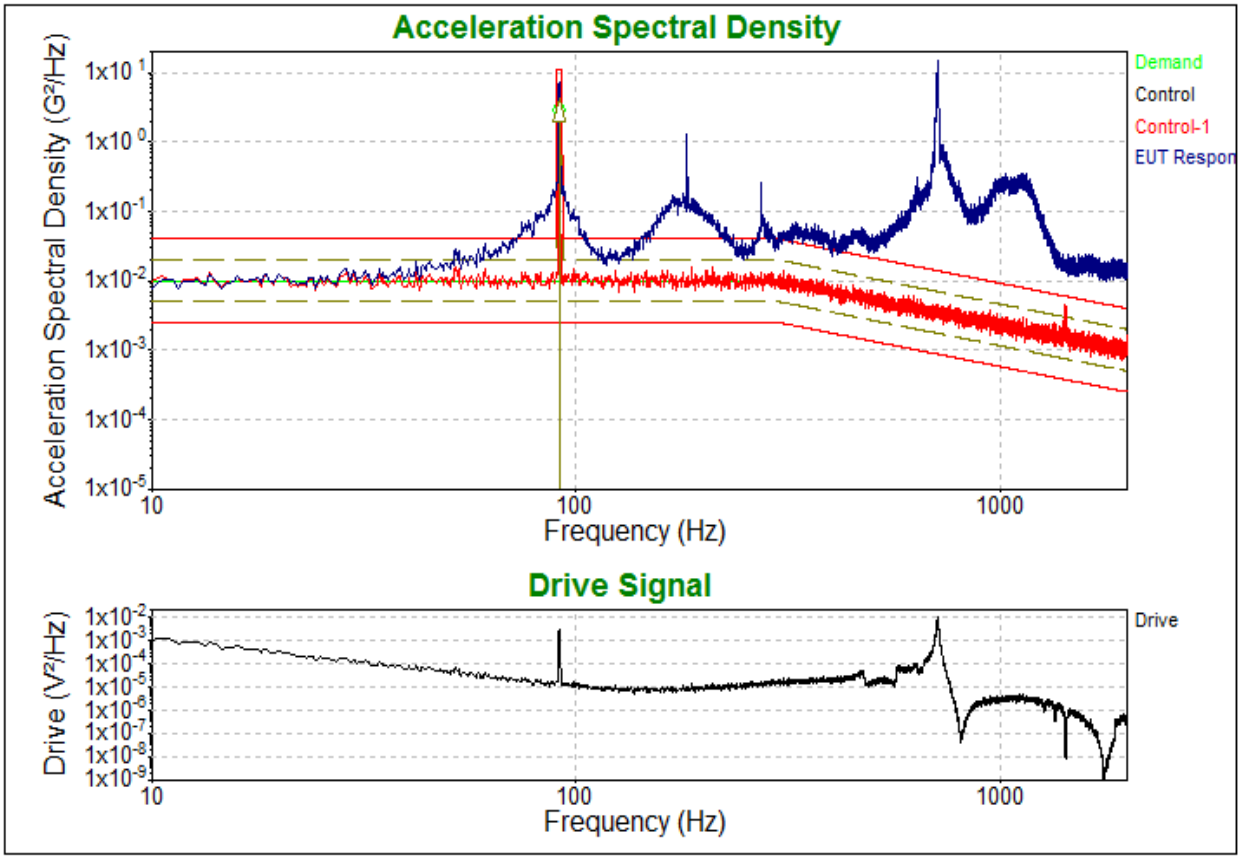
Z Axis Initial Cat R Zone 2 Curve G Performance Level SOR Vibration in 5 Vdc mode, EUT # RGL-EYQ-A

Dwell performed at 91.45 Hz, as determined from initial sine sweep.



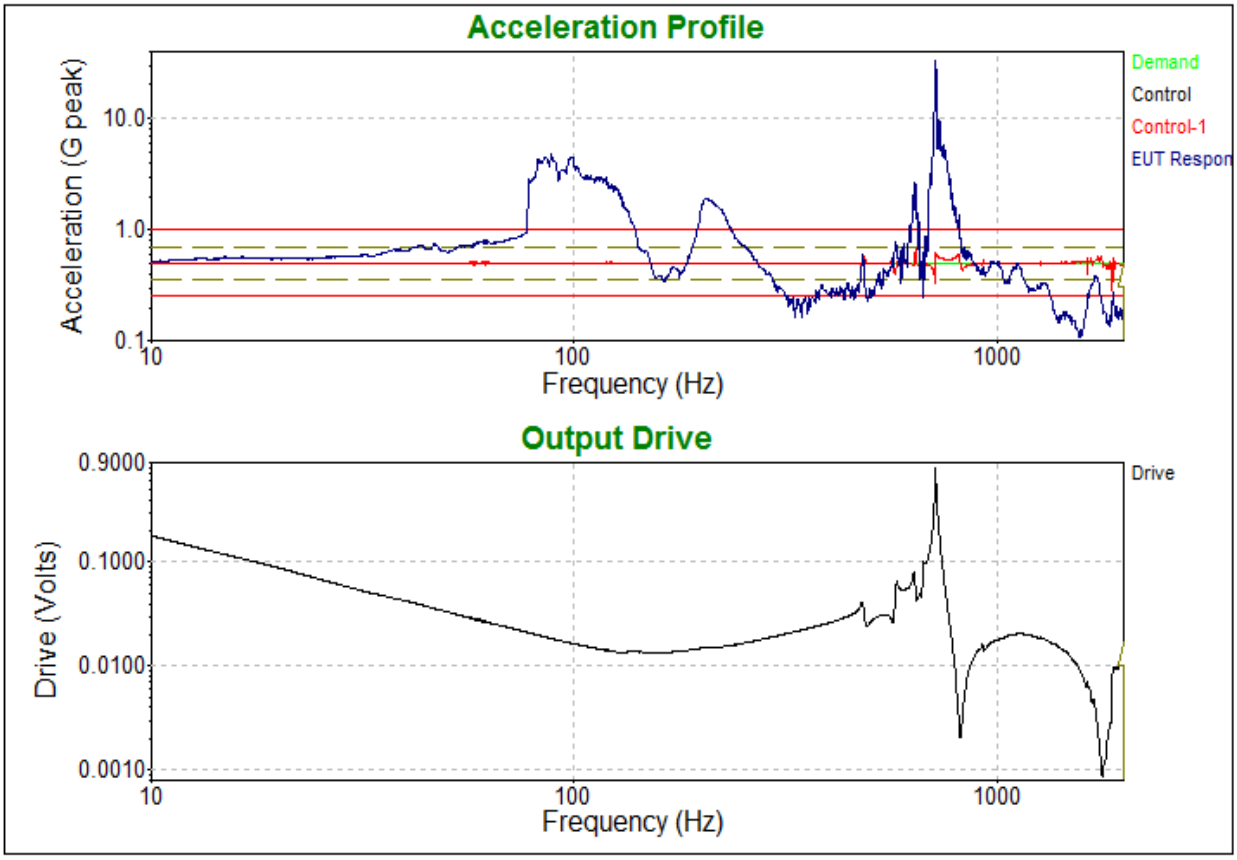
Z Axis Cat R Zone 2 Curve G Endurance Level SOR Vibration in 5 Vdc mode, EUT # RGL-EYQ-A

Dwell performed at 91.45 Hz, as determined from initial sine sweep.

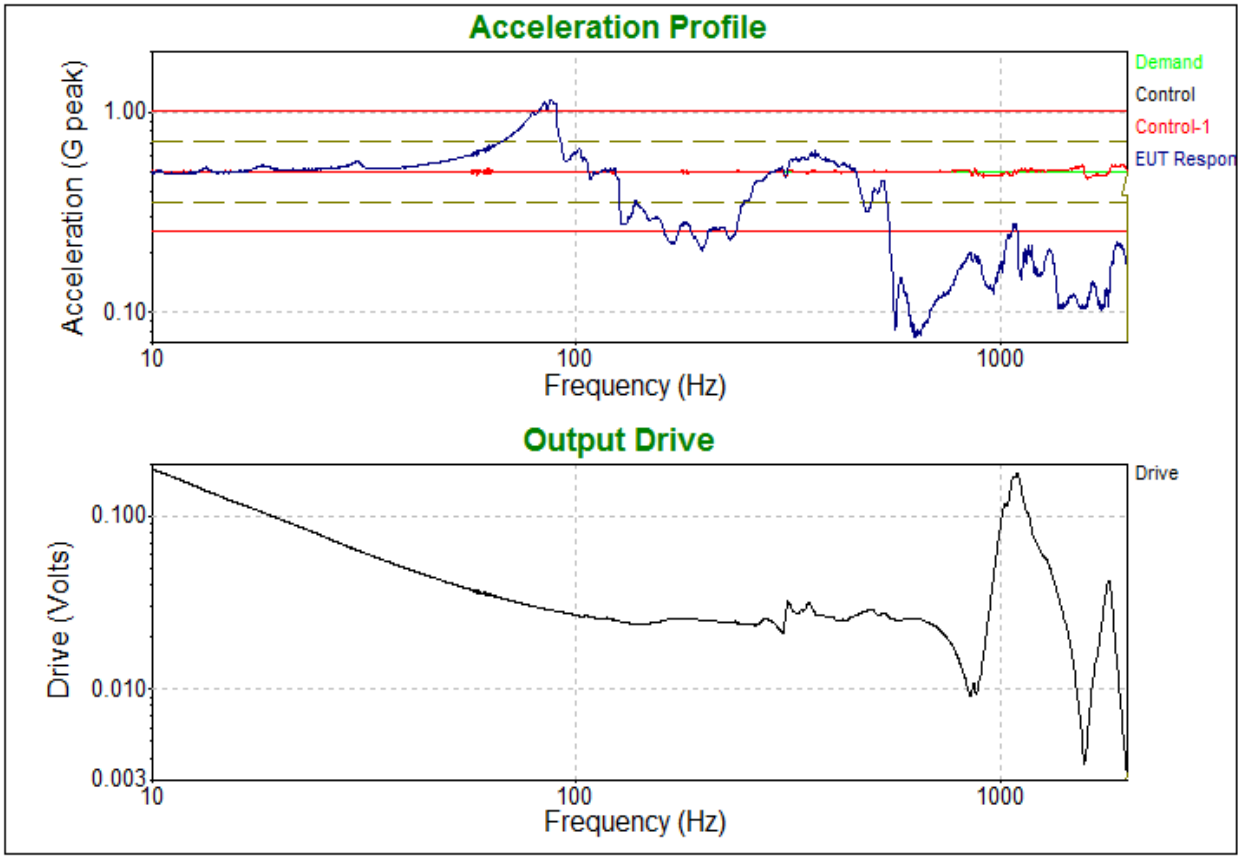


Z Axis Final Cat R Zone 2 Curve G Performance Level SOR Vibration in 5 Vdc mode, EUT # RGL-EYQ-A

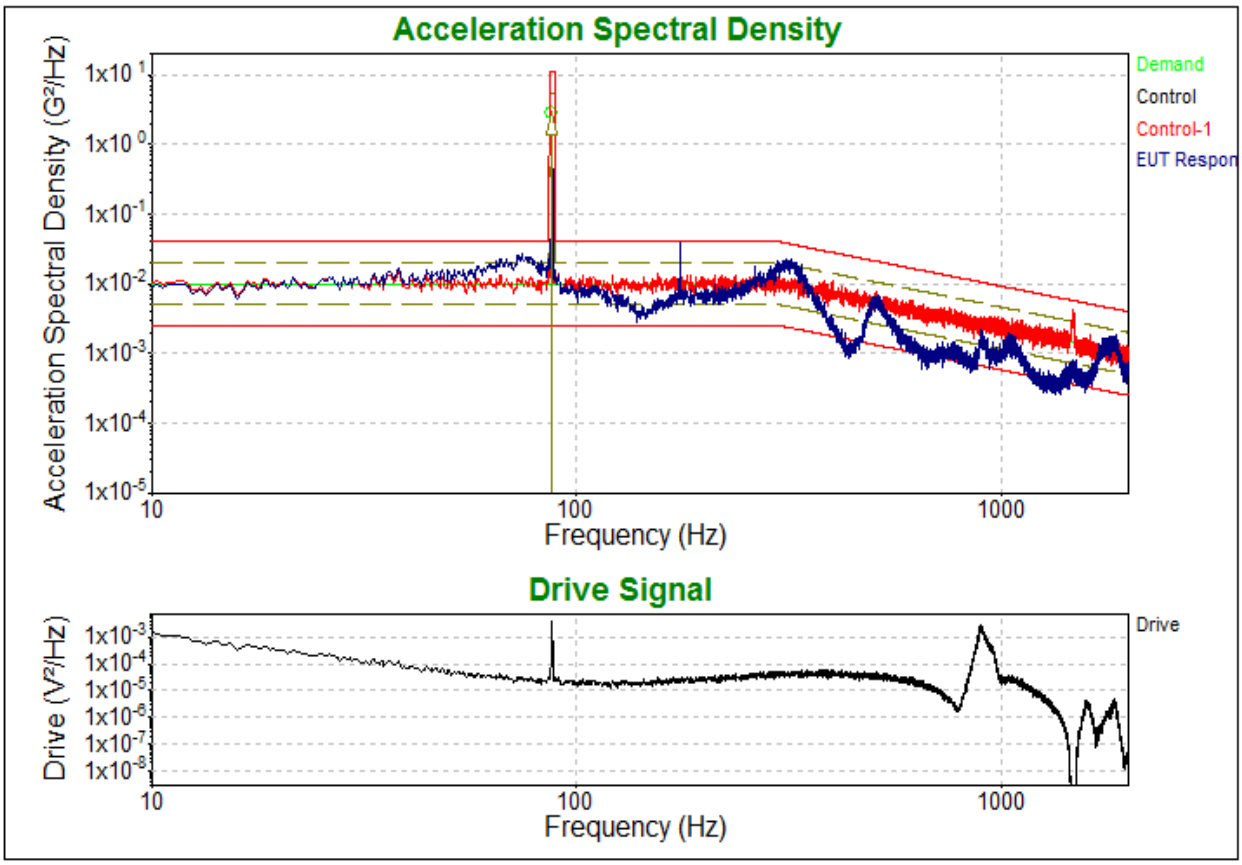
Dwell performed at 91.45 Hz, as determined from initial sine sweep.



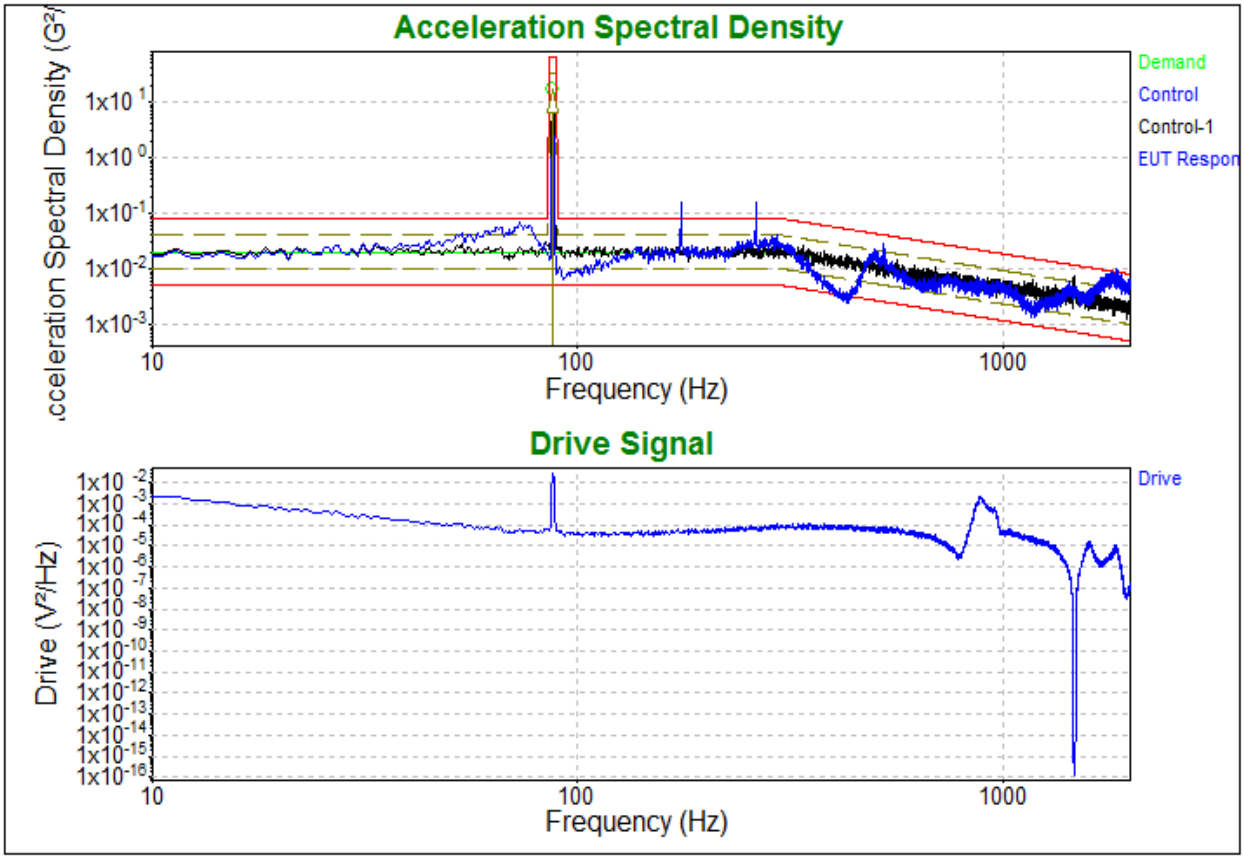
Z Axis Final Sine Sweep Resonance Check in 5 Vdc mode, EUT # RGL-EYQ-A



Y Axis Initial Sine Sweep Resonance Check in 5 Vdc mode, EUT # RGL-EYQ-A



Y Axis Initial Cat R Zone 2 Curve G Performance Level SOR Vibration in 5 Vdc mode, EUT # RGL-EYQ-A



Y Axis Cat R Zone 2 Curve G Endurance Level SOR Vibration in 5 Vdc mode, EUT # RGL-EYQ-A

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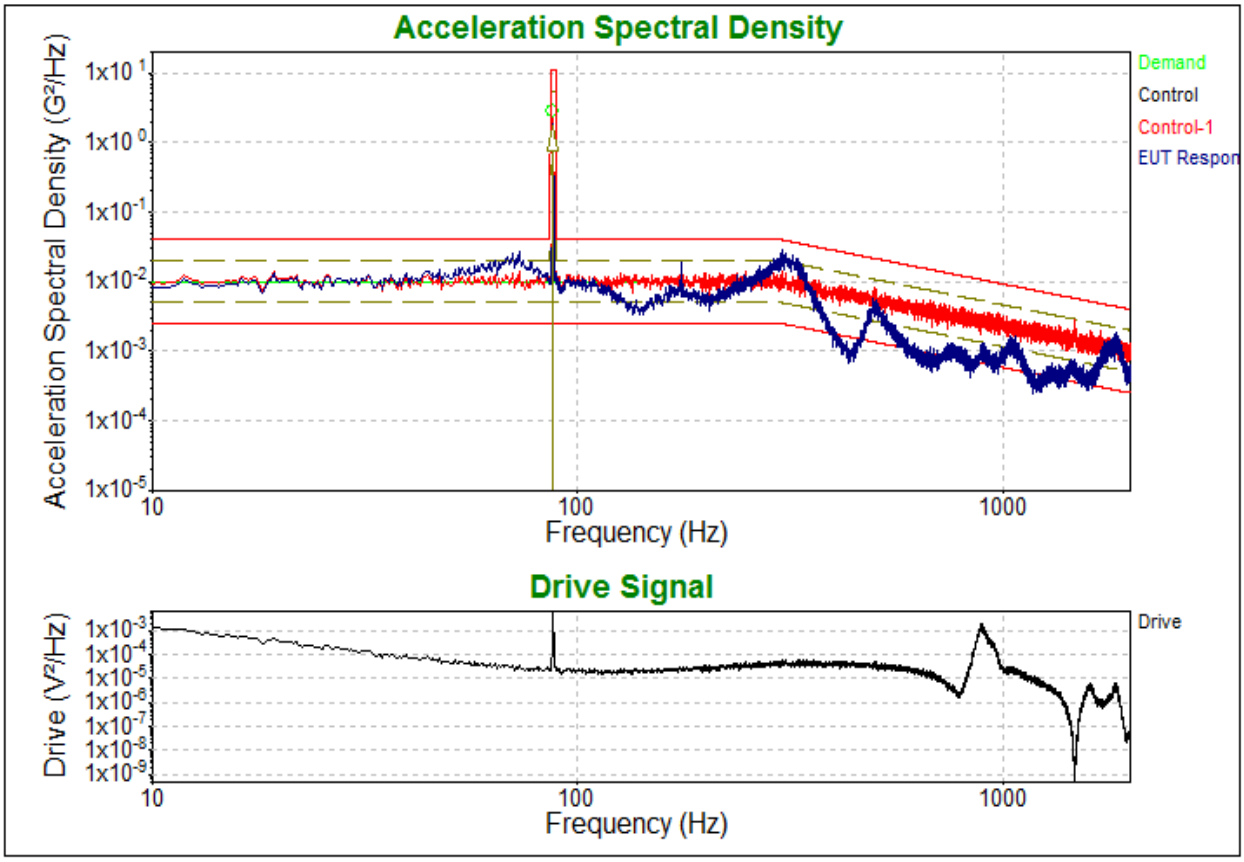
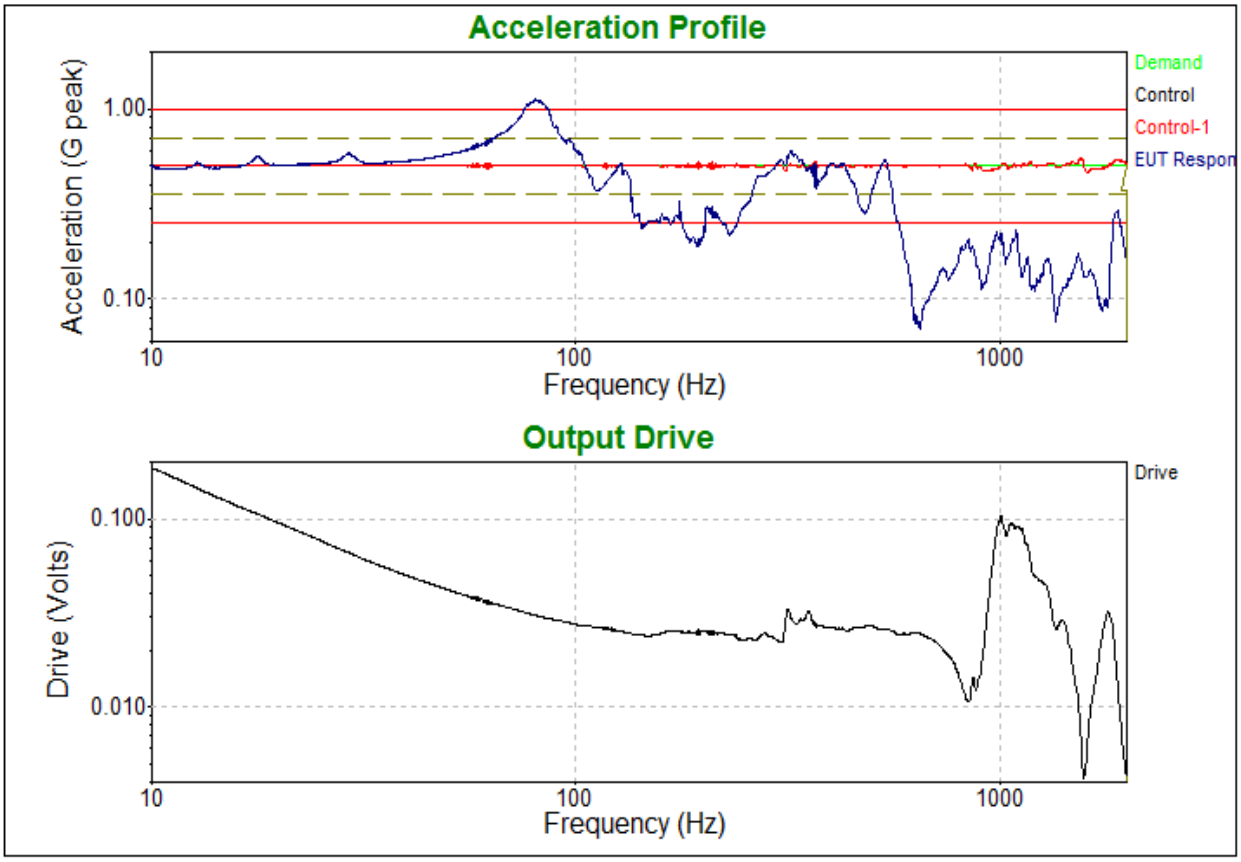


Y Axis Final Cat R Zone 2 Curve G Performance Level SOR Vibration in 5 Vdc mode, EUT # RGL-EYQ-A



Y Axis Final Sine Sweep Resonance Check in 5 Vdc mode, EUT # RGL-EYQ-A

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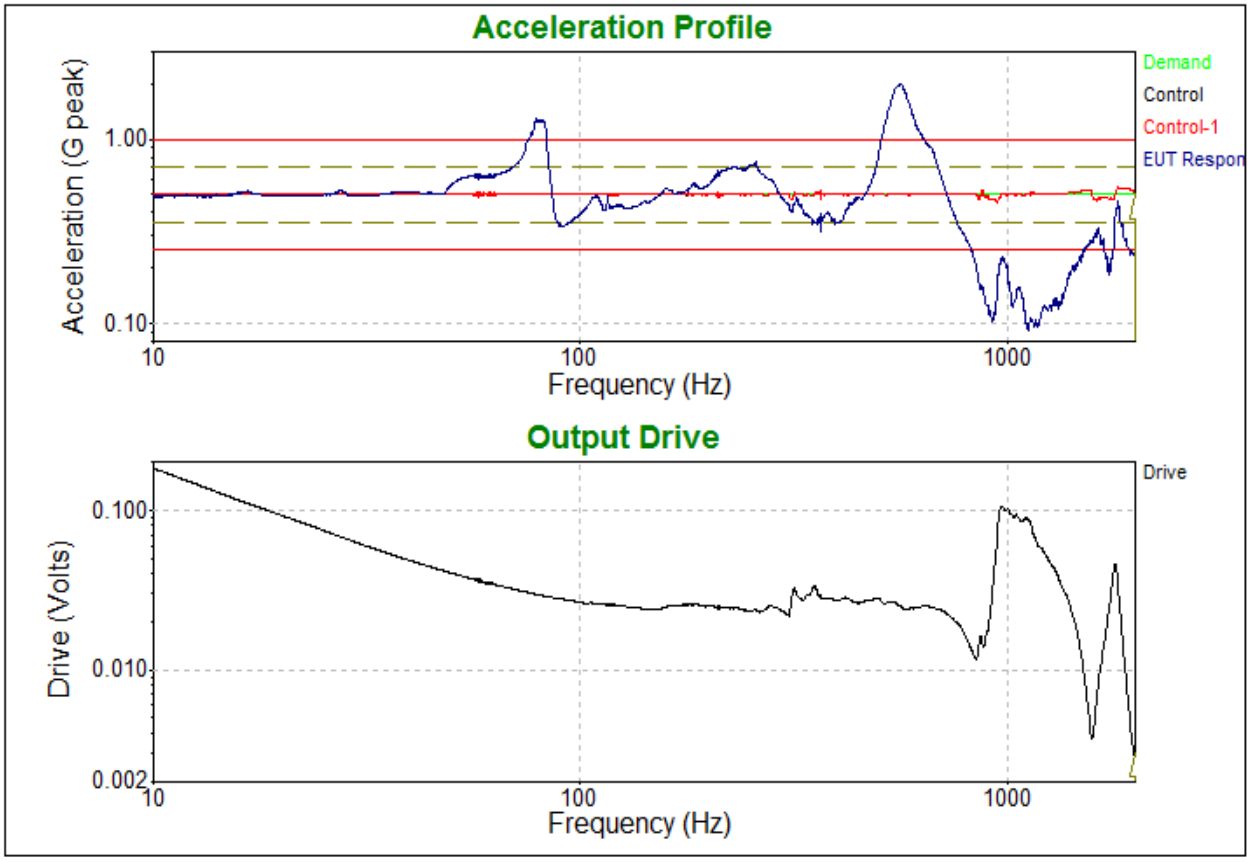

X Axis Initial Sine Sweep Resonance Check in 5 Vdc mode, EUT # RGL-EYQ-A

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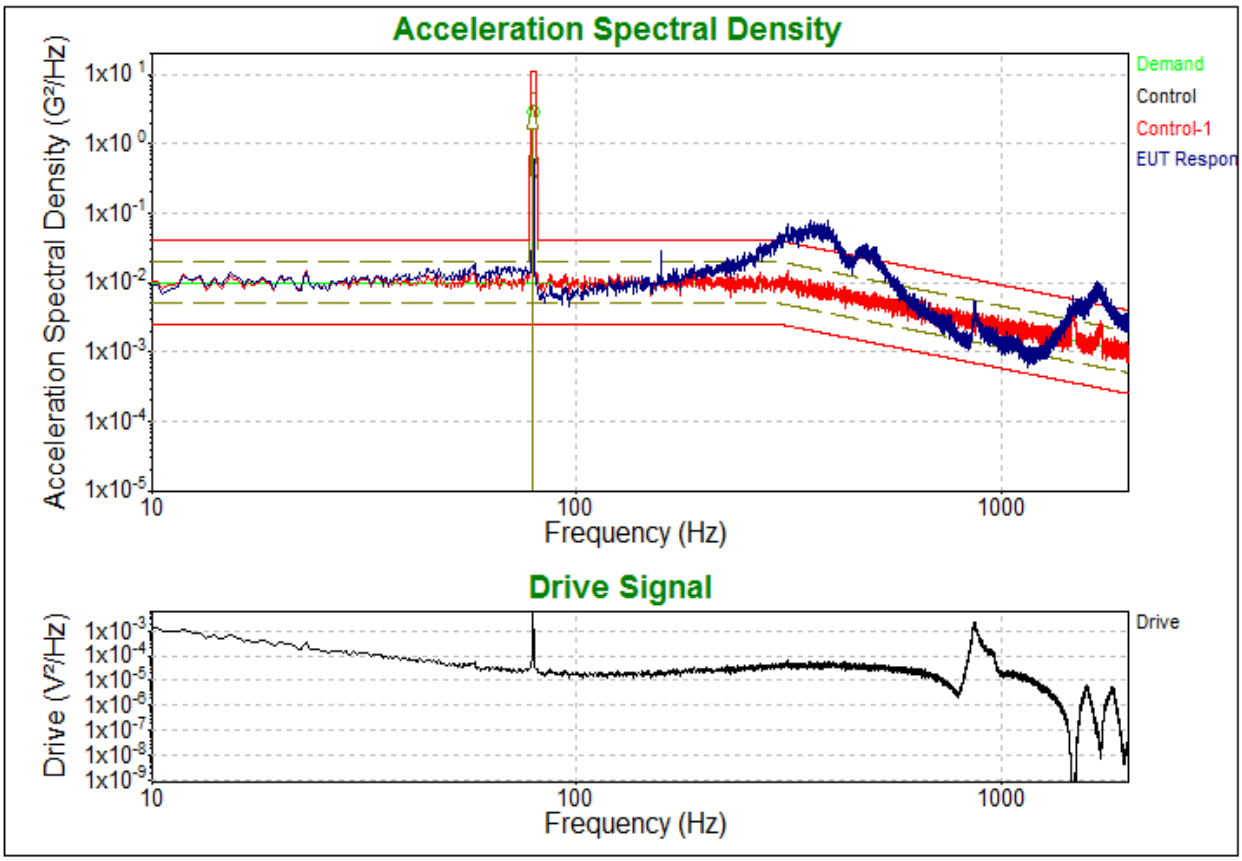
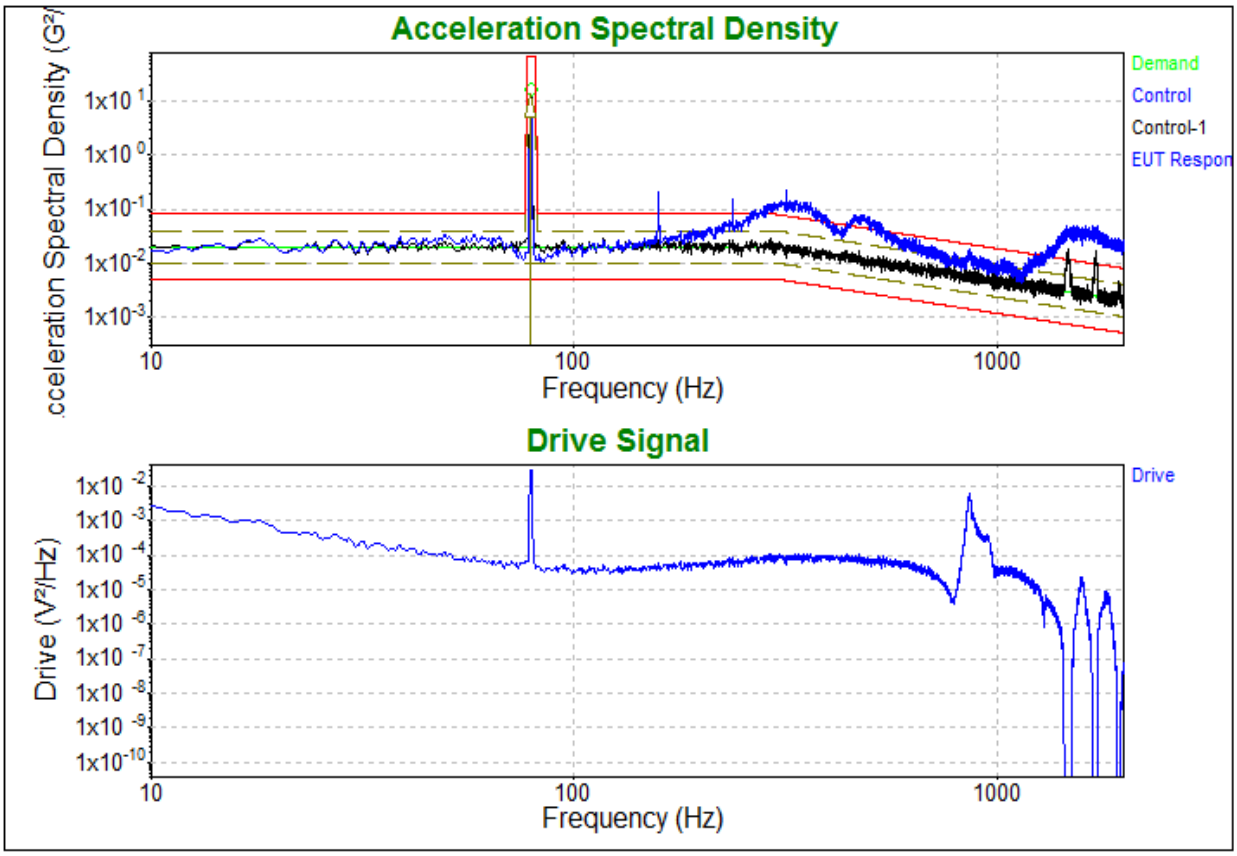


X Axis Initial Cat R Zone 2 Curve G Performance Level SOR Vibration in 5 Vdc mode, EUT # RGL-EYQ-A



X Axis Cat R Zone 2 Curve G Endurance Level SOR Vibration in 5 Vdc mode, EUT # RGL-EYQ-A

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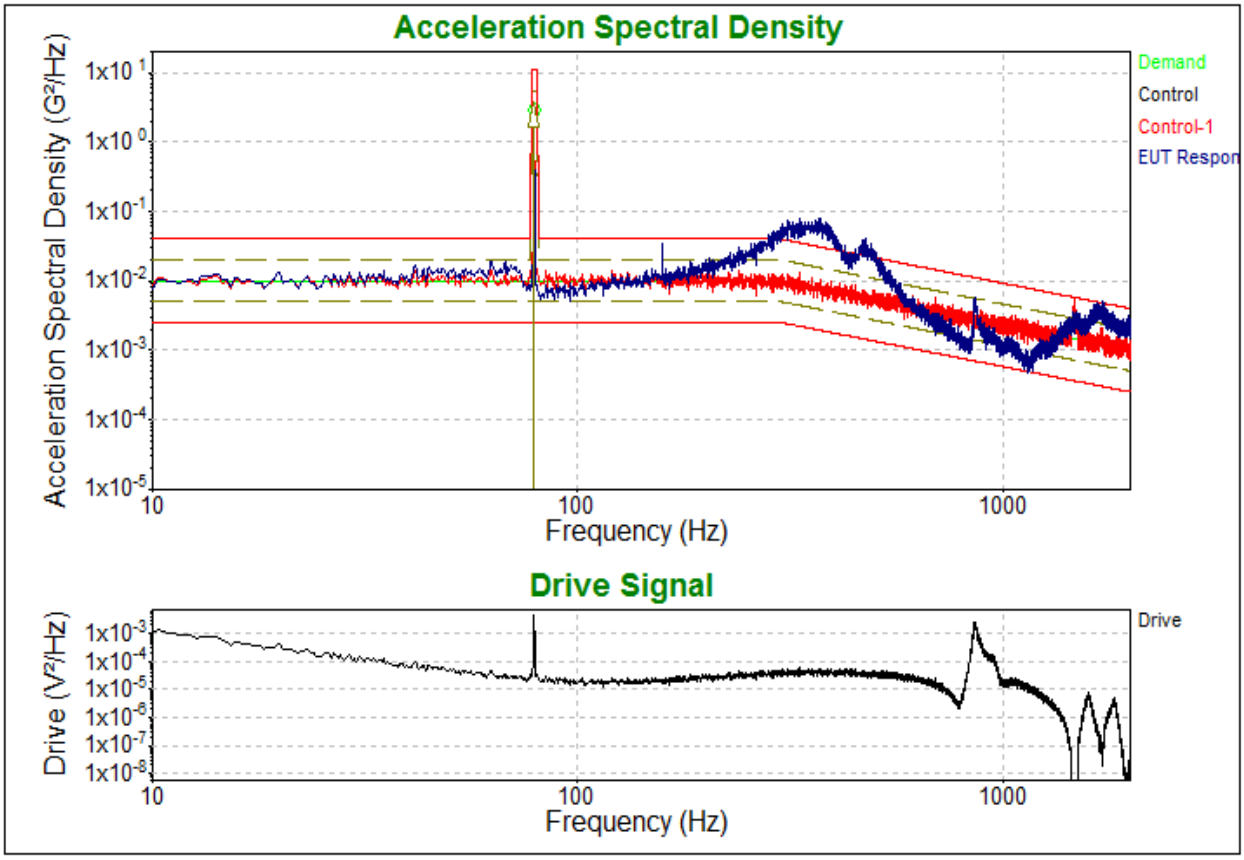
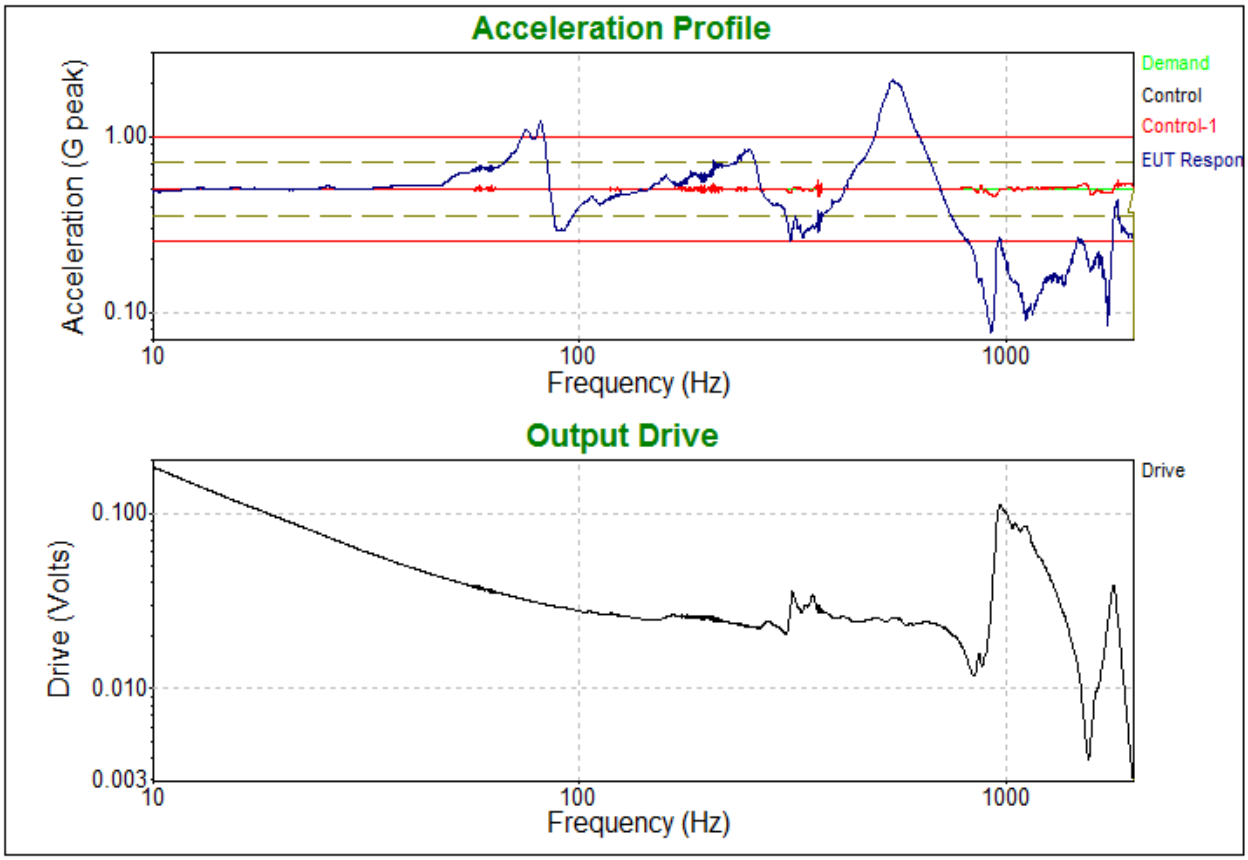


X Axis Final Cat R Zone 2 Curve G Performance Level SOR Vibration in 5 Vdc mode, EUT # RGL-EYQ-A



X Axis Final Sine Sweep Resonance Check in 5 Vdc mode, EUT # RGL-EYQ-A

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OPERATIONAL SHOCK

TEST DATES
06/05/2017 – 06/06/2017

EQUIPMENT UNDER TEST (EUT)
Quantity: One (1) Tracking / Messaging Unit
Part Number: RockAIR
Serial Number: RGL-EYQ-A

TEST SPECIFICATION(s)
RTCA DO-160G, Section 7.2.1, Test Condition E

REQUIREMENTS
The EUT shall undergo operational shock testing per RTCA DO-160G, Section 7.2.1, Test Condition E for Low Frequency Operational Shock. The EUT shall withstand six (6) sawtooth shocks, three in a positive direction, three negative, in each of three (3) mutually perpendicular axes, with a peak acceleration of 6 Gs and a duration of 20 msec while powered. There shall be no physical or electrical failures that prevent the EUT from being operated per customers post-test requirements, nor shall the EUT sustain physical damage.

PROCEDURE

RTCA DO-160G, Section 7.2.1, Test Condition E for Low Frequency Operational Shock

1. Attach the EUT test fixture to the shaker table in the axis to be tested.
2. Attach the EUT to the test fixture.
3. Attach a response accelerometer to the EUT in the axis of excitation.
4. Attach a control accelerometer to the shaker table in the axis of excitation.
5. Connect a dc power supply capable of delivering a maximum of 24 Vdc to the EUT, at the 24 Vdc power input connector.
6. Perform a pre-environment functional test on the EUT per customer requirements.
7. Apply 24 Vdc to the EUT.
8. Apply three (3) positive and three (3) negative shocks having a terminal saw-tooth wave shape with an acceleration peak value of six (6) g's and a nominal pulse duration of twenty (20) milliseconds.
9. Perform a post-environment functional test on the EUT per customer requirements.
10. Inspect the EUT visually and report any damage observed.
11. Repeat Steps 7 – 10 for all three orthoganol axes. Testing will be conducted in the 24 Vdc mode only, per the customer.

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TEST RESULTS

Testing was performed in the sequence of Z Axis (vertical), Y Axis (lateral) then X Axis (longitudinal). There was no damage to the unit in any of the axes tested, and the unit operated satisfactorily.

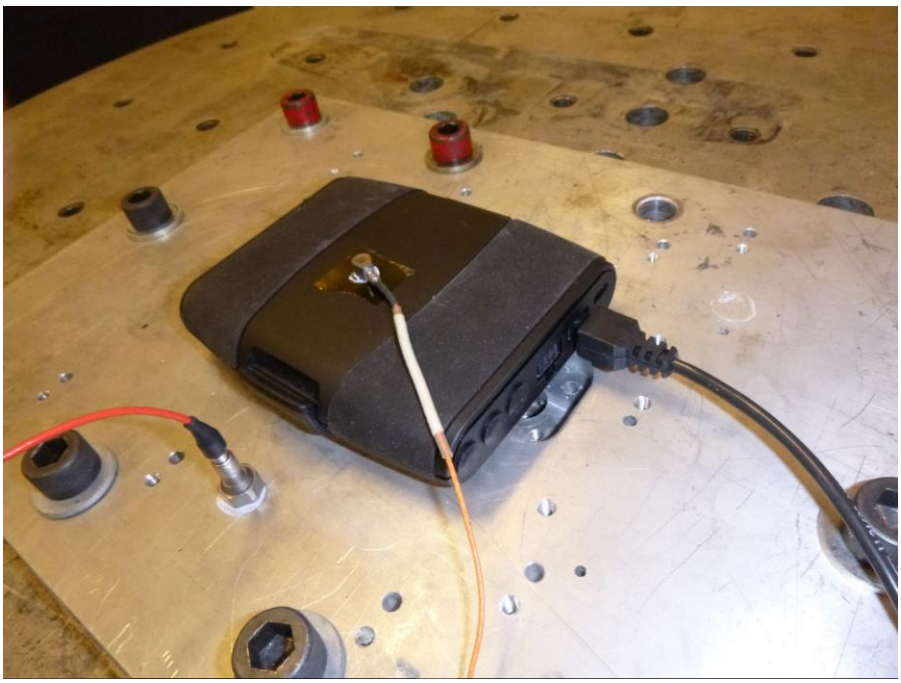
EQUIPMENT USED

Equipment	Manufacturer	DLS Lab Number	Model#	Date Calibrated	Calibration Due Date
Accelerometer	Dytran	153	3225F1T	07/05/2016	07/05/2017
Accelerometer	Dytran	163	3049E1	06/14/2016	06/14/2017
Accelerometer	Dytran	169	3049E3	08/24/2016	08/24/2017
Electrodynamic Shaker	ETS	182	M748A/GT 1200M	N/A	Verified w/Calibrated Accelerometers
Signal Generator	Vibration Research	147	VR9500	11/04/2016	11/04/2017
Digital Multimeter (DMM)	Fluke	263	87V	10/24/2016	10/24/2017
DC Power Supply	Yescom	260	DCP3010D	N/A	Verified w/Calibrated DMM

PHOTOS

Test Title
See Vibration Section for Setup Photos

EUT # RGL-EYQ-A After Completion of Operational Shock Testing (View 1)



EUT # RGL-EYQ-A After Completion of Operational Shock Testing (View 2)

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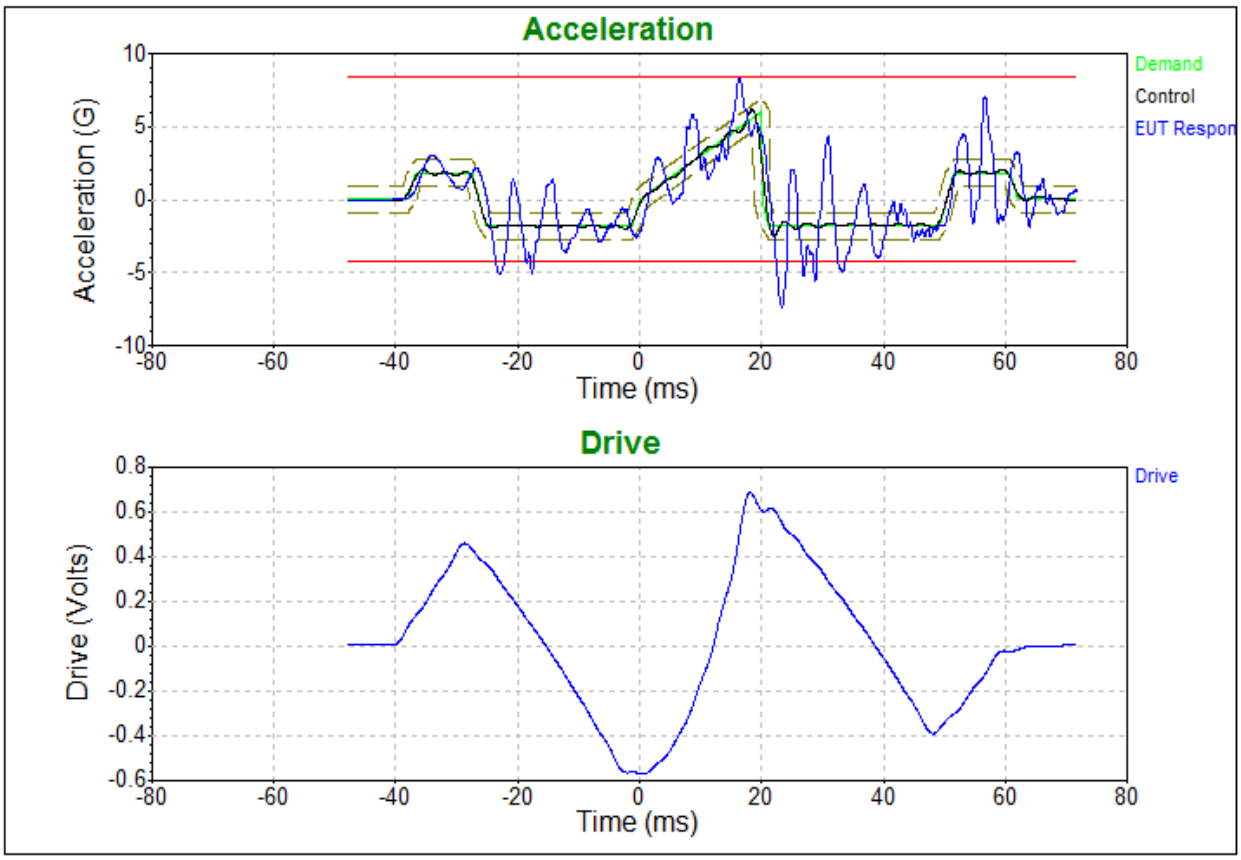
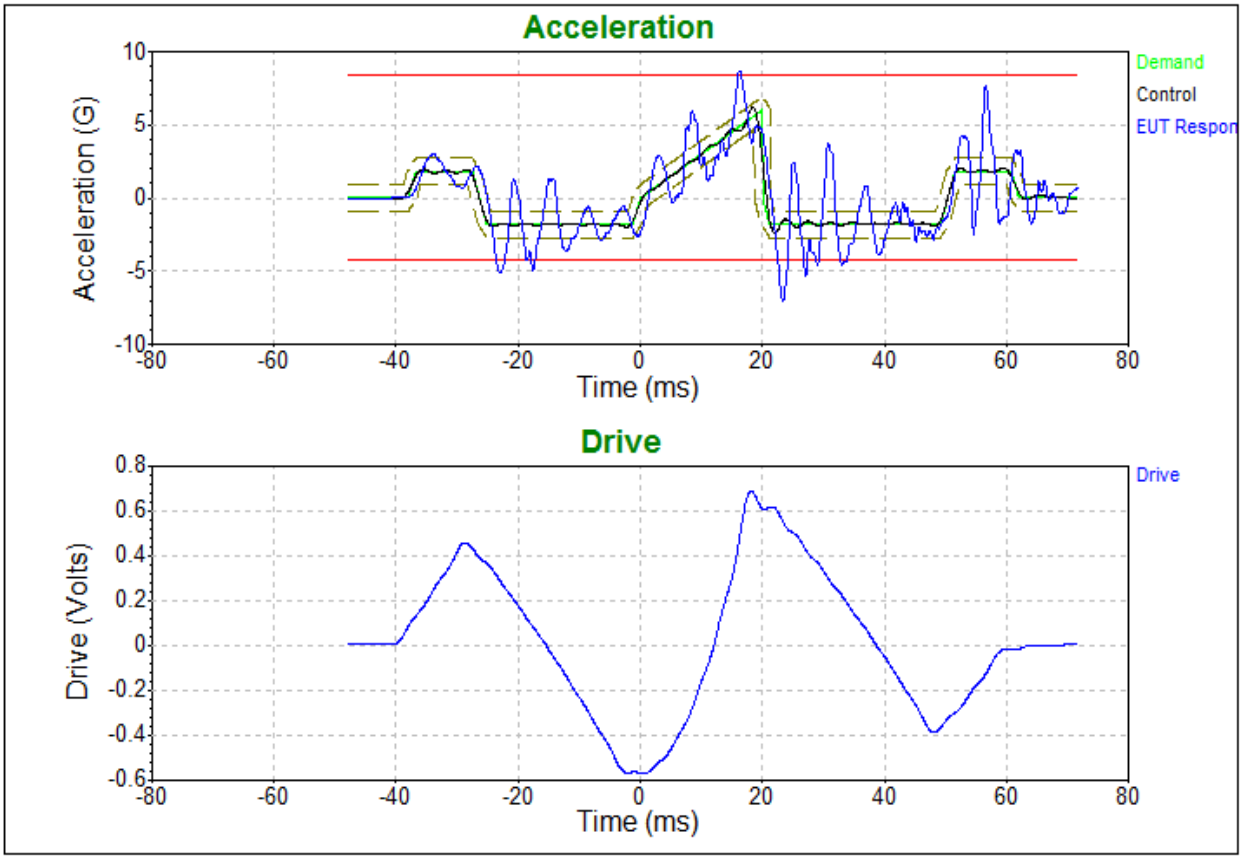
TEST DATA



Z Axis Low Frequency Operational Shock in 24 Vdc mode, 1st Positive Pulse, EUT # RGL-EYQ-A



Z Axis Low Frequency Operational Shock in 24 Vdc mode, 2nd Positive Pulse, EUT # RGL-EYQ-A

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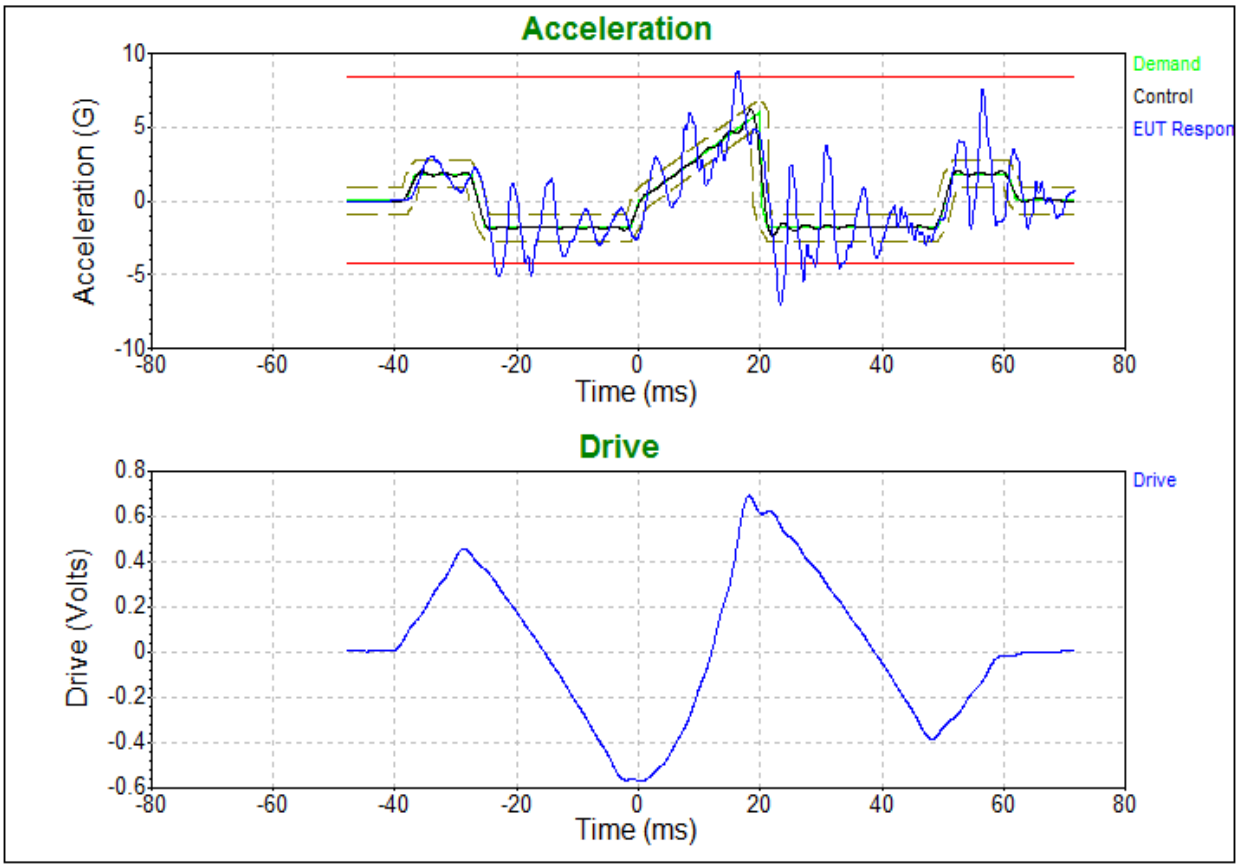
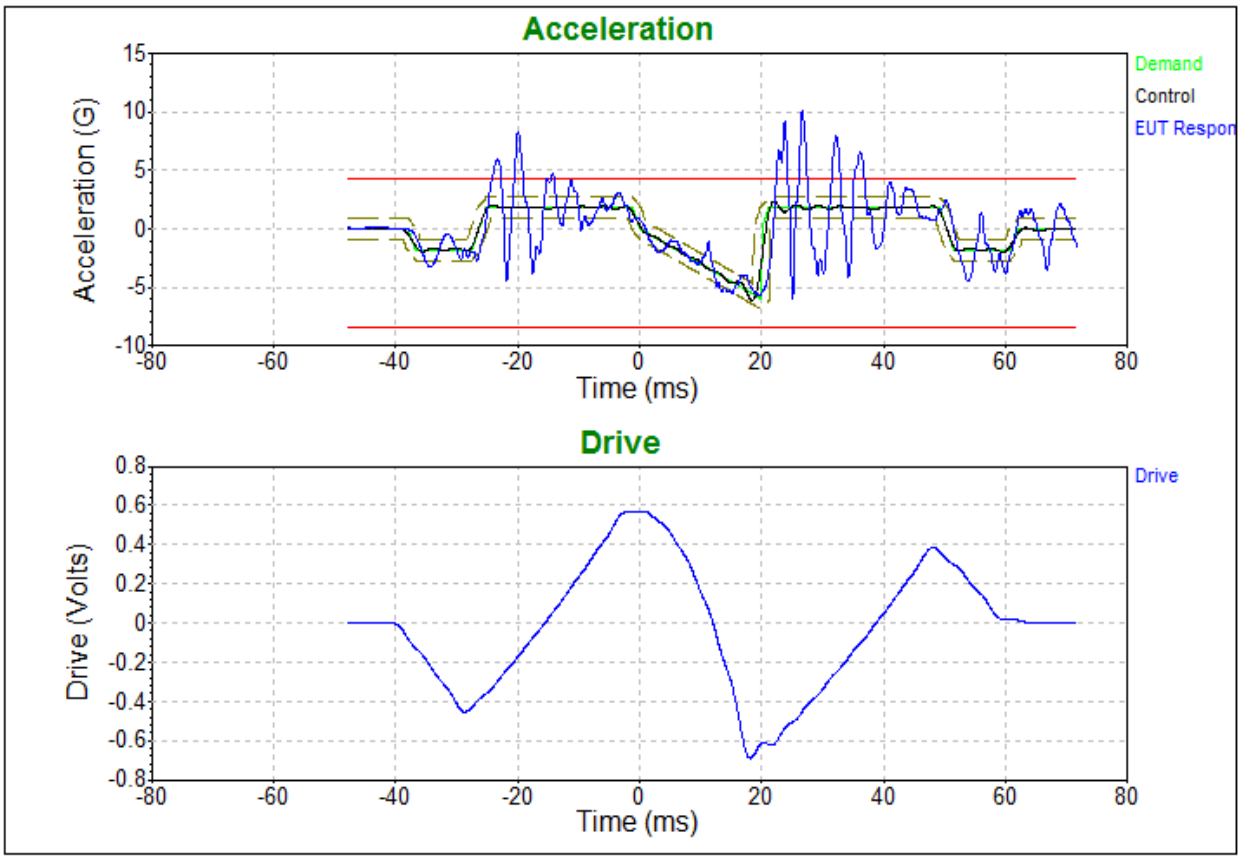


Z Axis Low Frequency Operational Shock in 24 Vdc mode, 3rd Positive Pulse, EUT # RGL-EYQ-A



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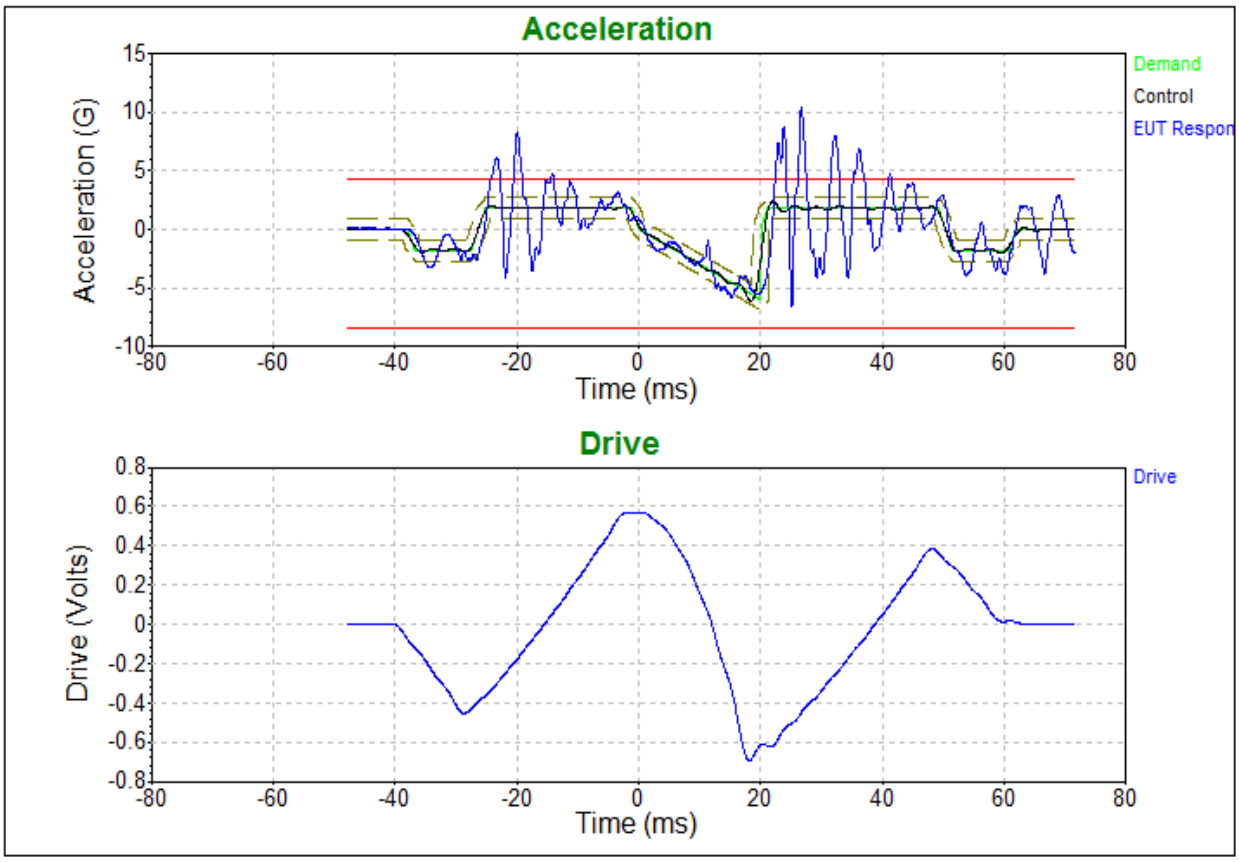
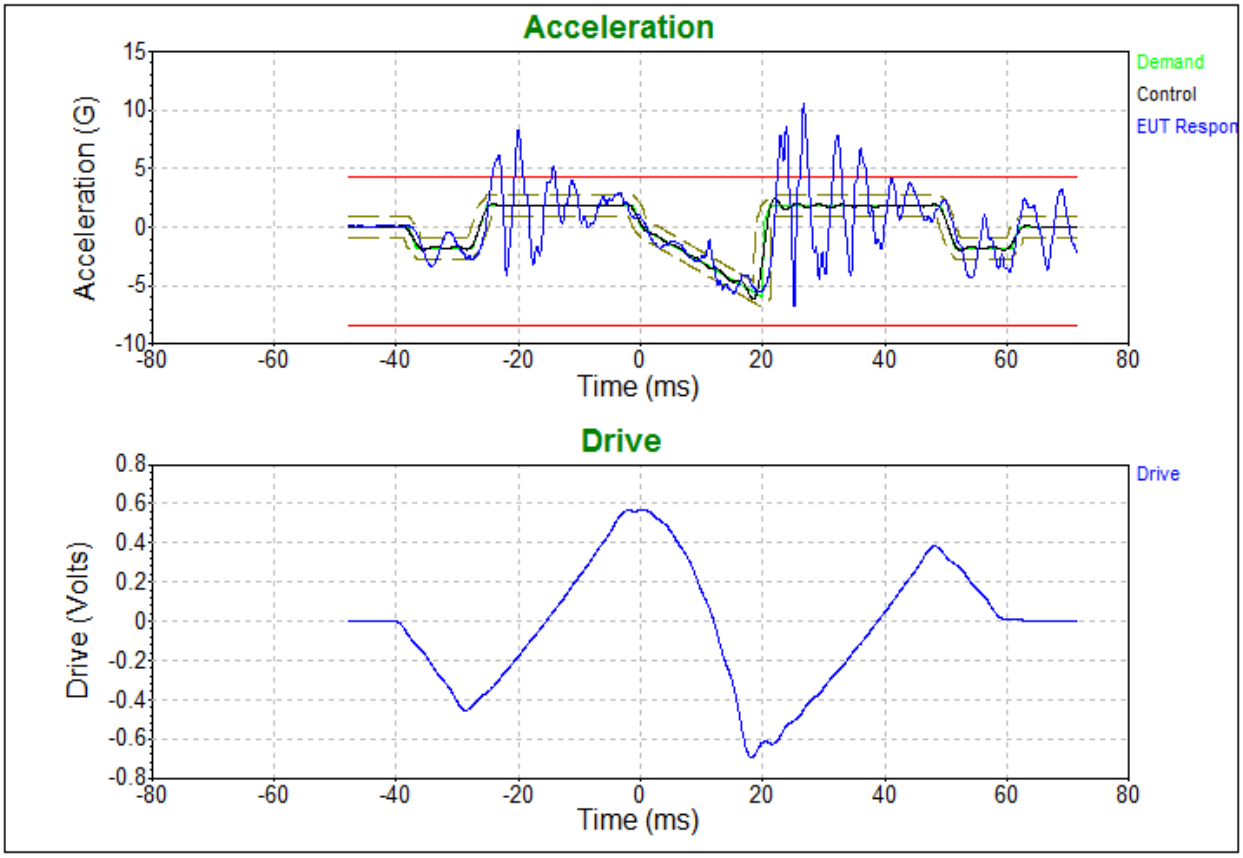


Z Axis Low Frequency Operational Shock in 24 Vdc mode, 2nd Negative Pulse, EUT # RGL-EYQ-A



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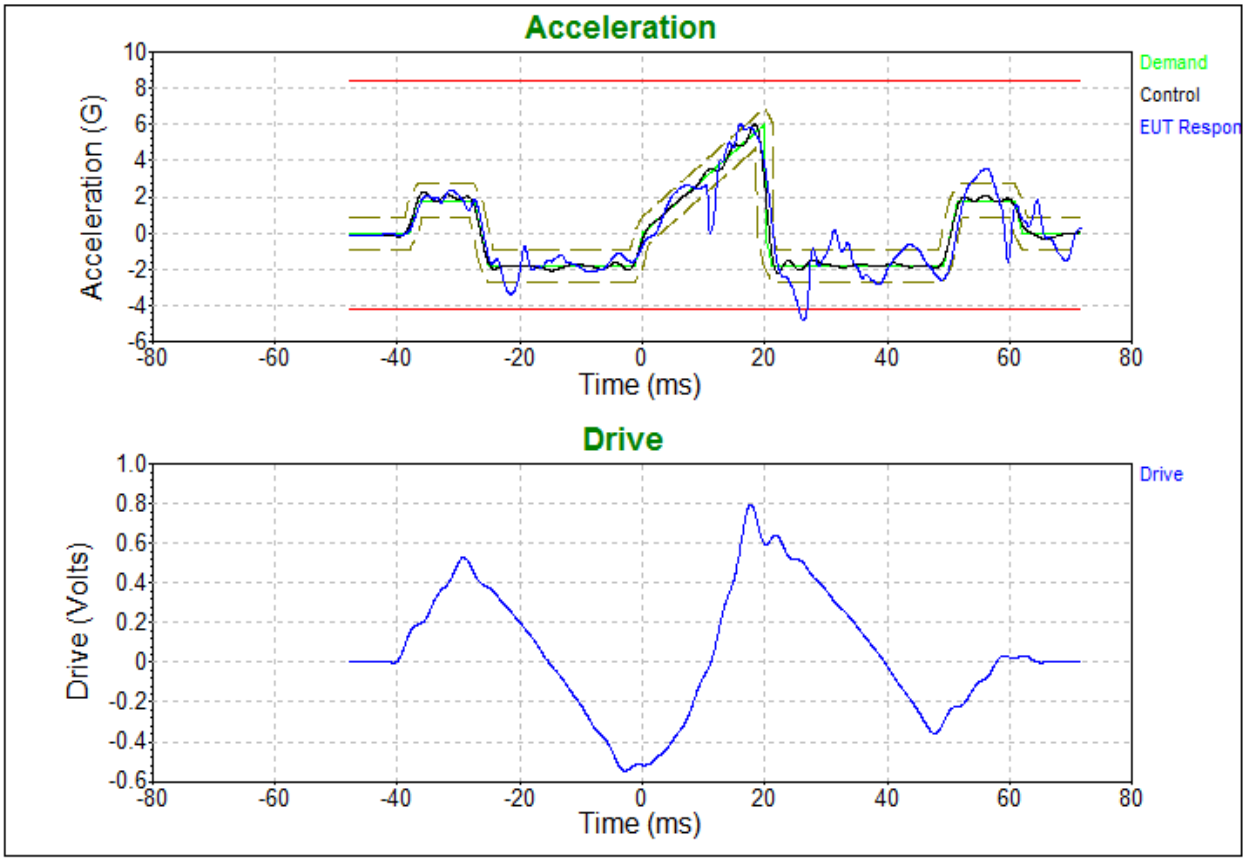

Y Axis Low Frequency Operational Shock in 24 Vdc mode, 1st Positive Pulse, EUT # RGL-EYQ-A

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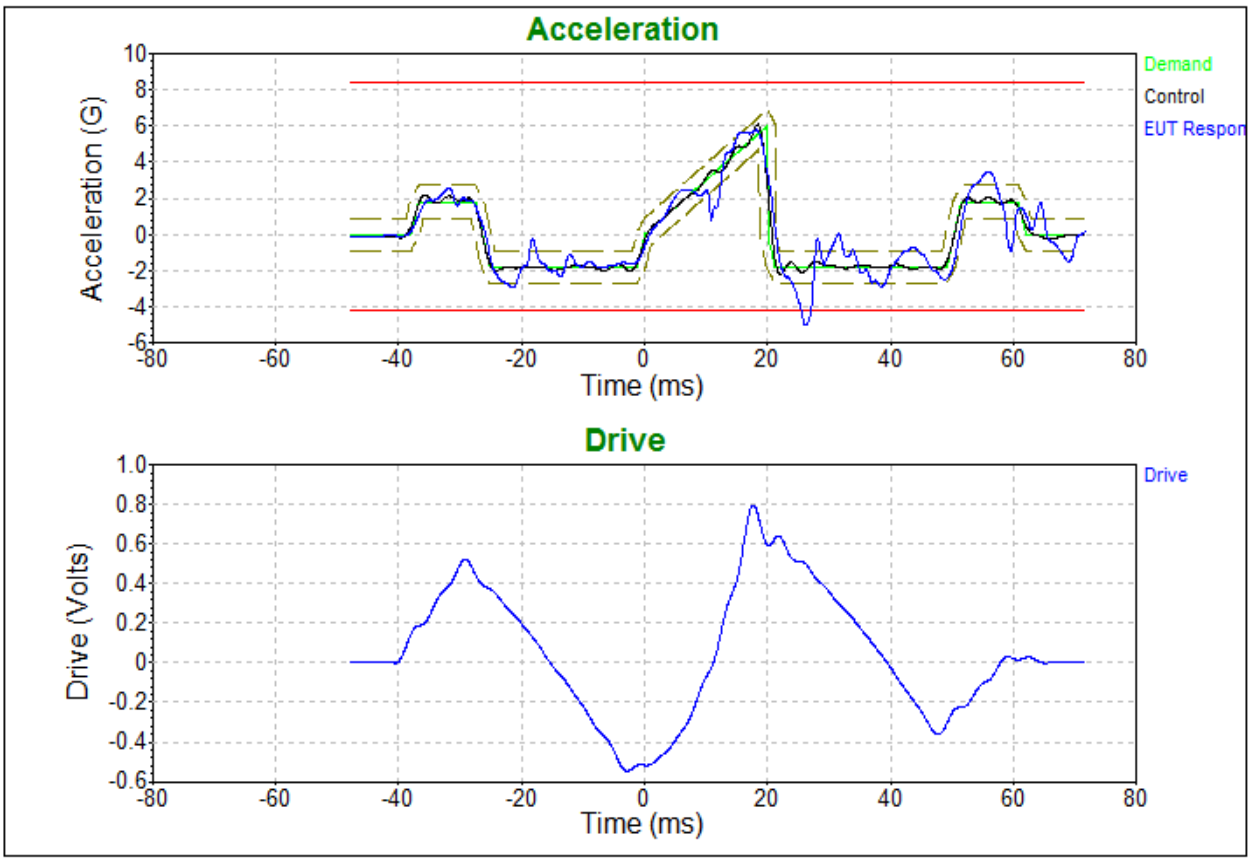

Y Axis Low Frequency Operational Shock in 24 Vdc mode, 2nd Positive Pulse, EUT # RGL-EYQ-A

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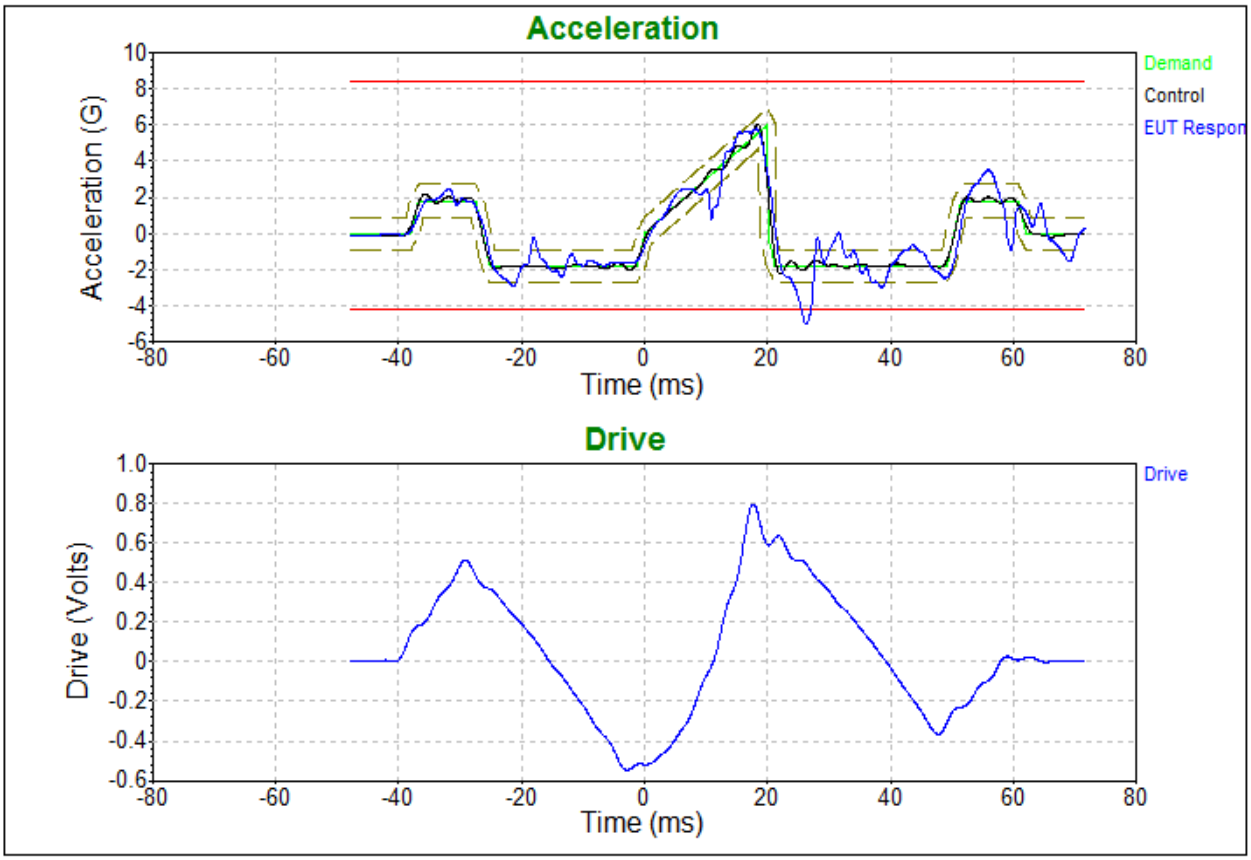
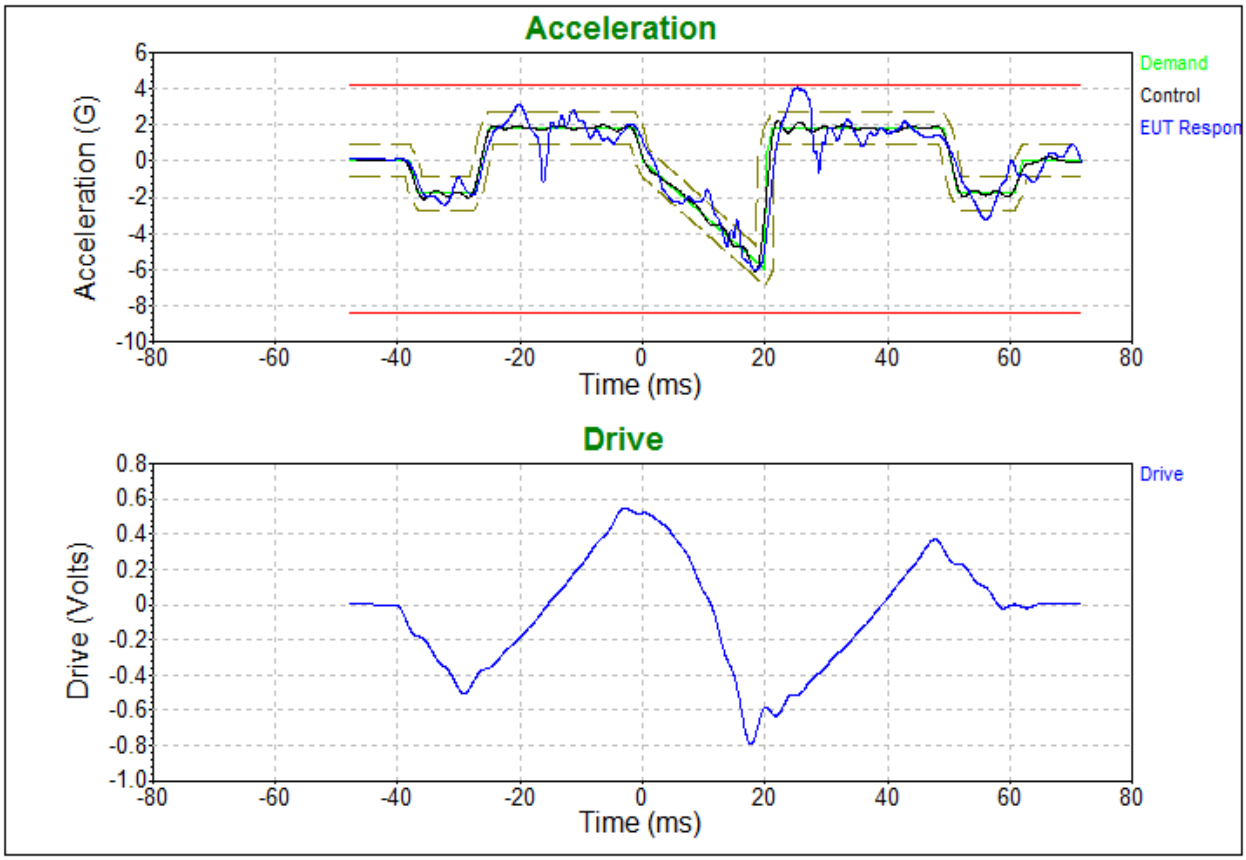


Y Axis Low Frequency Operational Shock in 24 Vdc mode, 3rd Positive Pulse, EUT # RGL-EYQ-A



Y Axis Low Frequency Operational Shock in 24 Vdc mode, 1st Negative Pulse, EUT # RGL-EYQ-A

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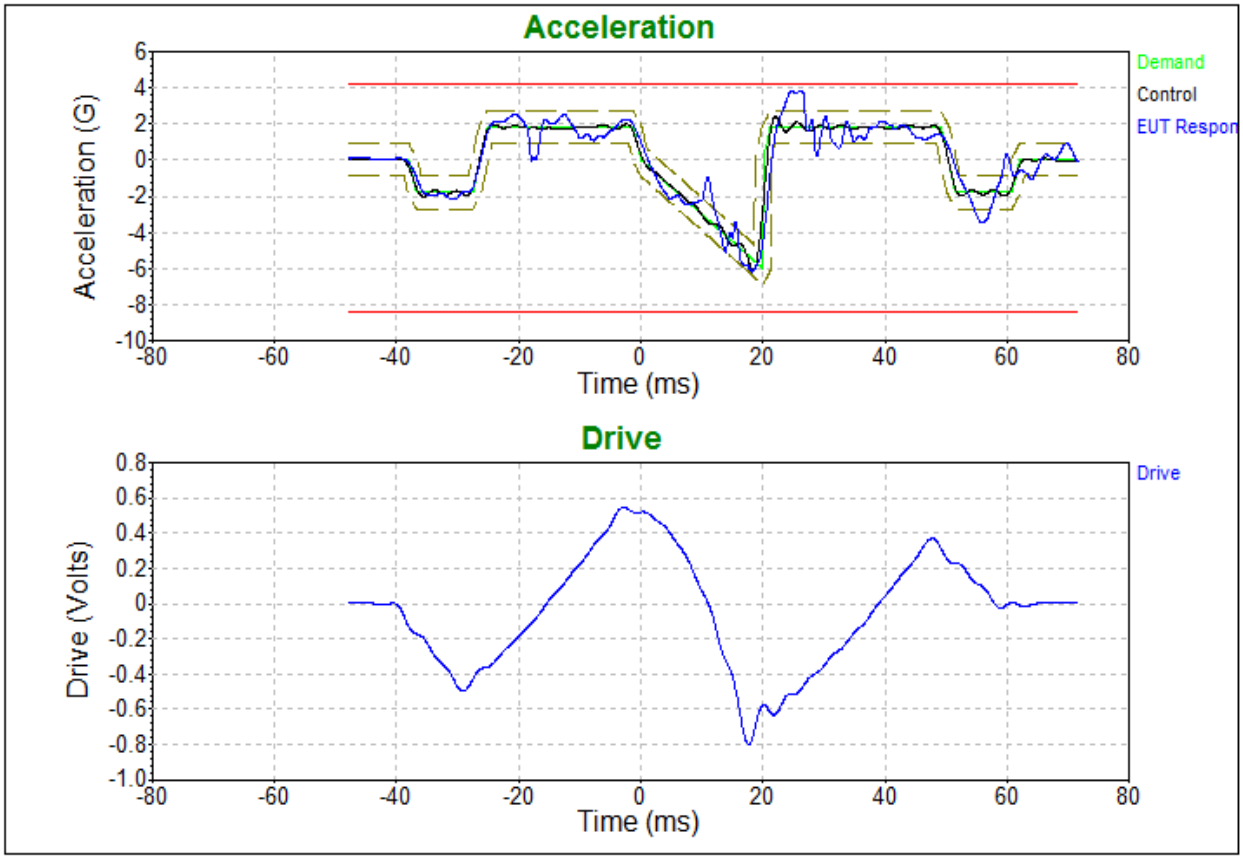

Y Axis Low Frequency Operational Shock in 24 Vdc mode, 3rd Negative Pulse, EUT # RGL-EYQ-A

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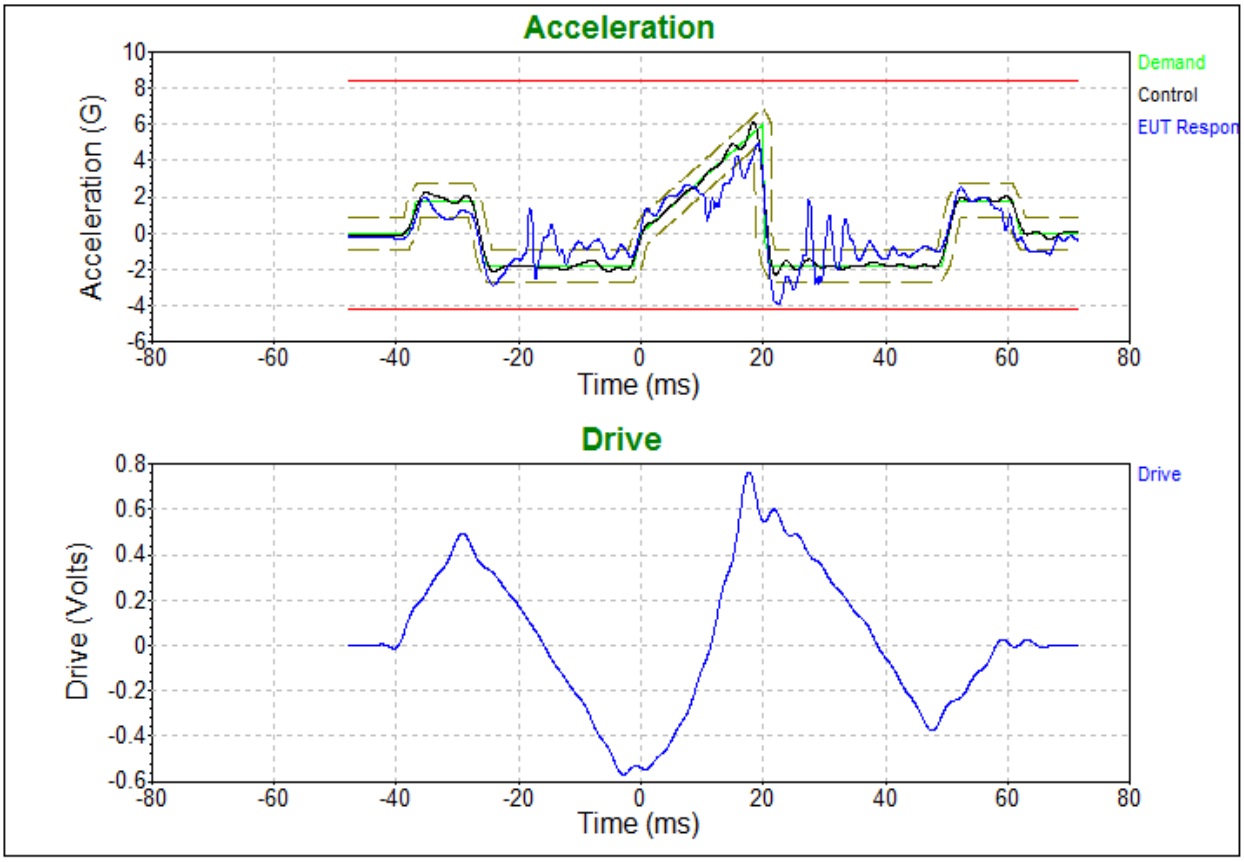
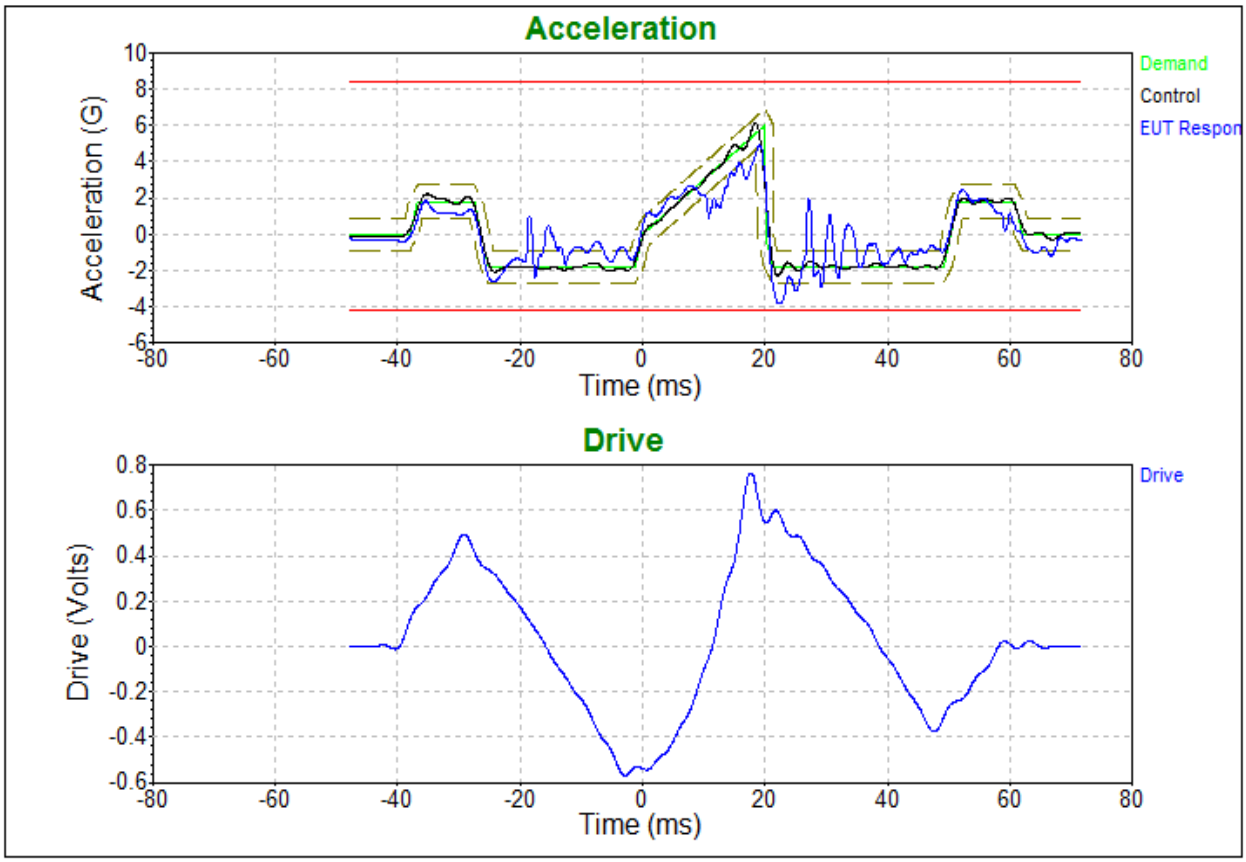
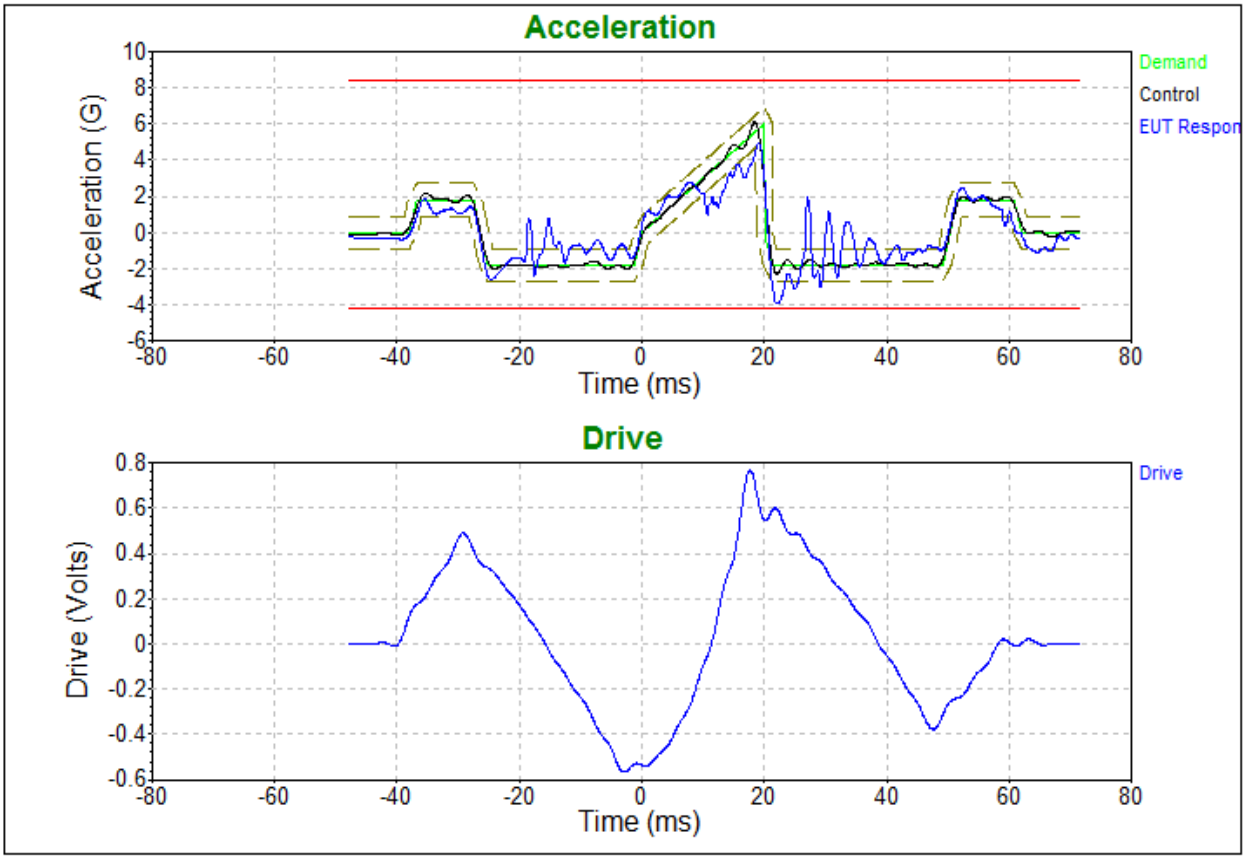


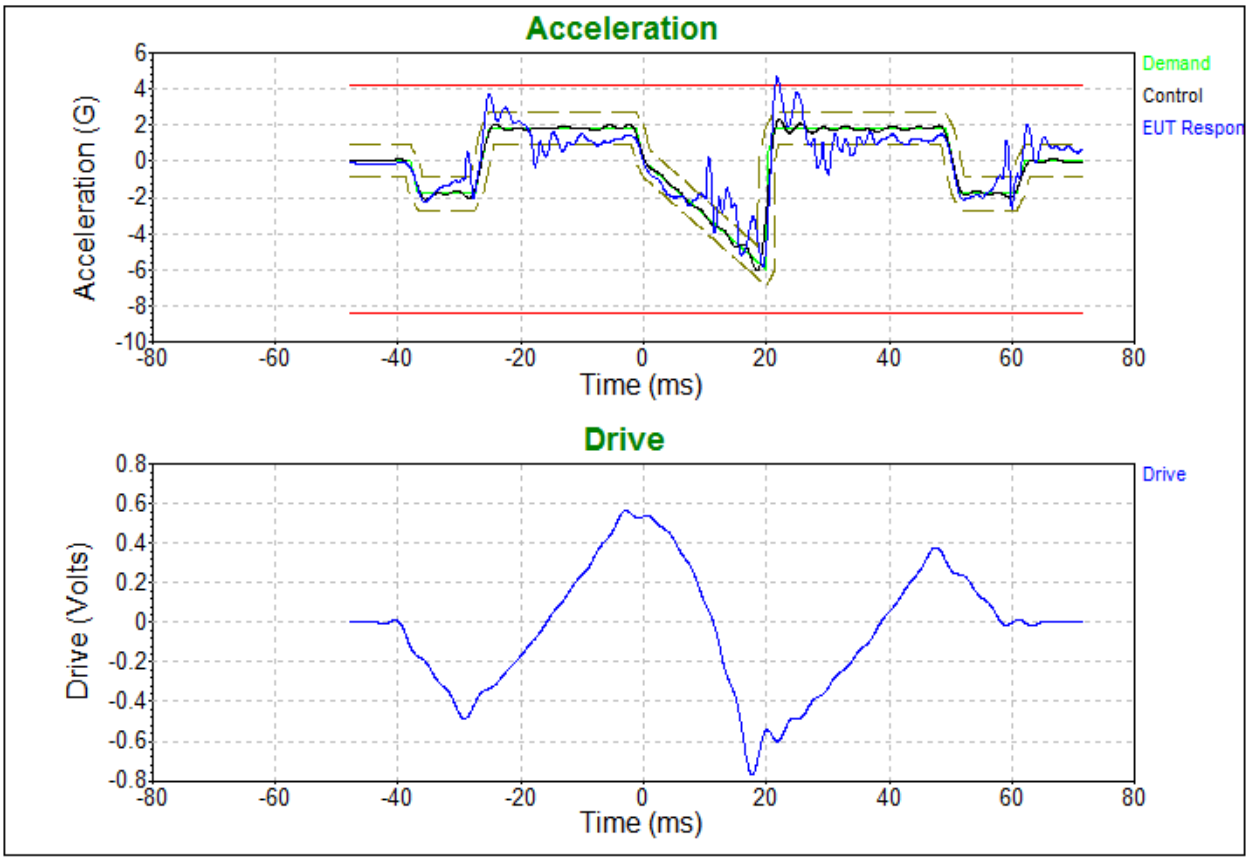
X Axis Low Frequency Operational Shock in 24 Vdc mode, 1st Positive Pulse, EUT # RGL-EYQ-A



X Axis Low Frequency Operational Shock in 24 Vdc mode, 2nd Positive Pulse, EUT # RGL-EYQ-A



X Axis Low Frequency Operational Shock in 24 Vdc mode, 3rd Positive Pulse, EUT # RGL-EYQ-



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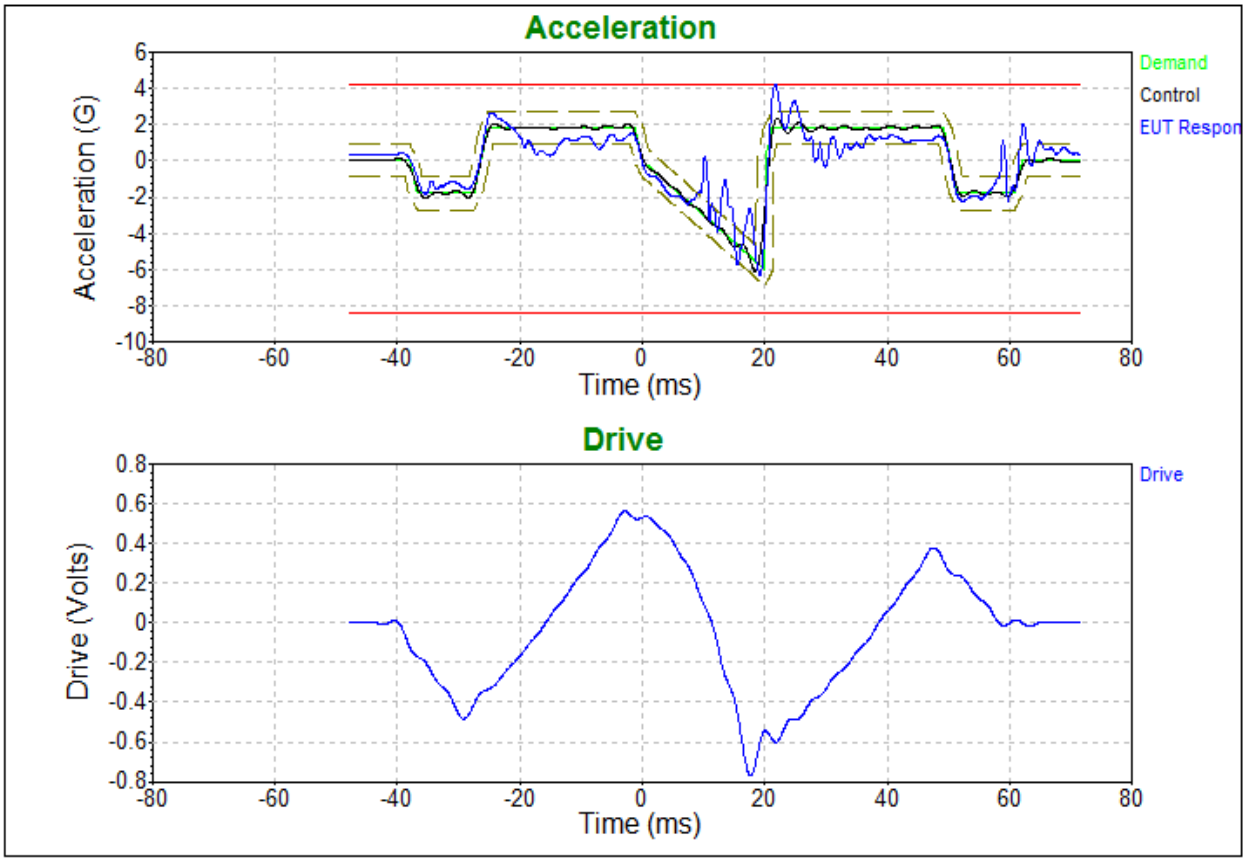
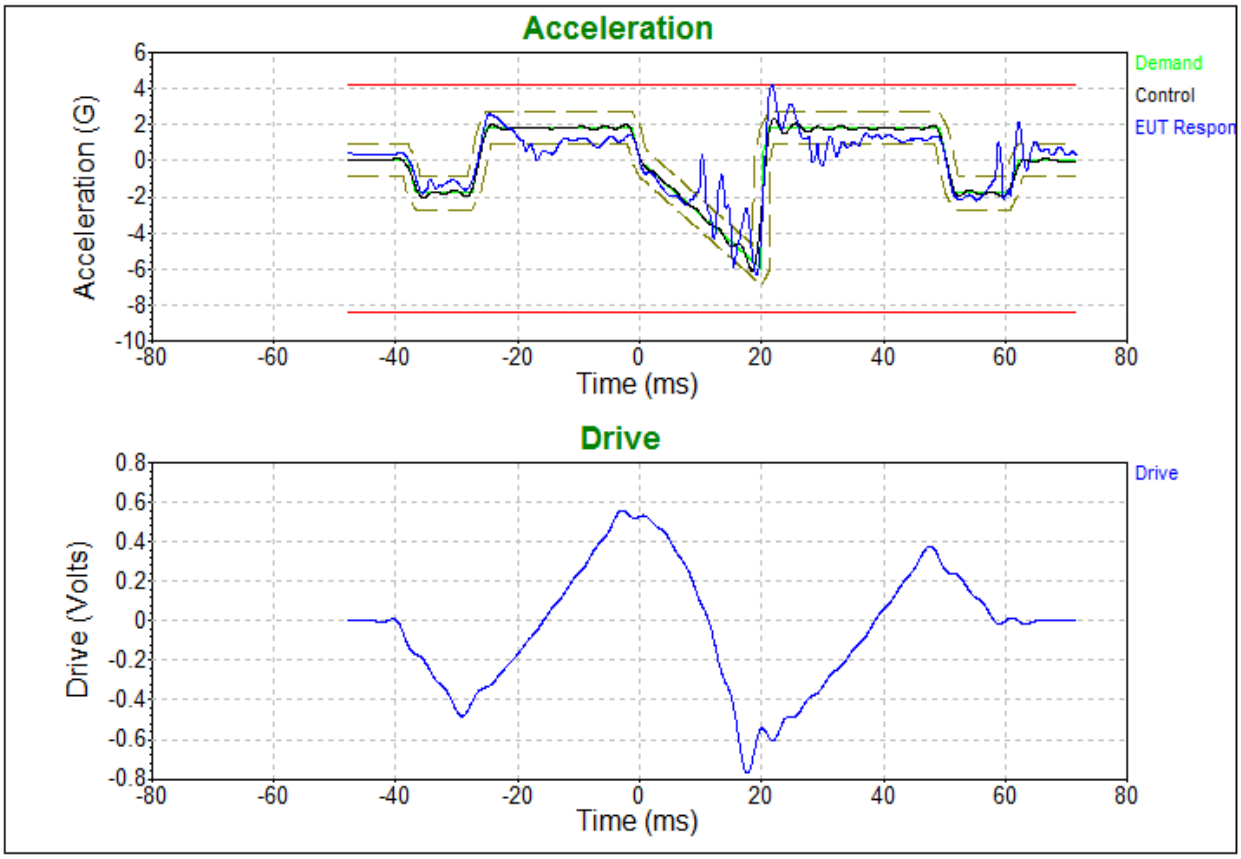


X Axis Low Frequency Operational Shock in 24 Vdc mode, 2nd Negative Pulse, EUT # RGL-EYQ



X Axis Low Frequency Operational Shock in 24 Vdc mode, 3rd Negative Pulse, EUT # RGL-EYQ

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CRASH SAFETY - IMPULSE

TEST DATES
06/05/2017 – 06/06/2017

EQUIPMENT UNDER TEST (EUT)
Quantity: One (1) Tracking / Messaging Unit
Part Number: RockAIR
Serial Number: RGL-EYQ-A

TEST SPECIFICATION(s)
RTCA DO-160G, Section 7.3.1

REQUIREMENTS
The EUT shall undergo crash safety impulse testing per RTCA DO-160G, Section 7.3.1, Category E for Low Frequency Impulse Crash safety. The EUT shall withstand two (2) sawtooth shocks, one in a positive direction, one negative in each of three (3) mutually perpendicular axes, with a peak acceleration of 6 Gs and a duration of 20 msec. There shall be no physical or electrical failures that prevent the EUT from being operated per customers post-test requirements, nor shall the EUT sustain physical damage.

PROCEDURE

RTCA DO-160G, Section 7.3.1, Category E for Low Freequency Impulse Crash Safety

1. Attach the EUT test fixture to the shaker table in the axis to be tested.
2. Attach the EUT to the test fixture.
3. Attach a response accelerometer to the EUT in the axis of excitation.
4. Attach a control accelerometer to the shaker table in the axis of excitation.
5. Connect a dc power supply capable of delivering a maximum of 24 Vdc to the EUT, at the 24 Vdc power input connector.
6. Perform a pre-environment functional test on the EUT per customer requirements at 24 Vdc.
7. Apply 24 Vdc to the EUT.
8. Apply one (1) positive and one (1) negative shock having a terminal saw-tooth wave shape with an acceleration peak value of twenty (20) g's and a nominal pulse duration of twenty (20) milliseconds.
9. Perform a post-environment functional test on the EUT per customer requirements.
10. Inspect the EUT visually and report any damage observed.
11. Repeat Steps 3 – 10 for all three orthoganol axes. Testing will be conducted in the 24 Vdc mode only, per the customer.

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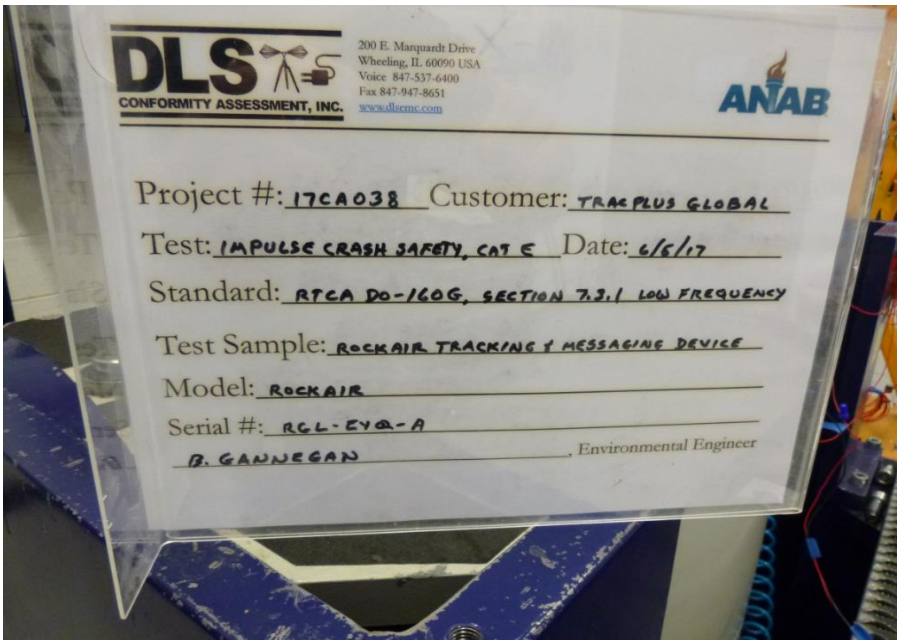
TEST RESULTS

Testing was performed in the sequence of Z Axis (vertical), Y Axis (lateral) then X Axis (longitudinal). There was no damage to the unit in any of the axes tested, and the unit operated satisfactorily.

EQUIPMENT USED

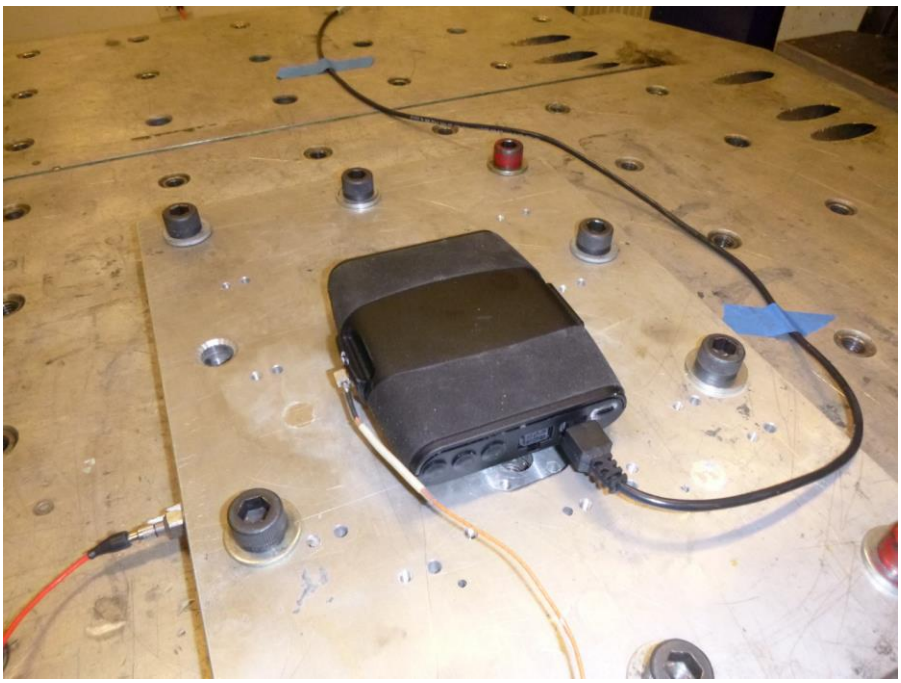
Equipment	Manufacturer	DLS Lab Number	Model#	Date Calibrated	Calibration Due Date
Accelerometer	Dytran	153	3225F1T	07/05/2016	07/05/2017
Accelerometer	Dytran	163	3049E1	06/14/2016	06/14/2017
Accelerometer	Dytran	169	3049E3	08/24/2016	08/24/2017
Electrodynamic Shaker	ETS	182	M748A/GT 1200M	N/A	Verified w/Calibrated Accelerometers
Signal Generator	Vibration Research	147	VR9500	11/04/2016	11/04/2017
Digital Multimeter (DMM)	Fluke	263	87V	10/24/2016	10/24/2017
DC Power Supply	Yescom	260	DCP3010D	N/A	Verified w/Calibrated DMM

PHOTOS



Test Title
See Vibration Section for Setup

EUT # RGL-EYQ-A After Completion of Impulse Crash Safety Testing (View 1)



EUT # RGL-EYQ-A After Completion of Impulse Crash Safety Testing (View 2)

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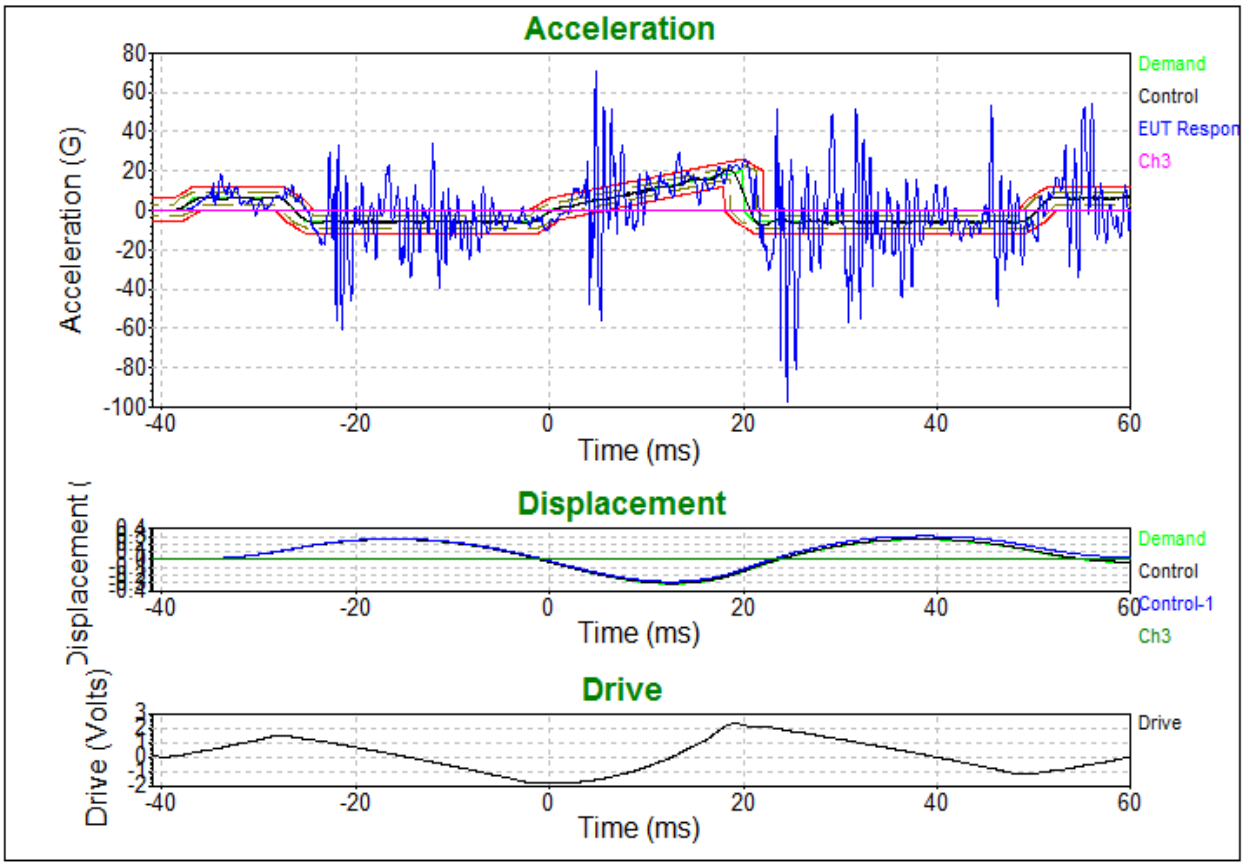
TEST DATA



Z Axis Low Frequency Impulse Crash Safety in 24 Vdc mode, Positive Pulse, EUT # RGL-EYQ-A

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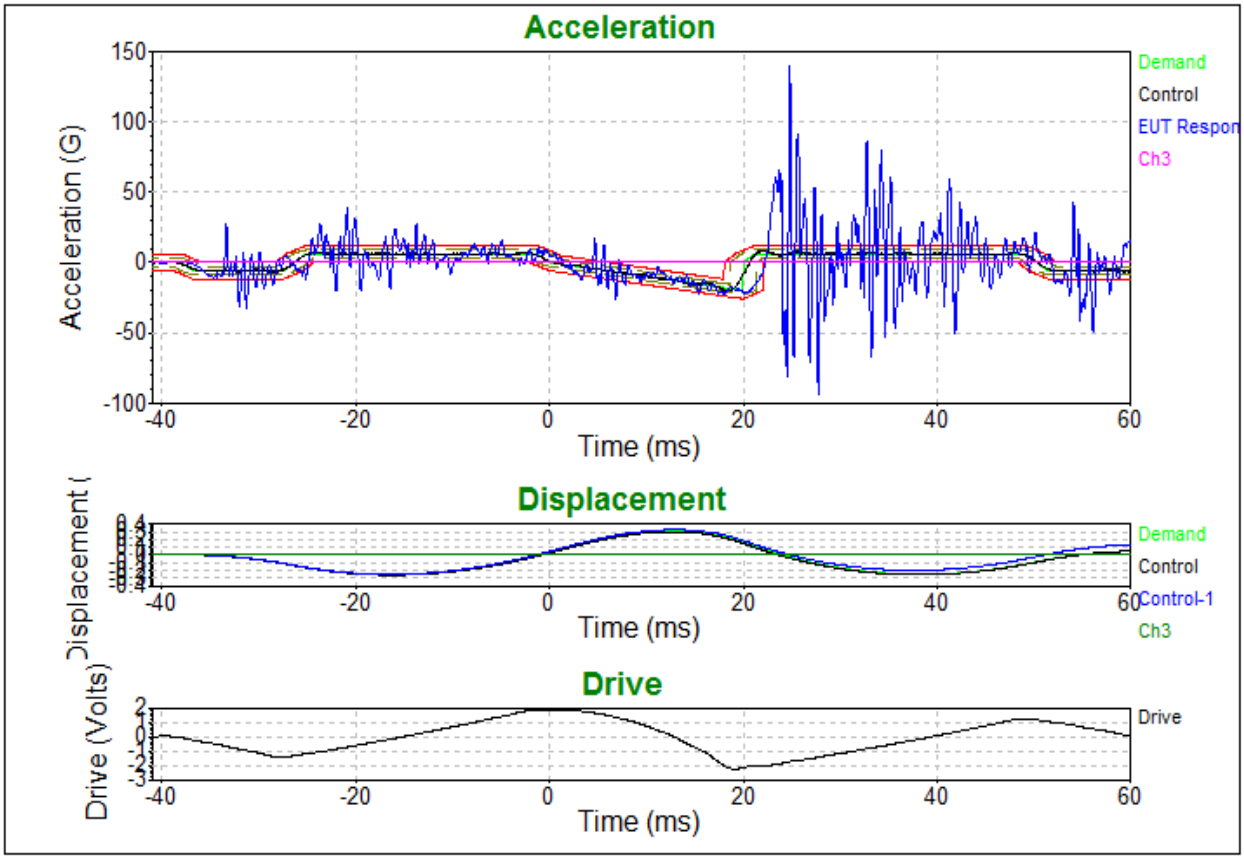
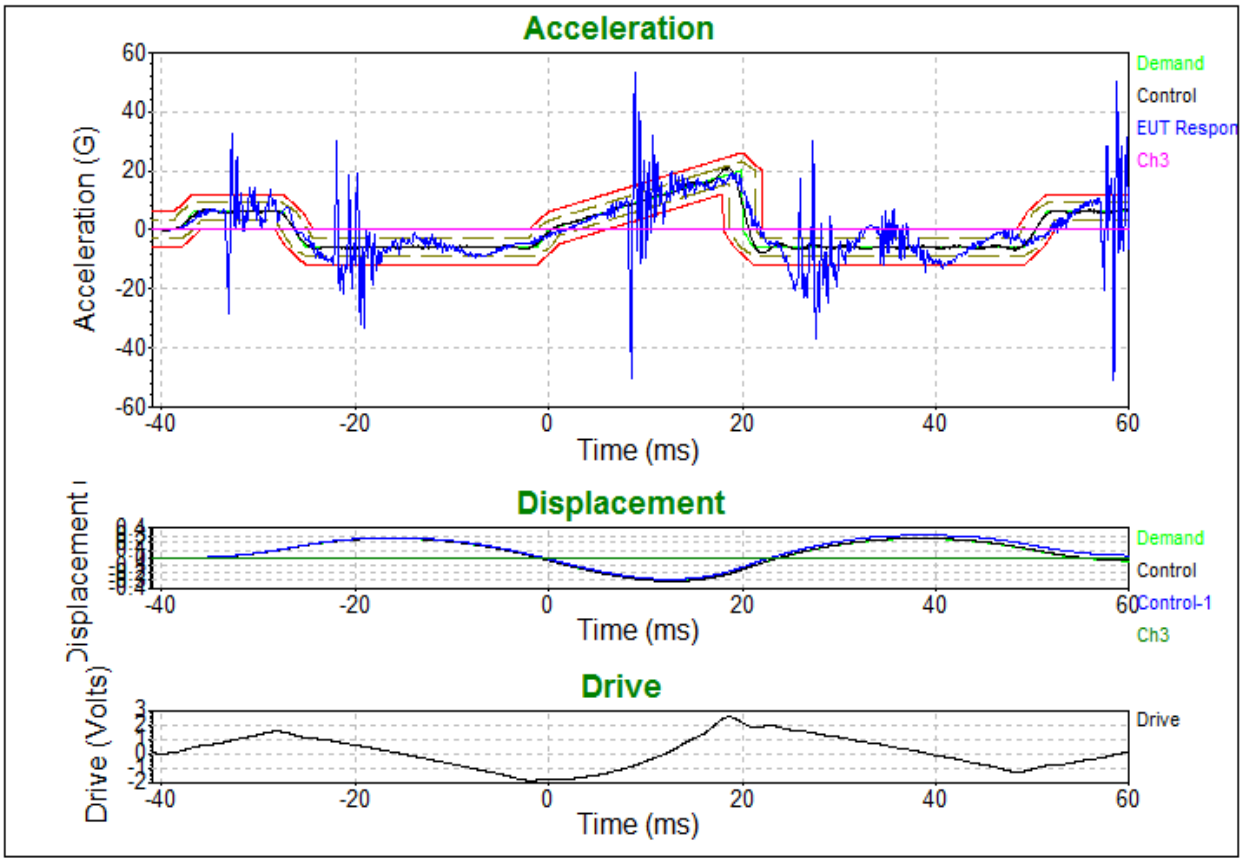


Z Axis Low Frequency Impulse Crash Safety in 24 Vdc mode, Negative Pulse, EUT # RGL-EYQ-A



Y Axis Low Frequency Impulse Crash Safety in 24 Vdc mode, Positive Pulse, EUT # RGL-EYQ-A

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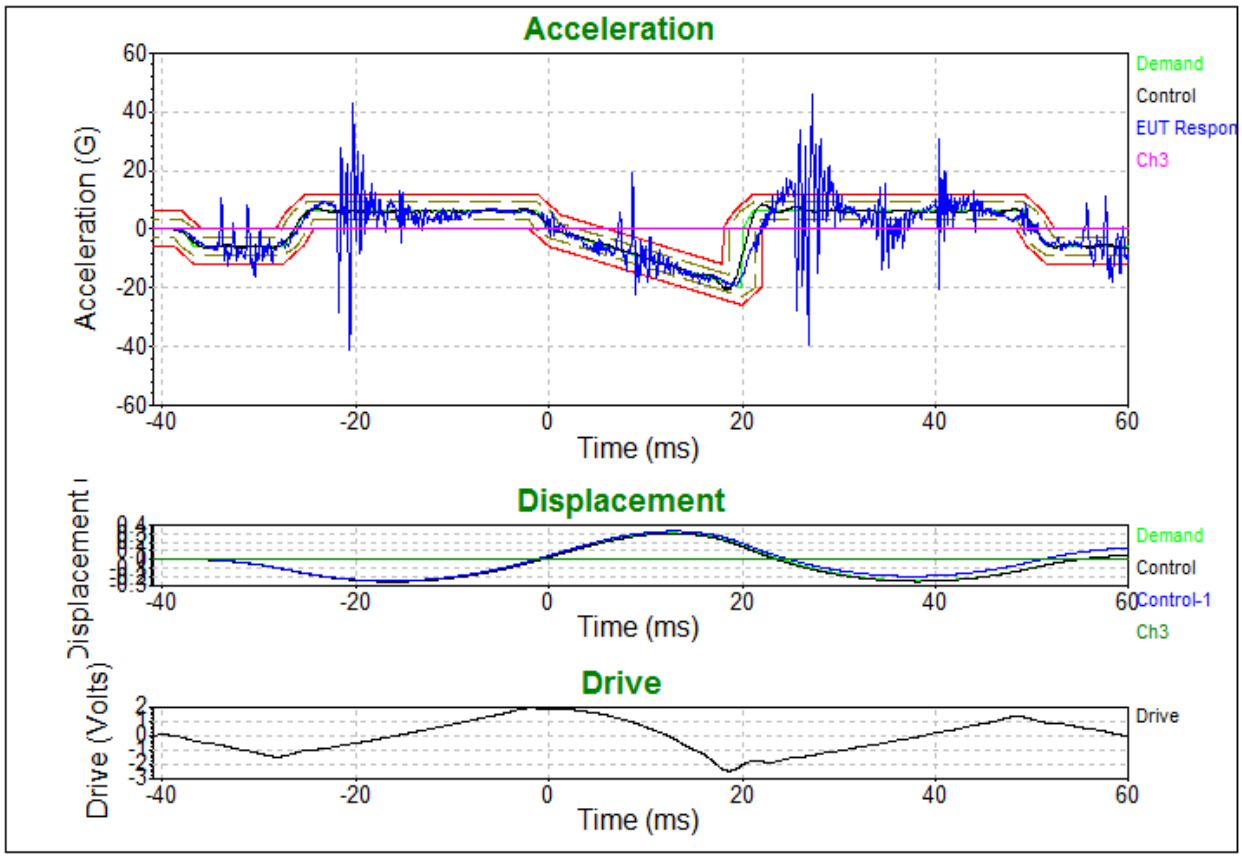

Y Axis Low Frequency Impulse Crash Safety in 24 Vdc mode, Negative Pulse, EUT # RGL-EYQ-A

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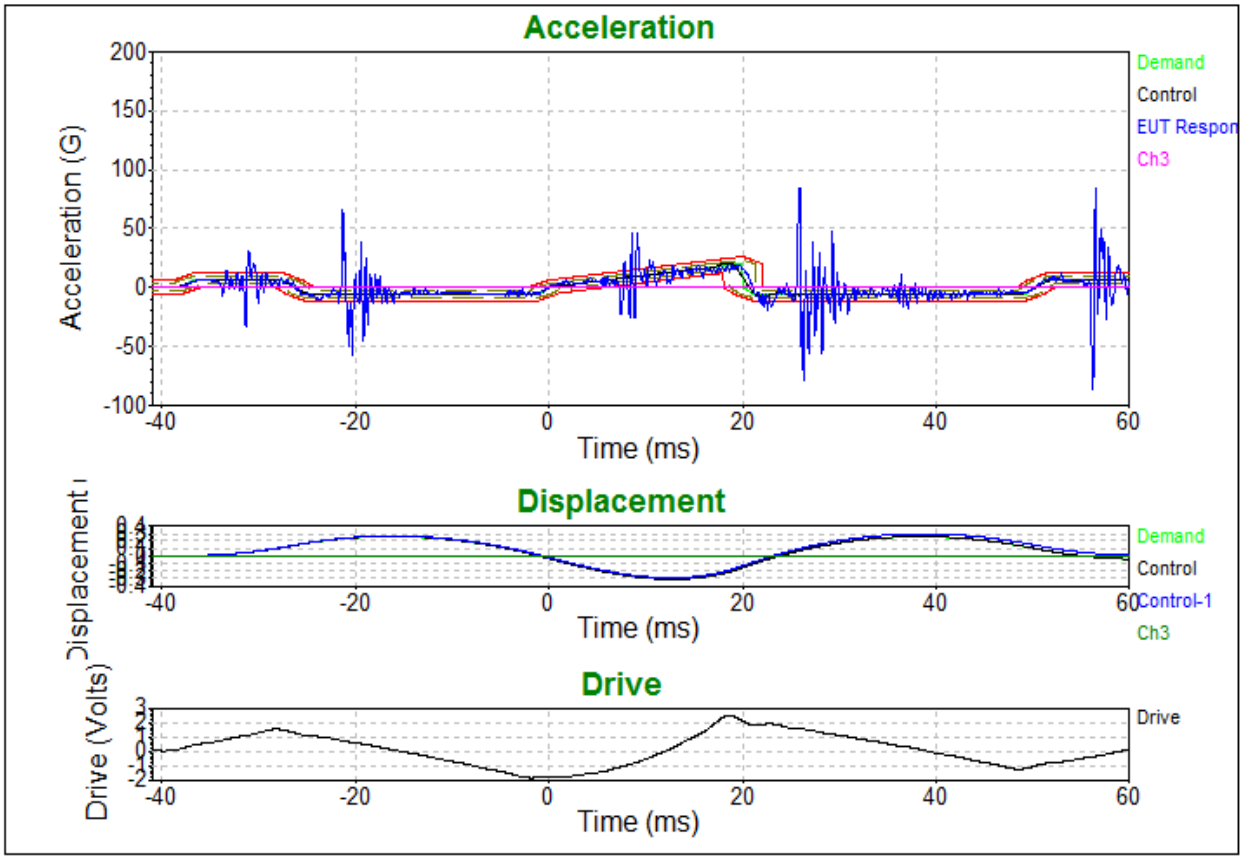

X Axis Low Frequency Impulse Crash Safety in 24 Vdc mode, Positive Pulse, EUT # RGL-EYQ-A

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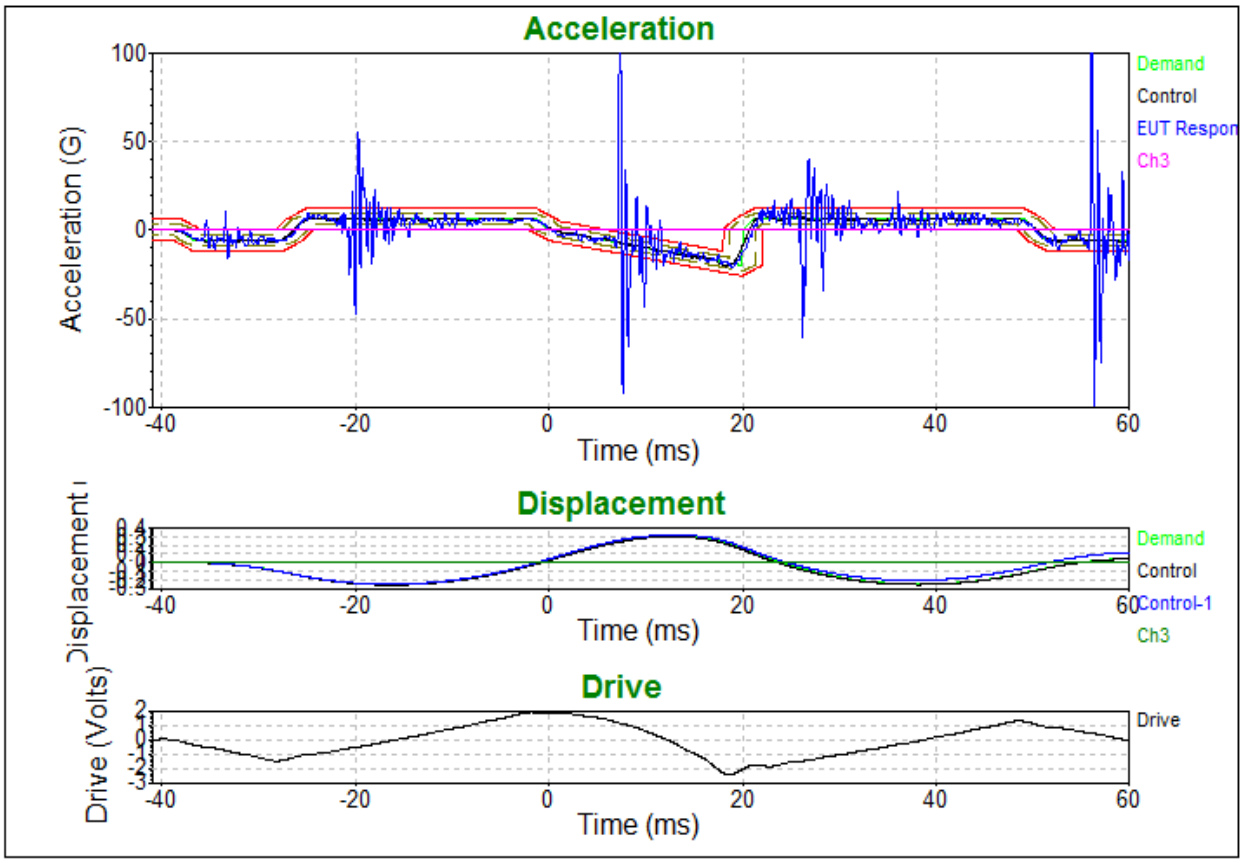

X Axis Low Frequency Impulse Crash Safety in 24 Vdc mode, Negative Pulse, EUT # RGL-EYQ-A

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CRASH SAFETY-SUSTAINED

TEST DATES
06/08/2017

EQUIPMENT UNDER TEST (EUT)
Quantity: One (1) Tracking / Messaging Unit
Part Number: RockAIR
Serial Number: RGL-EYQ-A

TEST SPECIFICATION(s)
RTCA DO-160G, Section 7.3.3

REQUIREMENTS
The EUT shall undergo crash safety sustained testing per RTCA DO-160G, Section 7.3.3. The EUT shall withstand the G force acceleration of Table 7-1 of RTCA DO-160G, Section 7.3.3, Aircraft Type 5 for helicopter and all fixed-wing, Test Type F for 3 seconds minimum while unpowered in each orientation. There shall be no physical or electrical failures that prevent the EUT from being operated per customers post-test requirements; there shall be no failure of the mounting attachment, and the EUT shall remain in place.

PROCEDURE

RTCA DO-160G, Section 7.3.3

1. Connect a dc power supply capable of delivering a maximum of 24 Vdc to the EUT, at the 24 Vdc power input connector.
2. Perform a pre-environment functional test on the EUT per customer requirements at 24 Vdc.
3. Remove power from the EUT and disconnect all wires and connectors.
4. Attach the EUT to the centrifuge in the orientation to be tested.
5. Attach the control accelerometer between the centrifuge rotation axis and the EUT to ensure that the entire EUT is subjected to the full sustained acceleration levels.
6. Counter balance the opposite arm of the centrifuge with the appropriate weight.
7. With the EUT not operating, apply the appropriate G force acceleration for three (3) seconds minimum in the test orientation. Use the forces listed in RTCA DO-160G, Section 7.3.3, Table 7-1, Aircraft Type 5 (Helicopter and all Fixed-Wing), Test Type F, as seen below.
8. Perform an external visual inspection and record any observations.
9. Repeat the above procedure until all orientations (Up, Down, Forward, Aft, Left, and Right) have been tested. Use the appropriate G force for each orientation as specified in Table 7-1.
10. Perform a post-environment functional test on the EUT.

Aircraft Type	Test Type (5)	Sustained Test Acceleration (g Minimum) Direction of Load (Aircraft Direction)				
		Up	Down	Forward	Aft	Side (4)
1. Helicopters (1)	F R	4.0 20.0	20.0 20.0	16.0 20.0	NA 20.0	8.0 20.0
2. Fixed-Wing Transport (2)	F R	3.0 9.0	6.0 9.0	9.0 9.0	1.5 9.0	4.0 9.0
3. Fixed-Wing Non-Transport (3)	F R	3.0 18.0	NA 18	18.0 18.0	NA 18.0	4.5 18.0
4. All Fixed-Wing	F R	3.0 18.0	6.0 18	18.0 18.0	1.5 18.0	4.5 18.0
5. Helicopter and All Fixed-Wing	F R	4.0 20.0	20.0 20.0	18.0 20.0	1.5 20.0	8.0 20.0

NOTES: (1) Reference FAR 27.561
(2) Reference FAR 25.561
(3) Reference FAR 23.561
(4) Side includes both left and right directions
(5) "F" is known and Fixed orientation. "R" is unknown or Random orientation.

Table 7-1 Crash Safety Sustained Test Levels

RTCA DO-160G Table 7-1 Aircraft Type 5, Test Type F Test Parameters

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TEST RESULTS

The EUT was tested in the following sequence: Aft, Forward, Left, Right, Downward, Upward. There was no visible damage to the unit in any of the axes tested, and the unit operated satisfactorily.

Note: After the unit was tested in the last orientation (Upward), the EUT internal circuit board had loosened and could be heard rattling when the unit was shaken.

EQUIPMENT USED

Equipment	Manufacturer	DLS Lab Number	Model#	Date Calibrated	Calibration Due Date
Centrifuge	VST	215	CAT10HP	N/A	Verified w/Calibrated Accelerometer
Accelerometer	Dytran	227	7500A6	04/19/2017	04/19/2018
Signal Conditioner	Dytran	194	4010	09/28/2016	09/28/2017
DC Power Supply	Yescom	242	DCP3010D	N/A	Verified w/Calibrated DMM
Digital Multimeter (DMM)	Fluke	117	87III	10/24/2016	10/24/2017

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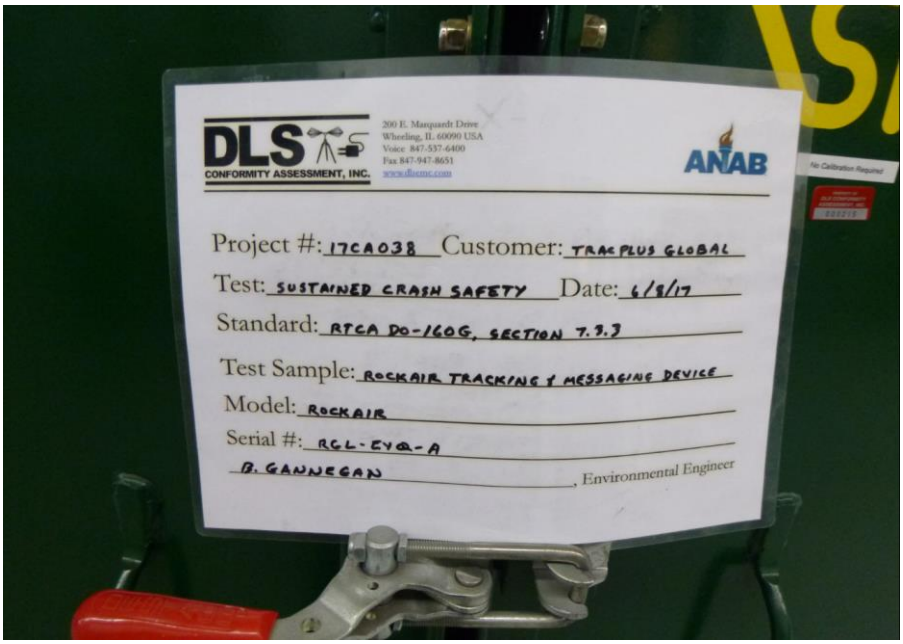
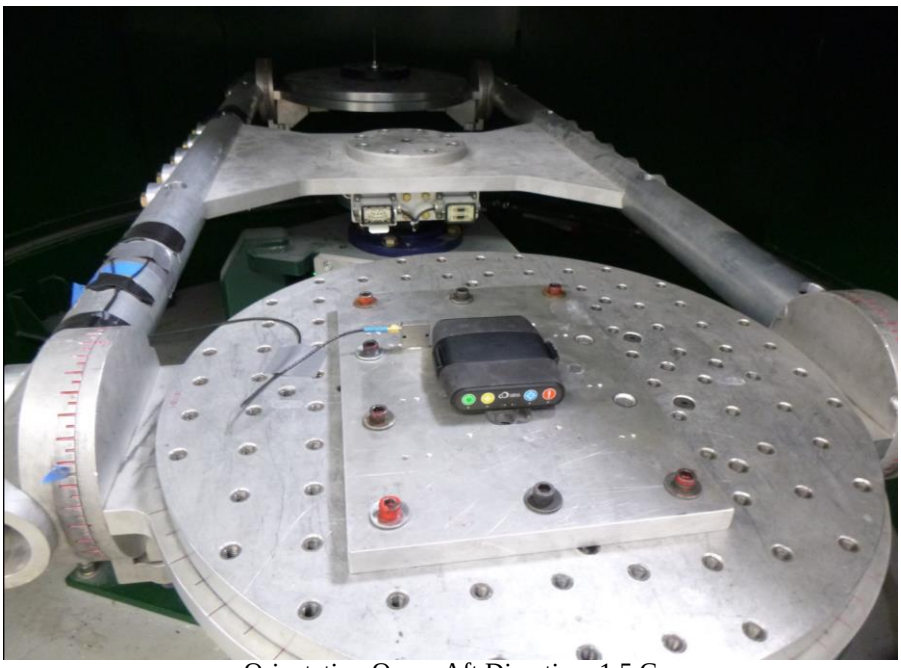
PHOTOS



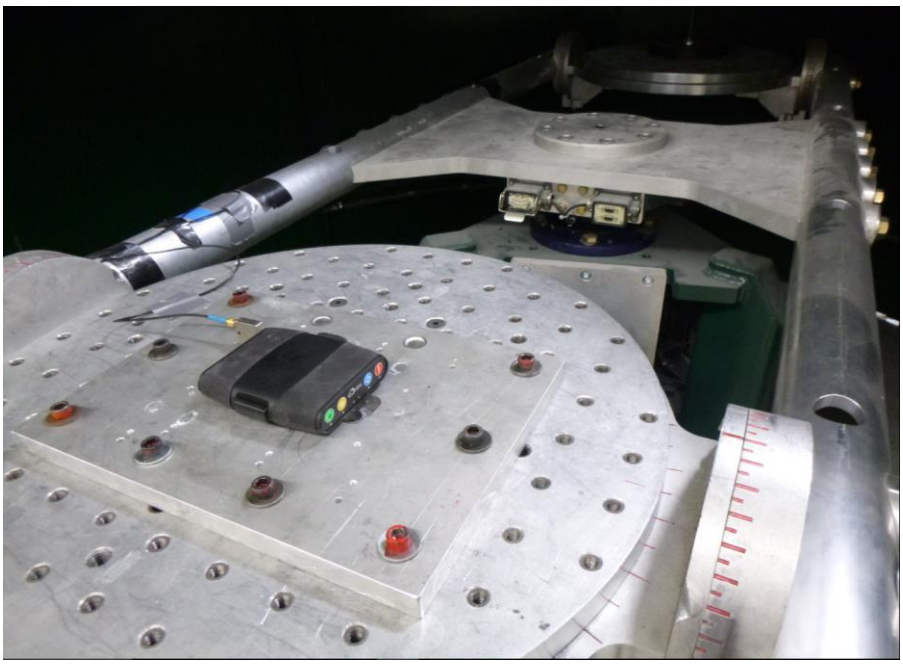
Test Title

Centrifuge for Sustained Crash Safety Test

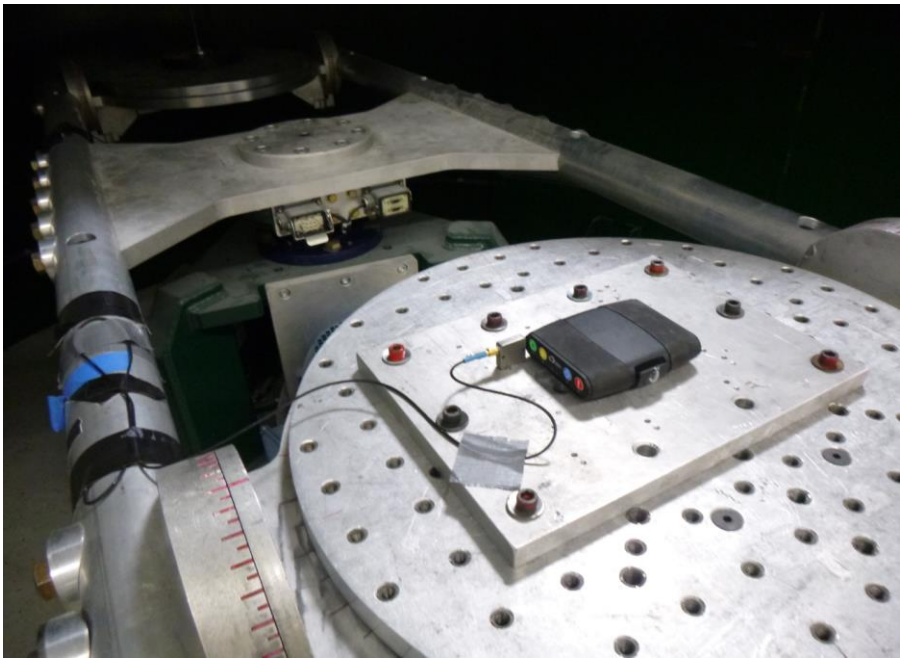


Orientation One – Aft Direction, 1.5 G

Orientation Two – Forward Direction, 18 G

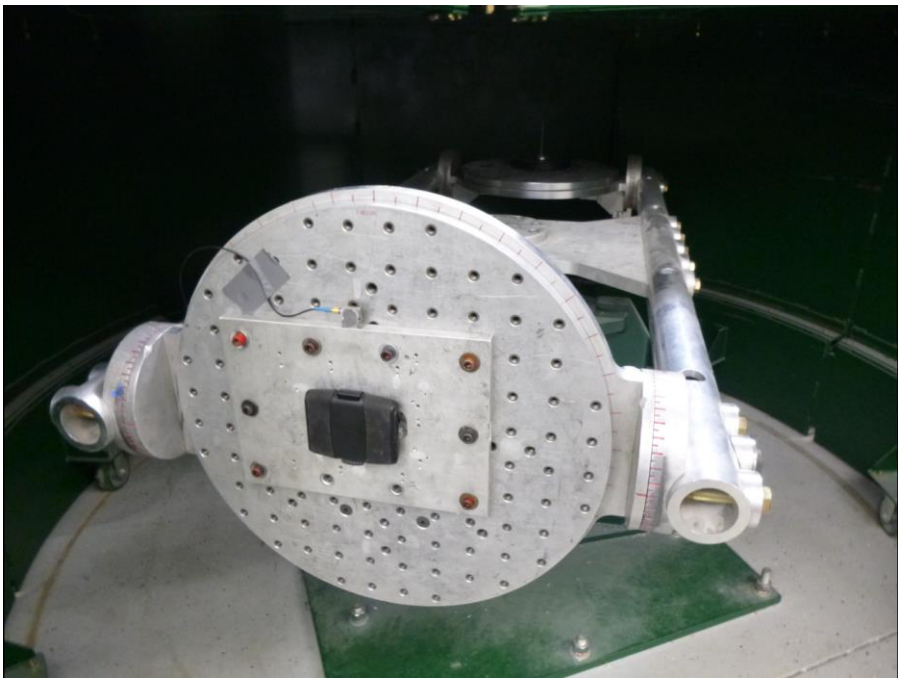


Orientation Three – Left Direction, 8 G



Orientation Four – Right Direction, 8 G

Orientation Five – Downward Direction, 20 G



Orientation Six – Upward Direction, 4 G

EUT After Test (View 1)

EUT After Test (View 2)

EUT Mounting Bracket After Test

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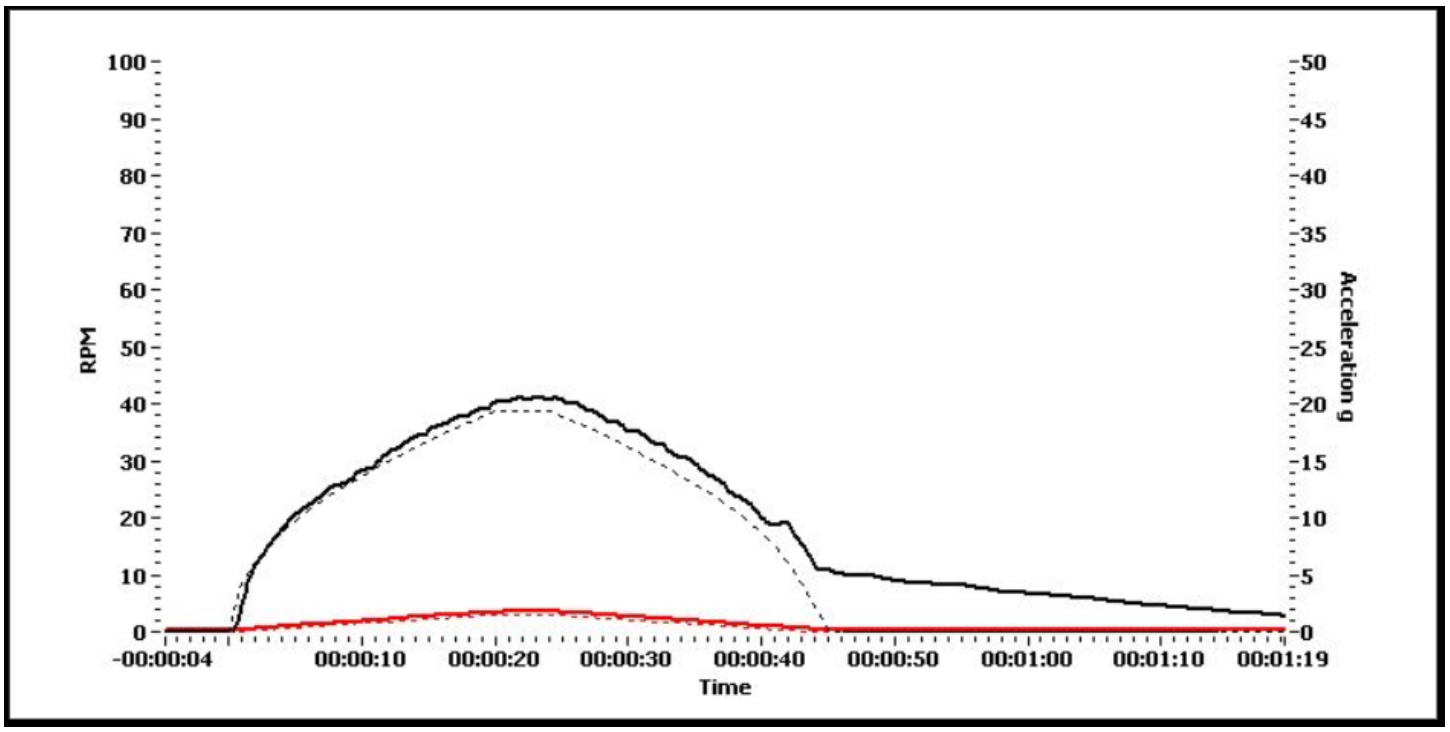
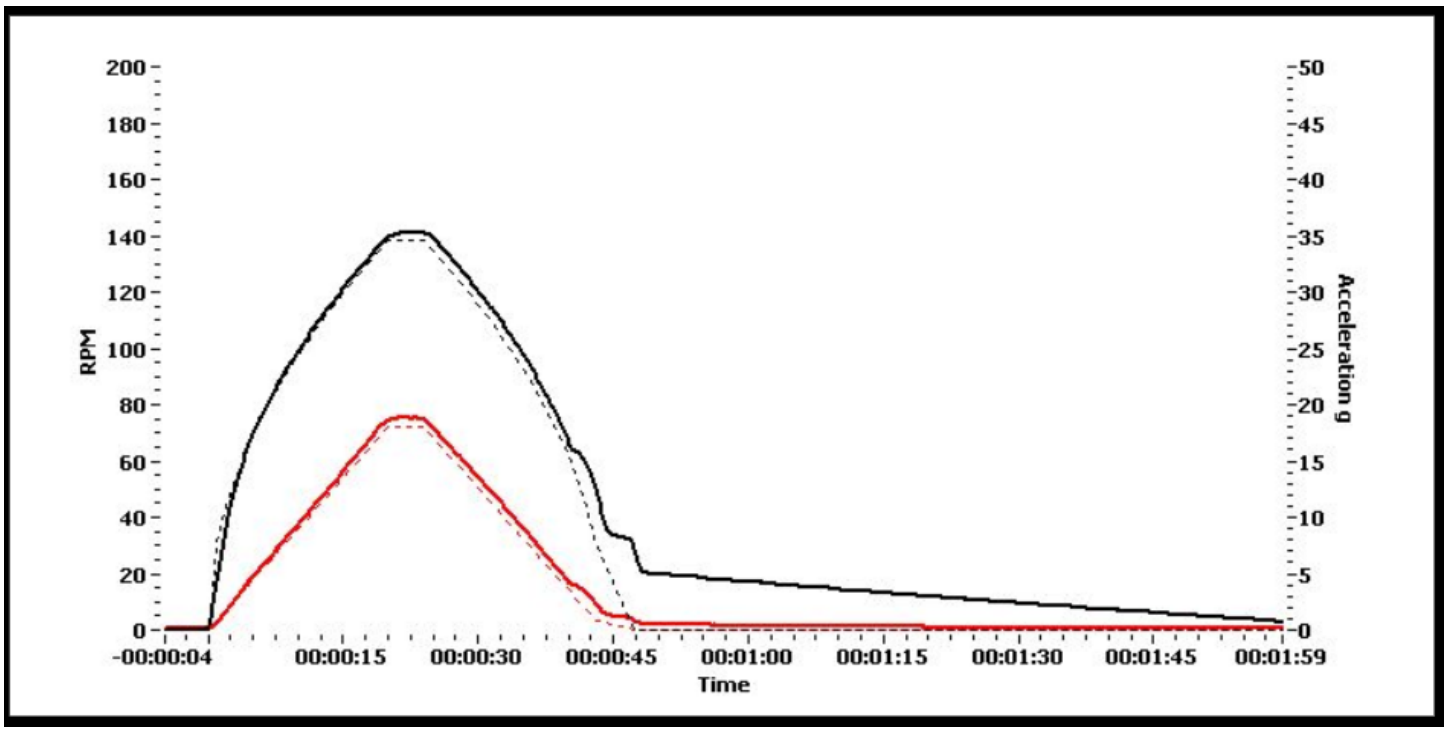
TEST DATA

Red Line = Acceleration (g)
Black Line = RPM



Orientation One – Aft Direction, 1.5 G

Red Line = Acceleration (g)
Black Line = RPM



Orientation Two – Forward Direction, 18 G

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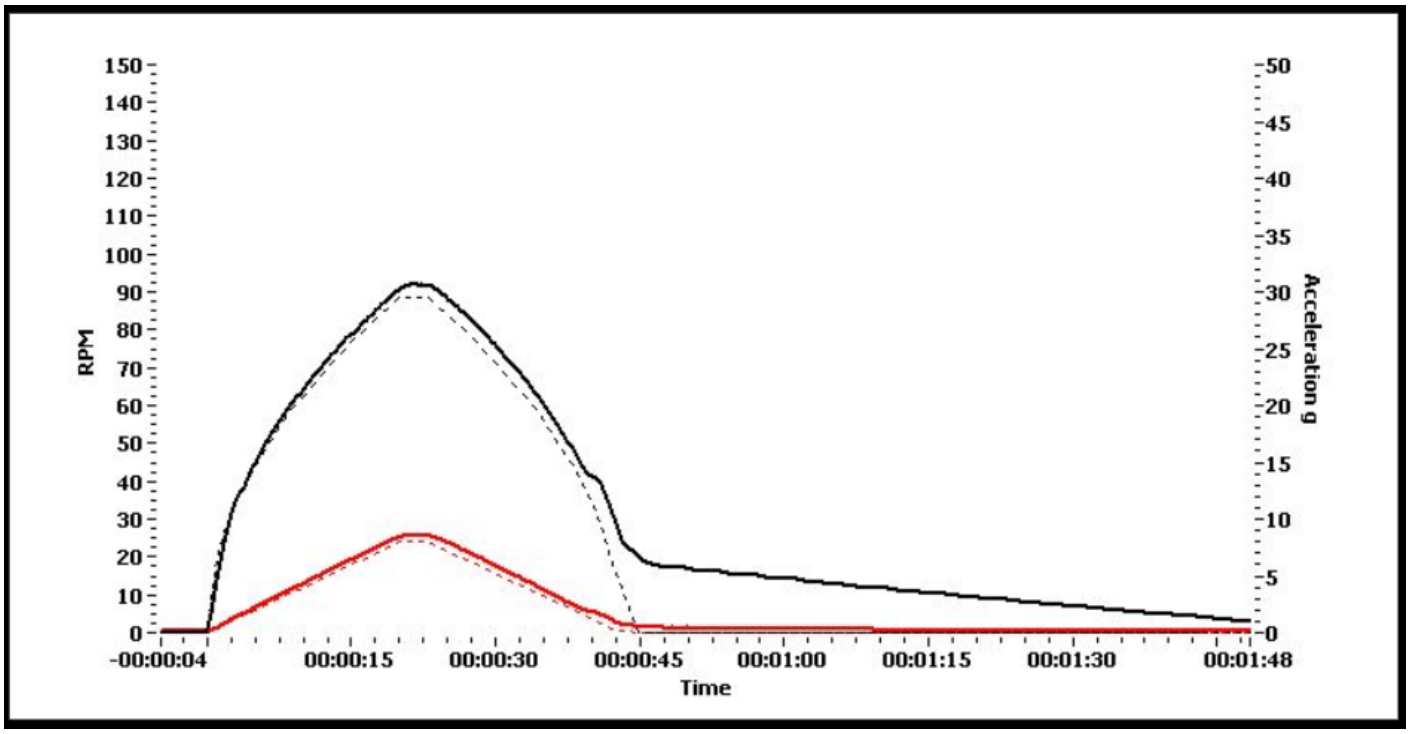
Red Line = Acceleration (g)
Black Line = RPM



Orientation Three – Left Direction, 8 G

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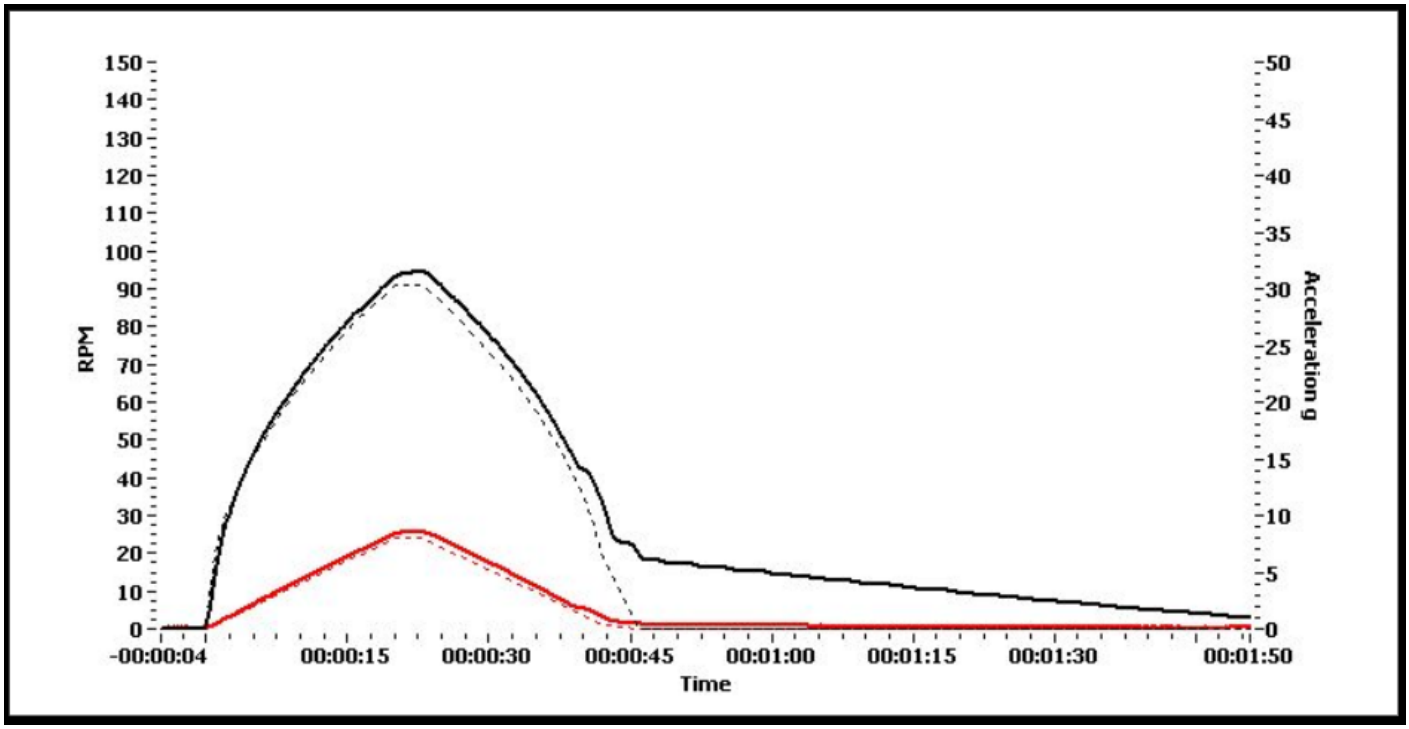
Red Line = Acceleration (g)
Black Line = RPM



Orientation Four – Right Direction, 8 G

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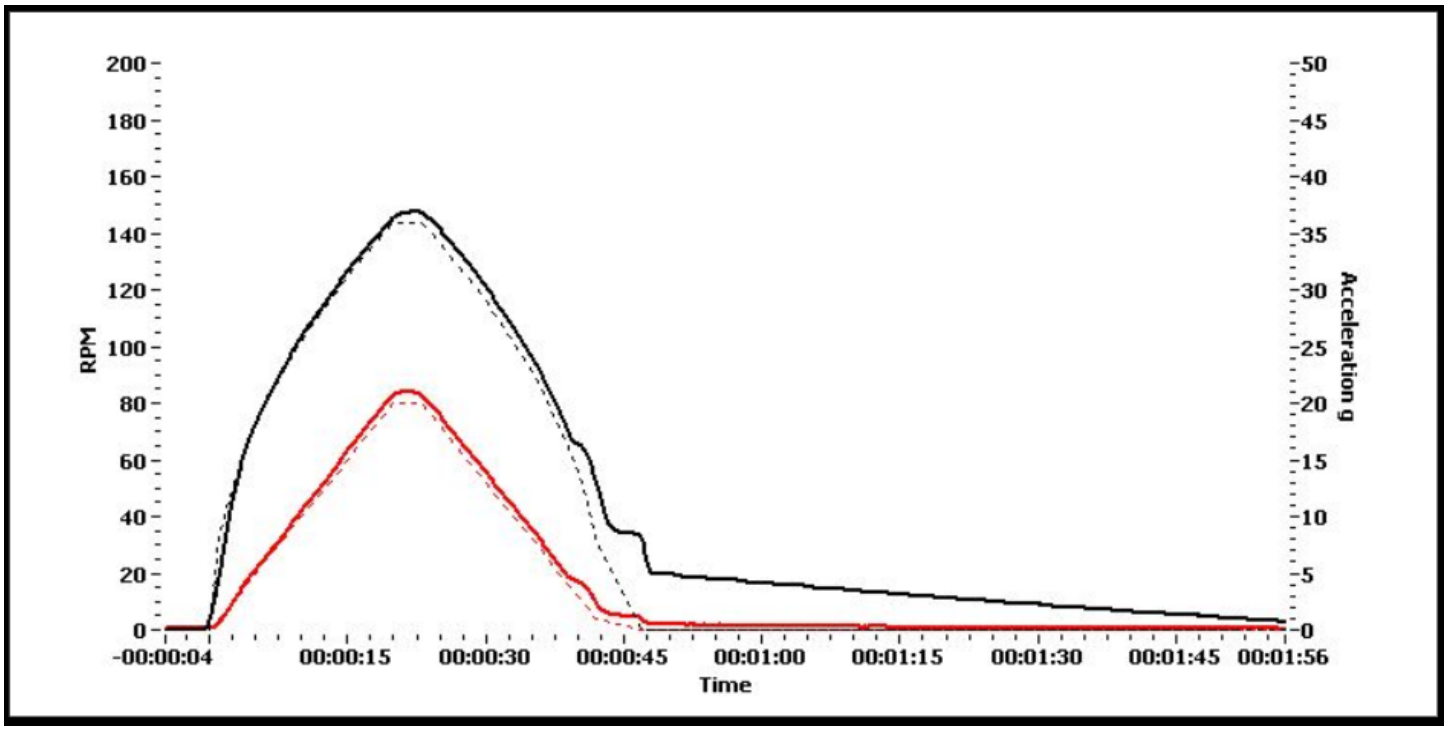
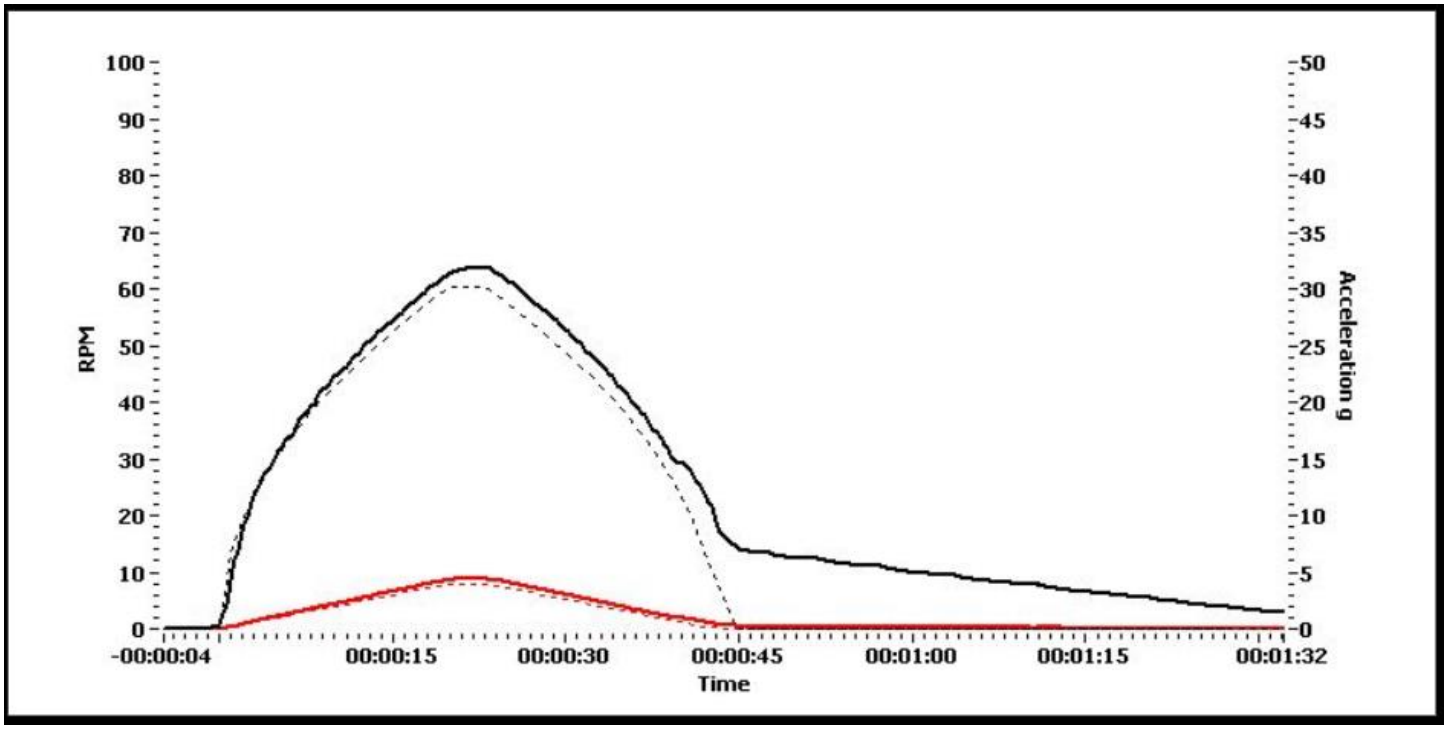
Red Line = Acceleration (g)
Black Line = RPM



Orientation Five – Downward Direction, 20 G

Red Line = Acceleration (g)
Black Line = RPM



Orientation Six – Upward Direction, 4 G

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FLAMMABILITY TEST

TEST DATES
05/30/2017 – 05/31/2017

SPECIMENS
Quantity: One (1) Tracking / Messaging Unit
Part Number: RockAIR
Serial Number: RGL-EYQ-A

Quantity: Six (6) Tracking /Messaging Unit Housings (3 top, 3 bottom pieces)
Material Part Number: FR3010 BLK
Sample Numbers: # 1-6

Quantity: Three (3) Tracking /Messaging Unit Mounting Brackets
Material Part Number: FR3010 BLK
Sample Numbers: # 7-9

Quantity: Three (3) Elastosil Sleeves
Material Part Number: Elastosil LR 3003/70 A&B
Sample Numbers: # 10-12

TEST SPECIFICATION(s)
RTCA / DO-160G, Section 26, Category C

REQUIREMENTS
The purpose of this test is to evaluate FR3010 BLK and Elastosil LR 3003/70 A&B material for the RockAIR Tracking/Messaging unit for compliance to the RTCA / DO-1670, Section 26, Category C: Flammability, vertical and horizontsal bunsen burner test requirements.

PROCEDURE

RTCA / DO-160G Section 26 Category C

Vertical method for FR3010 BLK Housing Material

1) Cut the test specimens to 12.0 inches long and 3.0 inches wide.
2) Condition the test specimens at 21° +/- 3° Celsius and 50% +/-5% relative humidity, for minimum 24 hrs (per sub clause 26.6.2.4 of the RTCA specification).
3) Adjust the Methane burner for a flame height of 1.5 inches and the inner cone to 0.875 inches using 99 % pure methane gas.
4) Clamp the specimens in the specimen holder frame, constructed in accordance with RTCA DO-160G,

Figure 26-9, clamped in a vertical orientation.

5) Position the burner height so that the flame impinges on the free end of the specimen to a depth of 3/4 inches.
6) Apply the flame to the test specimen for 12 seconds (Ignition Time) then remove the burner.
7) Start the timing device after removal of the flame, and continue to measure the flame time, until the flame self extinguishes.
8) Report the flame time for each specimen tested.
9) Determine and record the average value for flame time of all specimens tested.
10) The average flame time for all specimens shall not exceed 15 seconds.
11) If flaming material falls from the test specimen, determine the flame drip time for the specimen.
12) If there is more than one drip, the drip flame time is reported as the longest flaming drip.
13) If succeeding flaming drips reignite earlier drips that flamed, the drip flame time is reported as the total of all flaming drips.
14) Determine and record the average value for drip time of all specimens tested.
15) The average drip extinguishing time for all specimens tested shall not exceed 5 seconds.
16) Measure and report the burn length to the nearest 0.1 inch for each specimen tested.
17) Determine and record the average value for burn length.
18) The average burn length for all the specimens shall not exceed 8 inches.
19) Clear the test cabinet of smoke after testing each specimen.

RTCA / DO-160G Section 26 Category C

Horizontal method for Elastosil LR 3003/70 A&B Sleeving Material

1) Cut the test specimens to 12.0 inches long and 3.0 inches wide.
2) Condition the test specimens at 21° +/- 3° Celsius and 50% +/-5% relative humidity, for minimum 24 hrs (per sub clause 26.6.2.4 of the RTCA specification).
3) Adjust the Methane burner for a flame height of 1.5 inches and the inner cone to 0.875 inches using 99 % pure methane gas.
4) Clamp the specimens in the specimen holder frame, constructed in accordance with RTCA DO-160G, Figure 26-9, placed in a horizontal orientation.
5) Position the burner so that the centerline of the burner orifice is in line with the edge of the specimen holder and the centerline of the width of the specimen (see RTCA DO-160G, Figure 26-11).
6) Apply the flame to the test specimen for 15 seconds (Ignition Time) then remove the burner.
7) Start the timing device after removal of the flame, and continue to measure the flame time, until the flame self extinguishes.
8) Report the flame time for each specimen tested.
9) If the flame front self-extinguishes befor reaching 11.5 inches, record the burn rate as zero. Otherwise, follow the provisions of RTCA DO-160G, Sections 26.6.3.7.1.7 a-c, and 26.6.3.8.
10) Clear the test cabinet of smoke after testing each specimen.

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SUMMARY - TEST RESULTS

Initially, this test was to be performed using RockAIR unit, serial number RGL-EYQ-A. This unit was disassembled with the intention that the housing material and Elastosil sleeving could be tested for flammability. Due to the geometry and size of the unit, the 12 inch length and 3 inch width requirements could not be met for the test samples. The customer supplied additional empty housings and sleeves.

The housings were disassembled into top and bottom halves, and the sleeves were cut to form strips. The housings were subjected to the vertical flammability method described above, and the Elastosil strips were subjected to the horizontal method. Mounting brackets were sent along with the housings. Though it was not requested that the brackets be tested, these were also subjected to the vertical method. The mounting brackets were not cut or altered in any way prior to testing. The test samples that had come from the RockAIR unit, serial number RGL-EYQ-A were used for setup purposes.

The test specimens were tested and found to comply with the requirements for RTCA / DO-160G, Section 26, Category C: Flammability, vertical and vertical bunsen burner test requirements.

The average burn flame time of the housing material was 2.3 seconds. The average burn flame time of the mounting brackets was 4.0 seconds. The sleeving had a zero flame time. None of the samples exceeded the 15 second time limit requirement, for self extinguishing of the flame. - PASS

The average drip flame times for all samples did not exceed the 5 second time limit, and measured 0 seconds (No Drip) - PASS

The average burn lengths of the housing material and the mounting brackets were 0.57 inches and 0.34 inches respectively, and did not exceed 8 inches limit. – PASS

The average burn length of the sleeving material was 0.22 inches, resulting in a zero burn rate, per RTCA DO-160G, Section 26.6.3.8 – PASS

Individual test results are shown in the tables below:

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Specimen # & Cut Location	Flame Burn Time (Seconds)	Drip Flame Time (Seconds)	Burn Length (Inches)	Comments
# 1 Cut From Enclosure Top	1	0 - No Drip	0.27	FR3010 BLK Housing material self extinguishes with no flaming drips
# 2 Cut From Enclosure Top	3	0 - No Drip	0.83	
# 3 Cut From Enclosure Top	4	0 - No Drip	0.90	
# 4 Cut From Enclosure Bottom	1	0 - No Drip	0.40	
# 5 Cut From Enclosure Bottom	2	0 - No Drip	0.48	
# 6 Cut From Enclosure Bottom	3	0 - No Drip	0.52	
Top Average	2.7	0	0.67	Meets < 15 second Burn Time average , meets < 5 seconds Flame Drip Time, and meets < 8 inch average Burn Length
Bottom Average	2.0	0	0.47	
Overall Average	2.3	0	0.57	

Vertical method results for FR3010 BLK Housing Material

Specimen #	Flame Burn Time (Seconds)	Drip Flame Time (Seconds)	Burn Length (Inches)	Comments
# 7	0.0	0 - No Drip	0.26	Mounting bracket material self extinguishes with no flaming drips
# 8	5.0	0 - No Drip	0.36	
# 9	7.0	0 - No Drip	0.39	
Average	4.0	0	0.34	Meets < 15 second Burn Time average , meets < 5 seconds Flame Drip Time, and meets < 8 inch average Burn Length

Vertical method results for Mounting Bracket Material

Specimen #	Flame Burn Time (Seconds)	Drip Flame Time (Seconds)	Burn Length (Inches)	Comments
# 10	0.0	0 - No Drip	0.20	Elastosil LR 3003/70 A&B material self extinguishes with no flaming drips
# 11	0.0	0 - No Drip	0.22	
# 12	0.0	0 - No Drip	0.25	
Average	0.0	0	0.22	Meets < 11.5 inch burn length, 0 burn rate requirement

Horizontal method results for Elastosil LR 3003/70 A&B Sleeving Material

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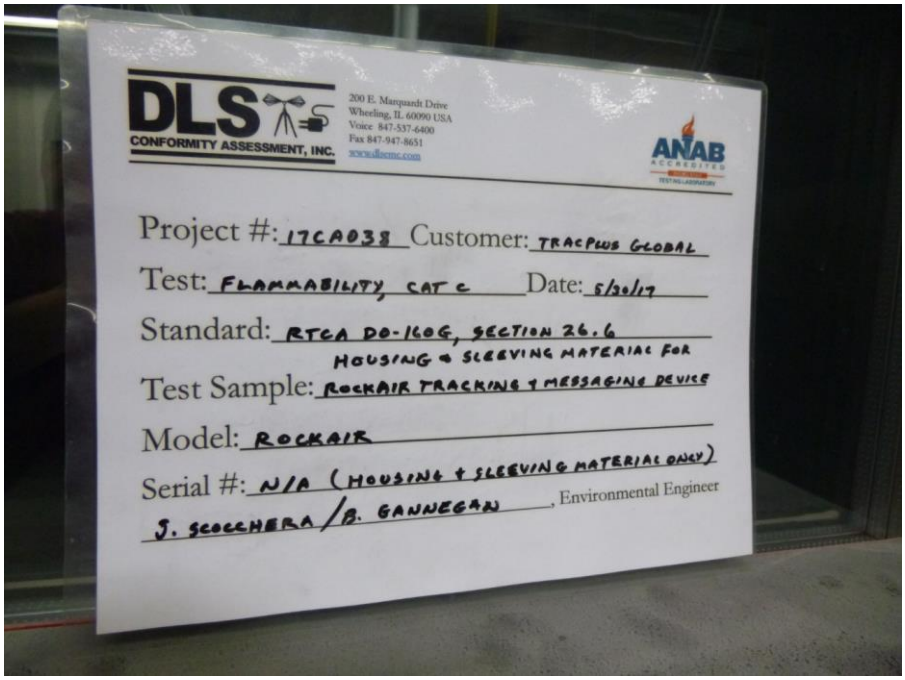
EQUIPMENT USED

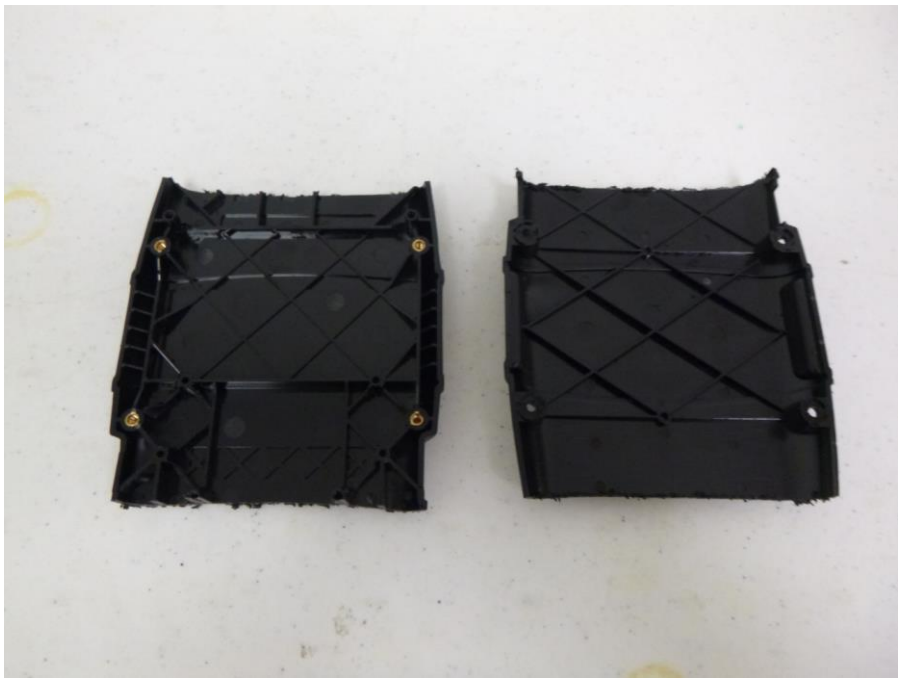
Equipment	Manufacturer	Lab Number	Model#	Date Calibrated	Calibration Due Date
Digital Caliper Micrometer	Mitutoyo	108	CD-6" CS	11/01/2016	11/01/2017
Timer, Digital Stopwatch	Cole Parmer	252	CP47469	3/17/2017	3/17/2018
Environmental Chamber	ESPEC	188	ENX60-6CAL	N/A	Verified with Calibrated Data Acquisition Unit
Data Acquisition Unit	Agilent	MY44082873	34970A	10/18/2016	10/18/2017

PHOTOS



Test Title

Empty Bayblend FR3010 BLK Housing Material



Cut Housing Specimens, Top and Bottom – Approximately 4.5” x 4”

Mounting Bracket – Bottom View

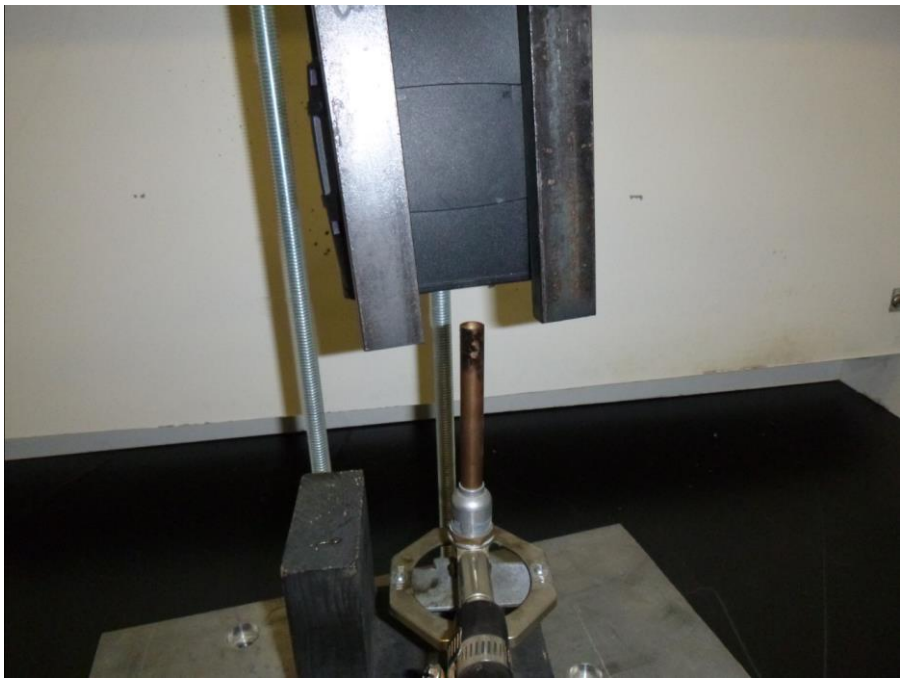
Mounting Bracket – Top View

Elastosil LR 3003/70 A&B Sleeves (Removed from housings)

Elastosil LR 3003/70 A&B Sleeves Cut Into Strips Approximately 8.5” x 1.75”

Environmental Chamber for Preconditioning

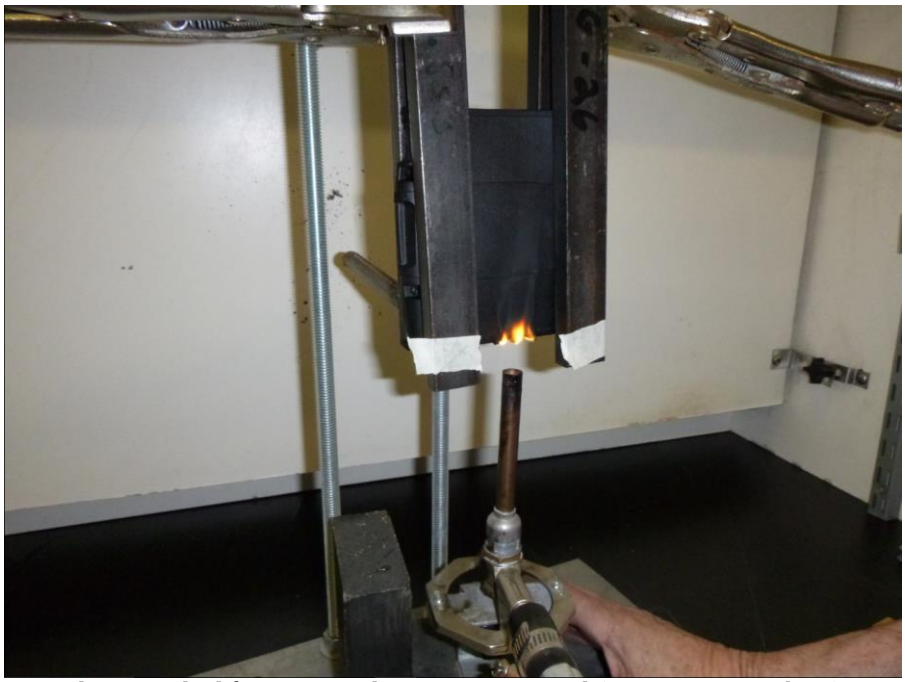
Test Samples in 24 Hour Preconditioning @ 21°C, 50% Rh



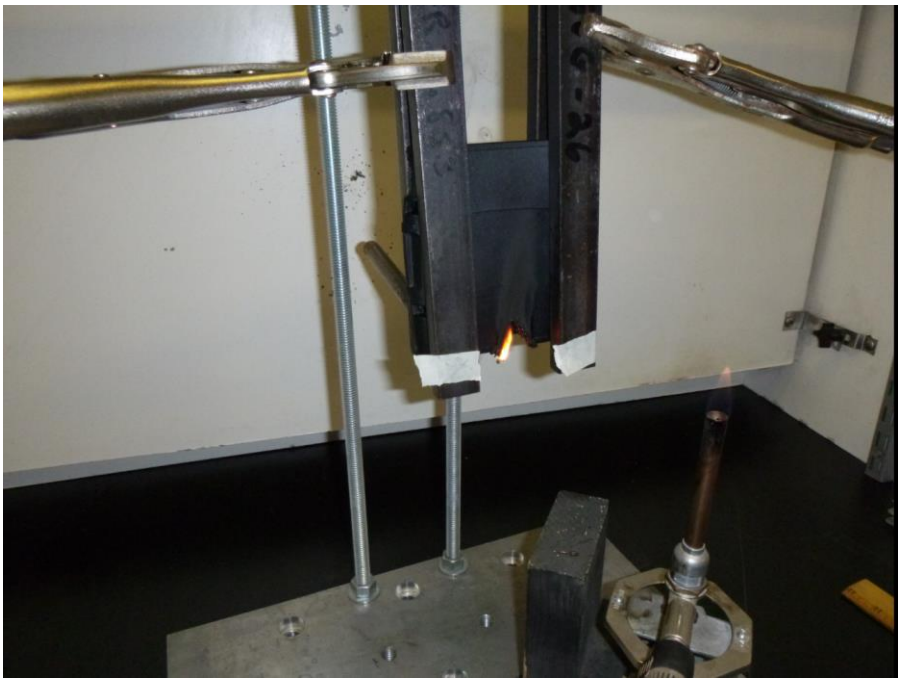
Housing Material Setup Prior to Start of Vertical Burn Test

Adjusting 1.5 Inch Flame Height

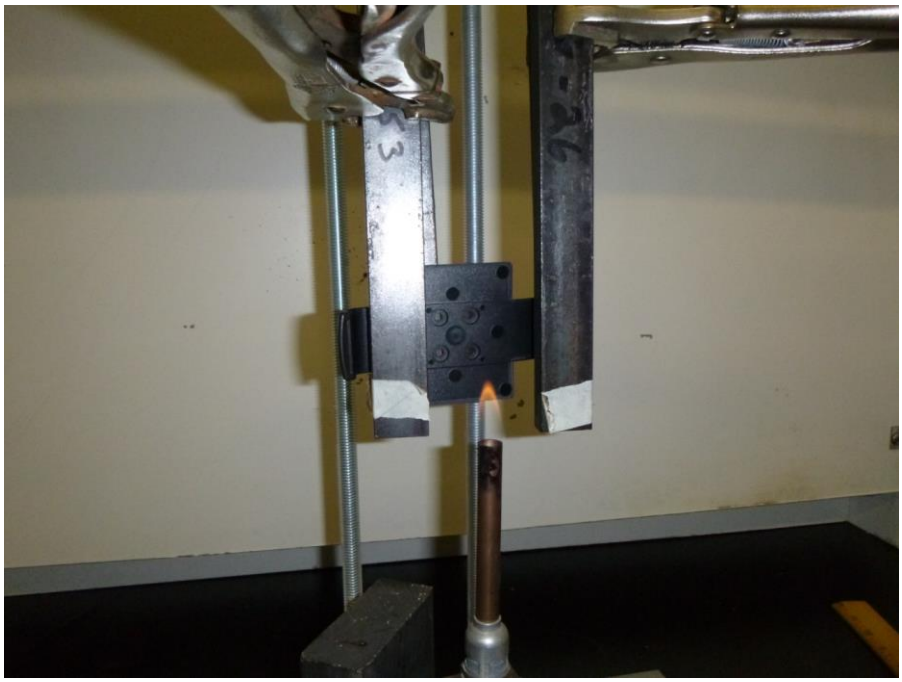
Adjusting 0.875 Inch Inner Cone Height



Flame Applied for 12 Seconds, Housing Material (Representative Photo)



Flame Burning During 15 Second Test, Housing Material (Representative Photo)



Flame Applied for 12 Seconds, Mounting Bracket (Representative Photo)

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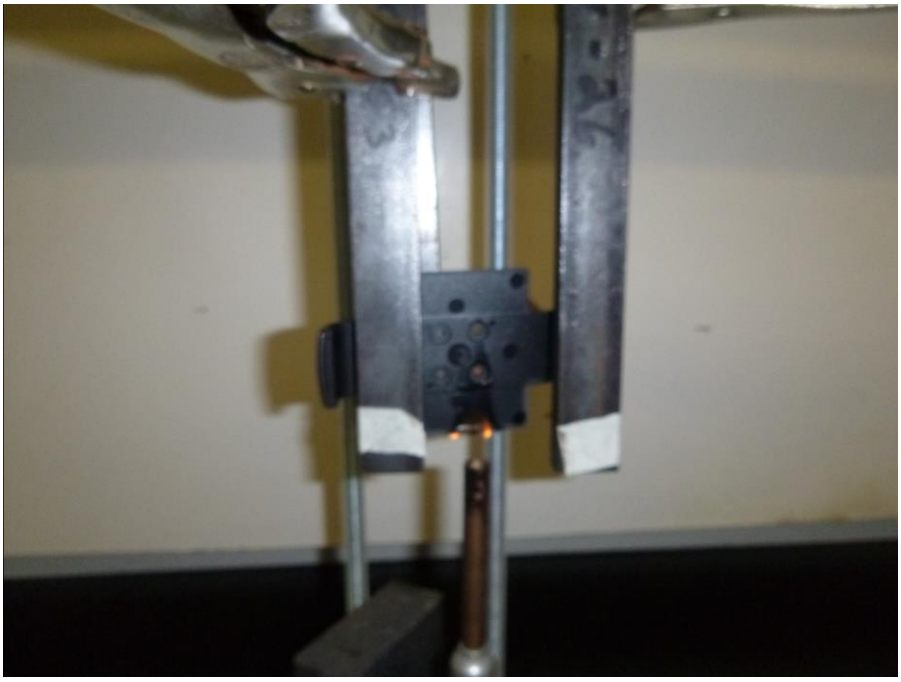
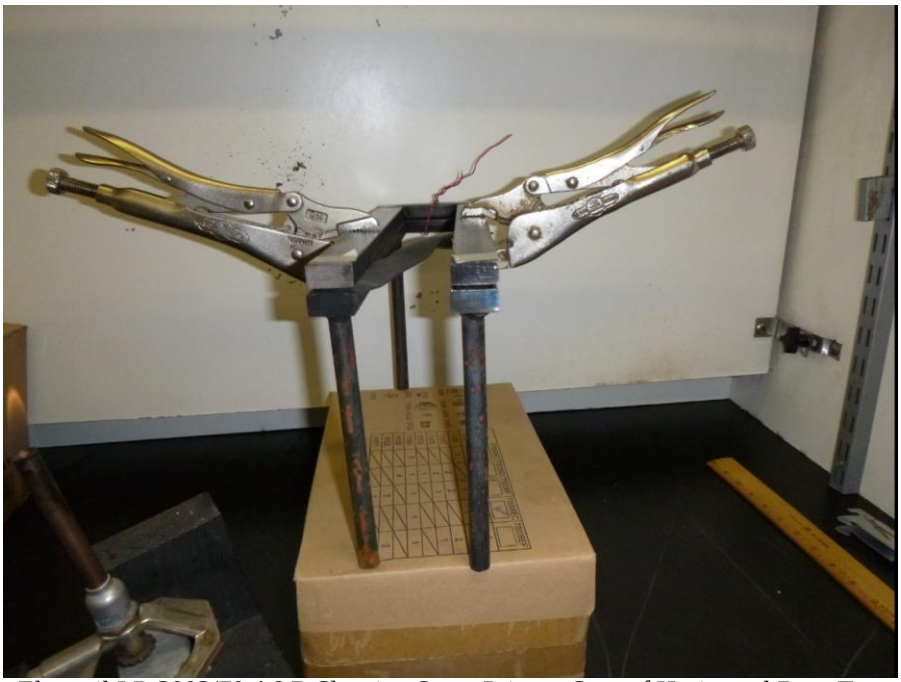
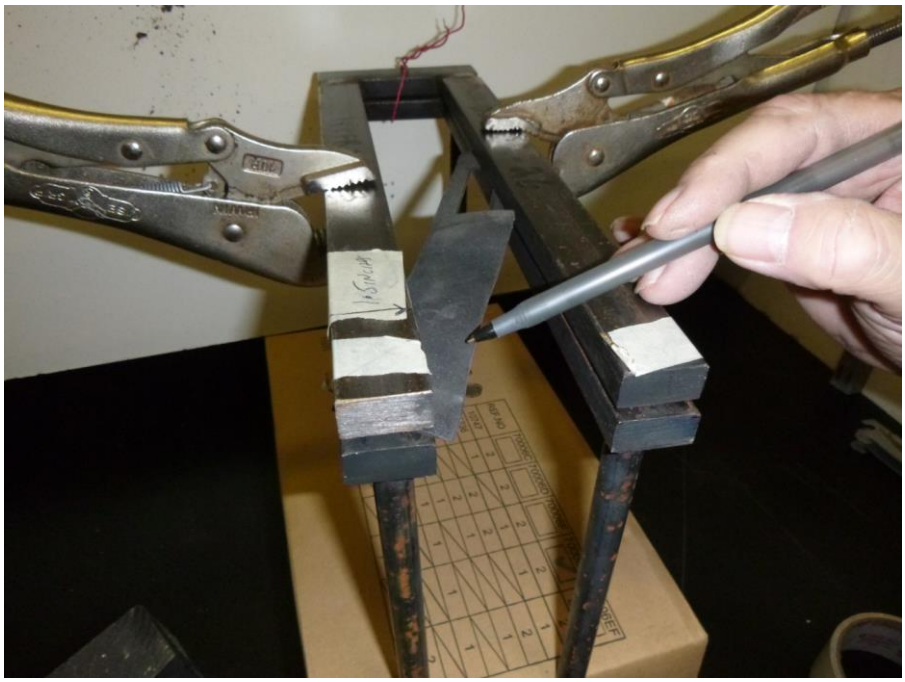


Flame Burning During 15 Second Test, Mounting Bracket (Representative Photo)



Elastosil LR 3003/70 A&B Sleeving Setup Prior to Start of Horizontal Burn Test



Elastosil LR 3003/70 A&B Sleeving Setup Showing Markings For Burn Length

Flame Applied for 15 Seconds, Elastosil LR 3003/70 A&B Sleeve (Representative Photo)

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Bayblend FR3010 BLK Housing Material Sample # 1 After Test

Bayblend FR3010 BLK Housing Material Sample # 2 After Test

Bayblend FR3010 BLK Housing Material Sample # 3 After Test

Bayblend FR3010 BLK Housing Material Sample # 4 After Test

Bayblend FR3010 BLK Housing Material Sample # 5 After Test

Bayblend FR3010 BLK Housing Material Sample # 6 After Test

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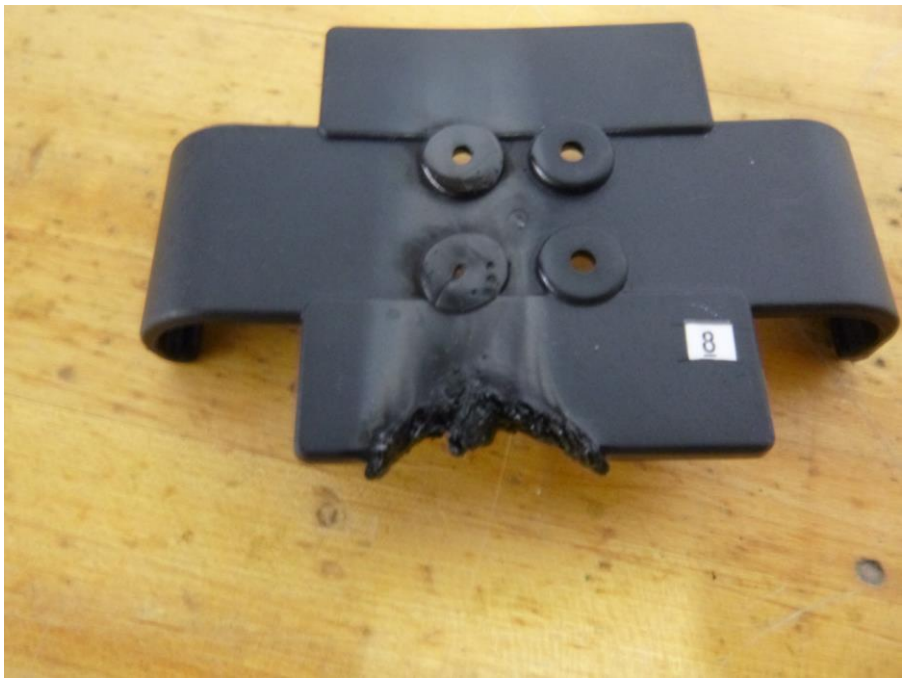
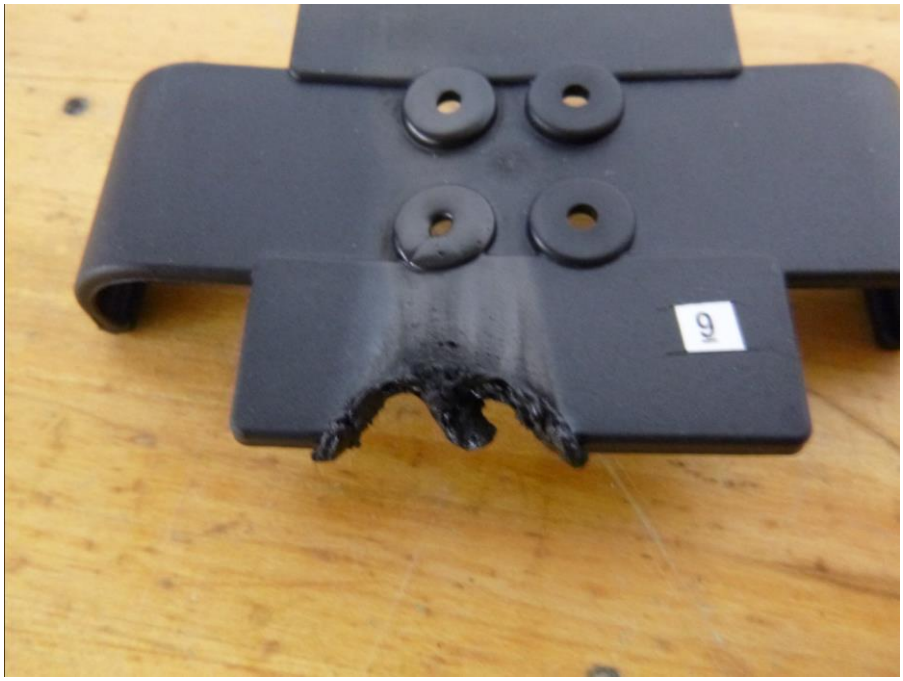
Mounting Bracket Sample # 7 After Test

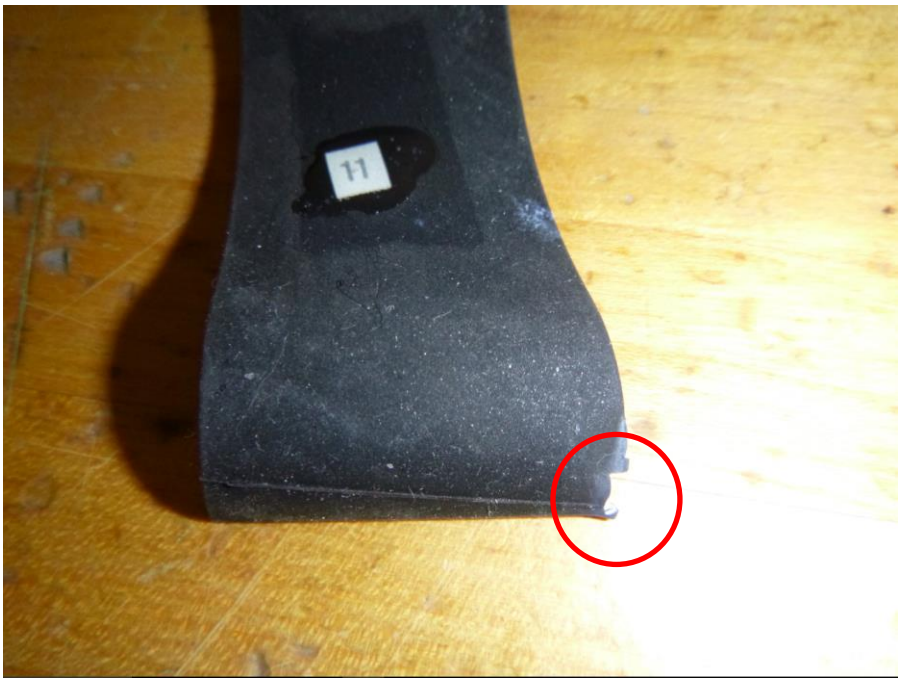


Mounting Bracket Sample # 8 After Test



Mounting Bracket Sample # 9 After Test

Elastosil LR 3003/70 A&B Sleeve Material Sample # 10 After Test



Elastosil LR 3003/70 A&B Sleeve Material Sample # 11 After Test

Elastosil LR 3003/70 A&B Sleeve Material Sample # 12 After Test

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TEST ITEM DISPOSITION

Samples were returned to TracPlus Global.

PERSONNEL

DLS Conformity Assessment, Inc.,
Blair Gannegan
Jim Scocchera

REPORT DISTRIBUTION

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REVISIONS TO REPORT

Revision: Initial Release