**MET Laboratories, Inc.** ***Safety Certification - EMI - Telecom Environmental Simulation***
**914 WEST PATAPSCO AVENUE ! BALTIMORE, MARYLAND 21230-3432 ! PHONE (410) 354-3300 ! FAX (410) 354-3313**

May 30, 2018

LG Electronics, Inc.
LG Twin Tower, 128 Yeoui-daero,
Seoul, Republic of Korea

Dear Shin Junghae,

Enclosed are the test data and photographs obtained from the testing of the LG Electronics, Inc., LG Q Stylus was subjected to Environmental Simulation Testing in accordance with MET Quote Number 2LGE0405-1, and LG Electronics, Inc. Order Number LGE_STD180405_1.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Michelle Tawmging
Documentation Department

Reference: (\LG Electronics, Inc.\ESL98555-MIL)

DOC-ESL 1604 2/26/2004

# Environmental Simulation Testing

for the

**LG Electronics, Inc.**
**LG Q Stylus**

**Tested Under**
Customer Order #LGE_STD180405_1, MIL-STD 810G

**MET Report: ESL98555-MIL**

**May 30, 2018**

**Prepared For:**

**LG Electronics, Inc.**
**LG Twin Tower, 128 Yeoui-daero,**
**Seoul, Republic of Korea**

**Prepared By:**
**MET Laboratories, Inc.**
914 W. Patapsco Avenue
Baltimore, Maryland 21230

**Test Report**
for the

**LG Electronics, Inc.**
**LG Q Stylus**

Tested Under
Customer Order #LGE_STD180405_1
And
MIL-STD 810G

**Testing Performed By:**

Kevin Lynn
Test Engineer

**Report Prepared By:**

Michelle Tawmging
Documentation Department

**Lab Manager**

Johnnie Evans
Manager, Environmental Lab

# Report Status Sheet

| Revision | Report Date | Reason for Revision |
|---|---|---|
| ∅ | May 30, 2018 | Initial Issue |

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# I. Executive Summary

MET Laboratories, Inc. was contracted by LG Electronics, Inc. to perform acceptance testing to MIL-STD-810G criteria on the LG Q Stylus under the LG Electronics, Inc. purchase order number #LGE_STD180405_1.

The tests were based on MIL-STD-810G and Customer Order #LGE_STD180405_1

The results obtained relate only to the item(s) tested.

**Altitude Test Methods**

**Procedure II – Operation**

The EUT was subjected to an Altitude test in accordance with the procedures of MIL-STD-810G, Method 500.5, Procedure II. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Altitude Requirements of MIL-STD-810G, Method 500.5, Procedure II.

**High Temperature Test Methods**

The EUT was subjected to a High Temperature test in accordance with the procedures of MIL-STD-810G, Method 501.5. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the High Temperature Requirements of MIL-STD-810G, Method 501.5.

**Low Temperature Test Methods**

The EUT was subjected to a Low Temperature test in accordance with the procedures of MIL-STD-810G, Method 502.5. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Low Temperature Requirements of MIL-STD-810G, Method 502.5.

**Temperature Shock Test Methods**

The EUT was subjected to a Temperature Shock test in accordance with the procedures of MIL-STD-810G, Method 503.5. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Temperature Shock Requirements of MIL-STD-810G, Method 503.5.

**Solar Radiation (Sunshine) Test Methods**

The EUT was subjected to a Solar Radiation (Sunshine) test in accordance with the procedures of MIL-STD-810G, Method 505.5. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Solar Radiation (Sunshine) Requirements of MIL-STD-810G, Method 505.5.

**Rain Test Methods**

The EUT was subjected to a Rain test in accordance with the procedures of MIL-STD-810G, Method 506.5. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Rain Requirements of MIL-STD-810G, Method 506.5.

**Humidity Test Methods**

The EUT was subjected to a Humidity test in accordance with the procedures of MIL-STD-810G, Method 507.5. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Humidity Requirements of MIL-STD-810G, Method 507.5.

**Salt Fog Test Methods**

The EUT was subjected to a Salt Fog test in accordance with the procedures of MIL-STD-810G, Method 509.5. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Salt Fog Requirements of MIL-STD-810G, Method 509.5.

**Sand and Dust Test Methods**

The EUT was subjected to a Sand and Dust test in accordance with the procedures of MIL-STD-810G, Method 510.5. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Sand and Dust Requirements of MIL-STD-810G, Method 510.5.

**Immersion Test Methods**

The EUT was subjected to an Immersion test in accordance with the procedures of MIL-STD-810G, Method 512.5. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Immersion Requirements of MIL-STD-810G, Method 512.5.

**Vibration Test Methods**

The EUT was subjected to a Vibration Contents test in accordance with the procedures of MIL-STD-810G, Method 514.6. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Vibration Contents Requirements of MIL-STD-810G, Method 514.6.

**Shock Test Methods**

The EUT was subjected to a Shock test in accordance with the procedures of MIL-STD-810G, Method 516.6. The EUT was **compliant** to this requirement. No anomalies were observed. The EUT **conforms** to the Shock Requirements of MIL-STD-810G, Method 516.6.

# II. Equipment Configuration

# A. Overview

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform an Acceptance Test of the LG Electronics, Inc., LG Q Stylus. The tests were based on MIL-STD-810G. The tests described in this document were formal tests as described in MIL-STD 810G. The objective of the testing was to verify compliance of the Equipment Under Test (EUT) to the requirements of the aforementioned specifications.

| | | |
|---|---|---|
| **Model(s) Tested:** | LG Q Stylus | |
| **Model(s) Covered:** | LG Q Stylus<br>(Covered model : Q Stylus +, Q Stylo+, Stylo4+, Q8+ 2018, Q8 2018)<br><br>* Product name varied by region<br><br>LG Q Stylus, LG Q Styus + : SCA, EU, Asia, MEA<br>LG Q Stylo+, LG Stylo4+ : North America<br>LG Q8+ 2018, LG Q8 2018 : Korea | |
| **Analysis:** | The results obtained relate only to the item(s) tested. | |
| **Environmental Test Conditions:** | **Temperature:** | 15-35º C |
| | **Relative Humidity:** | 30-60% |
| | **Barometric Pressure:** | 860-1060 mbar |
| **Evaluated by:** | Kevin Lynn | |
| **Date:** | May 30, 2018 | |

# B. References

| | |
|---|---|
| **ISO 1012-1: 1992 (E)** | Quality Assurance Requirements for Measuring Equipment |
| **MIL-STD-810G** | Environmental Conditions and Test Procedures for Airborne Equipment |
| **MIL-STD 810G** | Environmental Test Methods and Engineering Guidelines |
| **SR-3580** | Bellcore Special Report, Network Equipment-Building System (NEBS) Criteria Levels |

## C. Test Site

All testing was performed in a limited access test laboratory. This facility is located at MET Laboratories, Inc., 914 W. Patapsco Avenue, Baltimore, Maryland 21230.

This testing was conducted in the Environmental Simulation Lab at MET Laboratories, Inc. All equipment used in making physical determinations is accurate and bears recent traceability to the National Standards and Technology.

## D. Modifications

### a) Modifications to the EUT

No modifications to the EUT were required.

### b) Modifications to the Test Standard

No modifications to the Test Standard were necessary.

## E. Disposition of EUT

The test sample including all support equipment (if any), submitted to the Environmental Simulation Lab for testing was returned to LG Electronics, Inc. upon completion of testing.

# III. METHOD 500.5 LOW PRESSURE (ALTITUDE)

## Low Pressure (Altitude), Procedure II - Operation (MIL-STD-810G, Method 500.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance as a result of being exposed to the low pressure altitude test as described in MIL-STD-810G Method 500.5, Procedure II.

**Test Procedure:**

**A.** The EUT was installed in the altitude chamber. The cables required for the operation and monitoring of the EUT were attached. The proper operation of the EUT was verified.

**B.** The internal chamber temperature was maintained at 25°C.

**C.** The chamber air pressure to was adjusted to 57.2 kPa or 8.3 psia to correspond to the required test altitude of 4,572m (15,000 ft), at a change rate that did not exceed 10 m/s.

**D.** The test altitude was maintained for 1 hour, while the EUT was functionally evaluated.

**E.** The chamber air was adjusted to standard ambient conditions at a change rate of 10 m/s.

**F.** The EUT was visually inspected and functionally verified.

**Test Results:** The EUT was **compliant** with the requirements of Low Pressure (Altitude), Procedure II - Operation. No anomalies were observed

**Test Engineer:** Kevin Lynn

**Test Date:** May 4, 2018

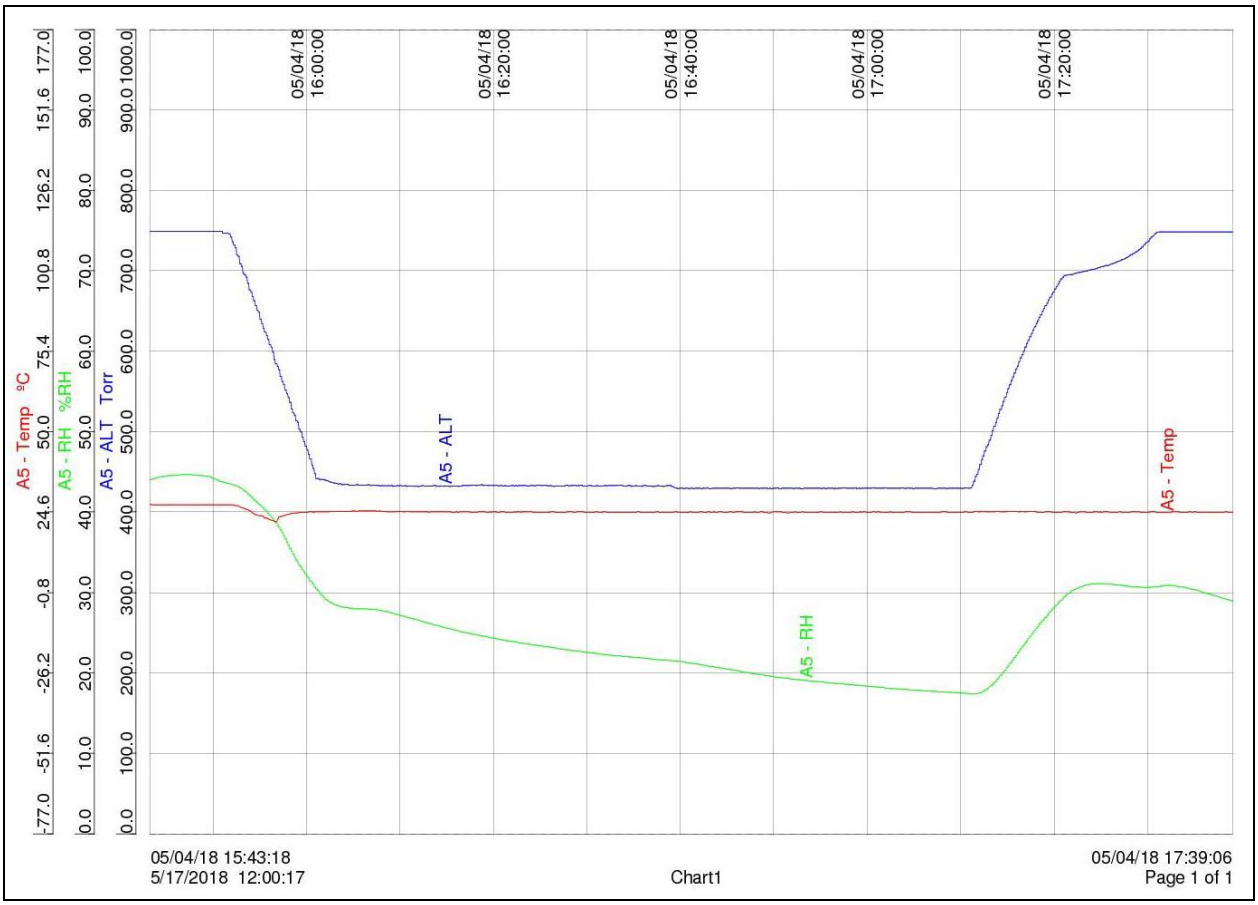
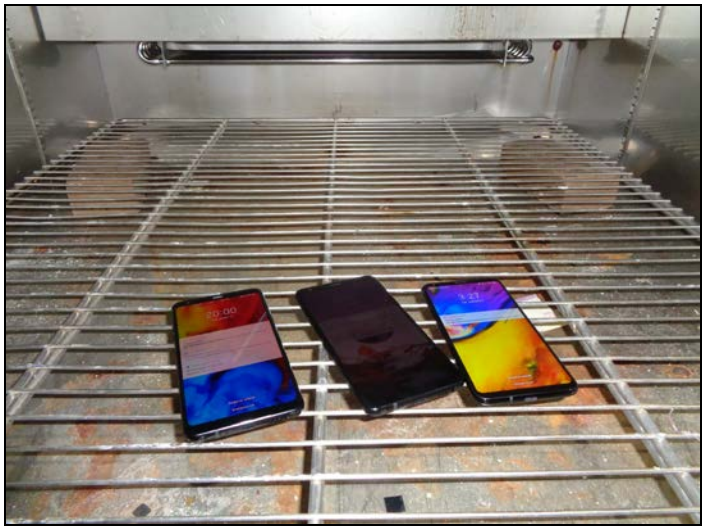



**Chart 1. Low Pressure (Altitude), Procedure II – Operation, Test Results**



**Photograph 1. Low Pressure (Altitude), Procedure II – Operation, Test Setup**

# IV. METHOD 501.5 HIGH TEMPERATURE

## A. High Temperature, Procedure I - Storage (MIL-STD-810G, Method 501.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance as a result of being exposed to the High Temperature test as described in MIL-STD-810G Method 501.5, Procedure I.

**Test Procedure:**

**A.** The EUT was placed in the chamber in its storage configuration.

**B.** The chamber environment was adjusted to 63 °C for the start of the test period and maintained for the specified time following temperature stabilization of the EUT.

**C.** The test temperature was maintained at least two hours following EUT temperature stabilization (see Part One, paragraph 5.5).

**D.** At the completion of the constant temperature soak or the last cycle, the chamber air temperature was adjusted to standard ambient conditions and maintained until the EUT temperature was stabilized.

**E.** A visual examination and operational checkout were conducted on the EUT and results were recorded for comparison with pretest data.

**Test Results:** The EUT was **compliant** with High Temperature, Procedure I - Storage. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Date:** April 30, 2018

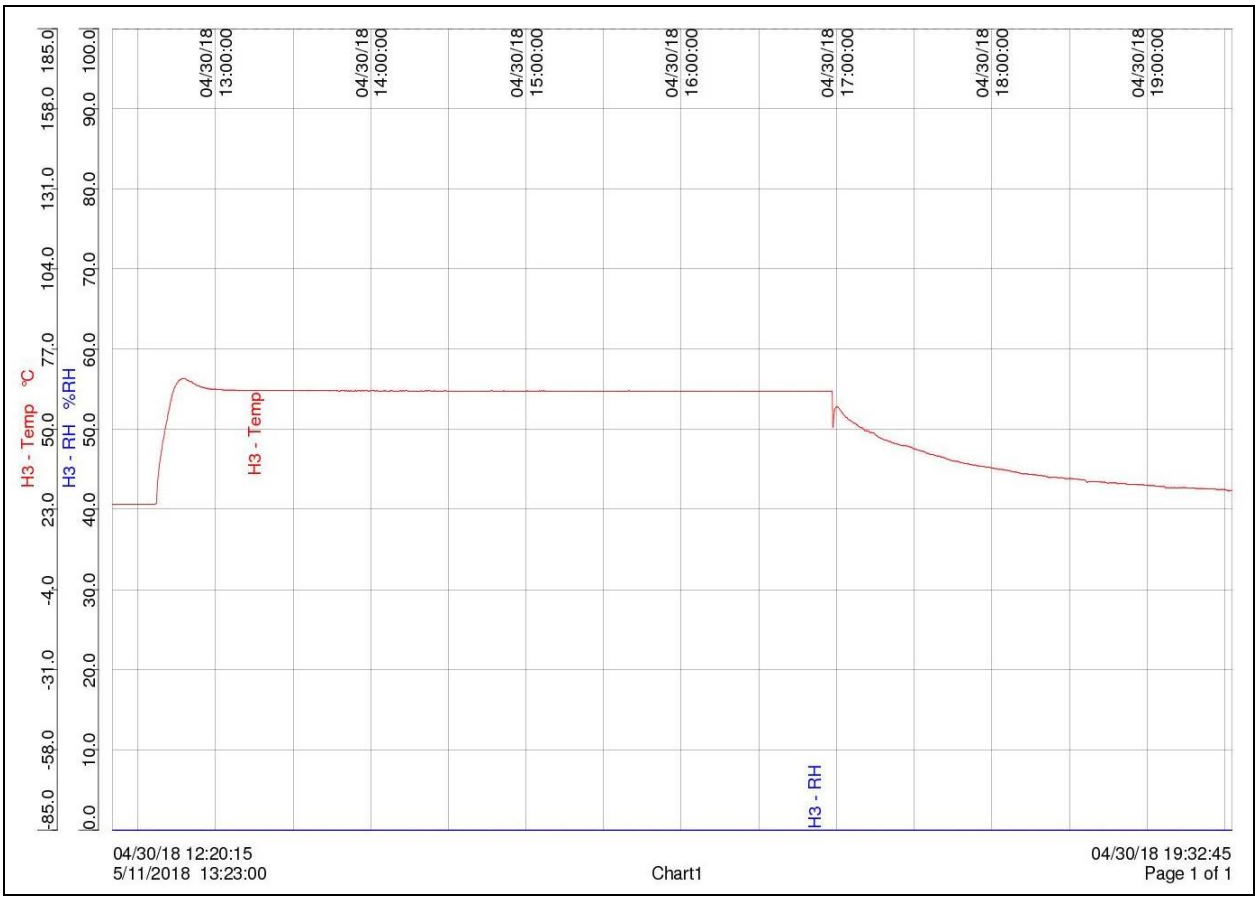



**Chart 2. High Temperature, Procedure I – Storage, Test Results**

**Photograph 2. High Temperature, Procedure I – Storage, Test Setup**

## B. High Temperature, Procedure II - Operation (MIL-STD-810G, Method 501.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance as a result of being exposed to the High Temperature test as described in MIL-STD-810G Method 501.5, Procedure II.

**Test Procedure:**

**A.** The EUT functionality was evaluated at ambient temperature and humidity level (25°C +/-5°C, 55%RH).

**B.** With the EUT placed in the chamber in its operational configuration, any additional temperature sensors necessary were installed to measure the maximum temperature response of the EUT, ensuring the functioning components are included.

**C.** The chamber air conditions was adjusted to the required steady state temperature of 43°C.

**D.** The chamber conditions were maintained for at least two hours following the EUTs temperature stabilization.

**E.** A visual examination and functional verification of the EUT was performed and the results were documented for comparison with pretest data.

**Test Results:** The EUT was **compliant** with High Temperature, Procedure II - Operational. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Date:** May 1, 2018

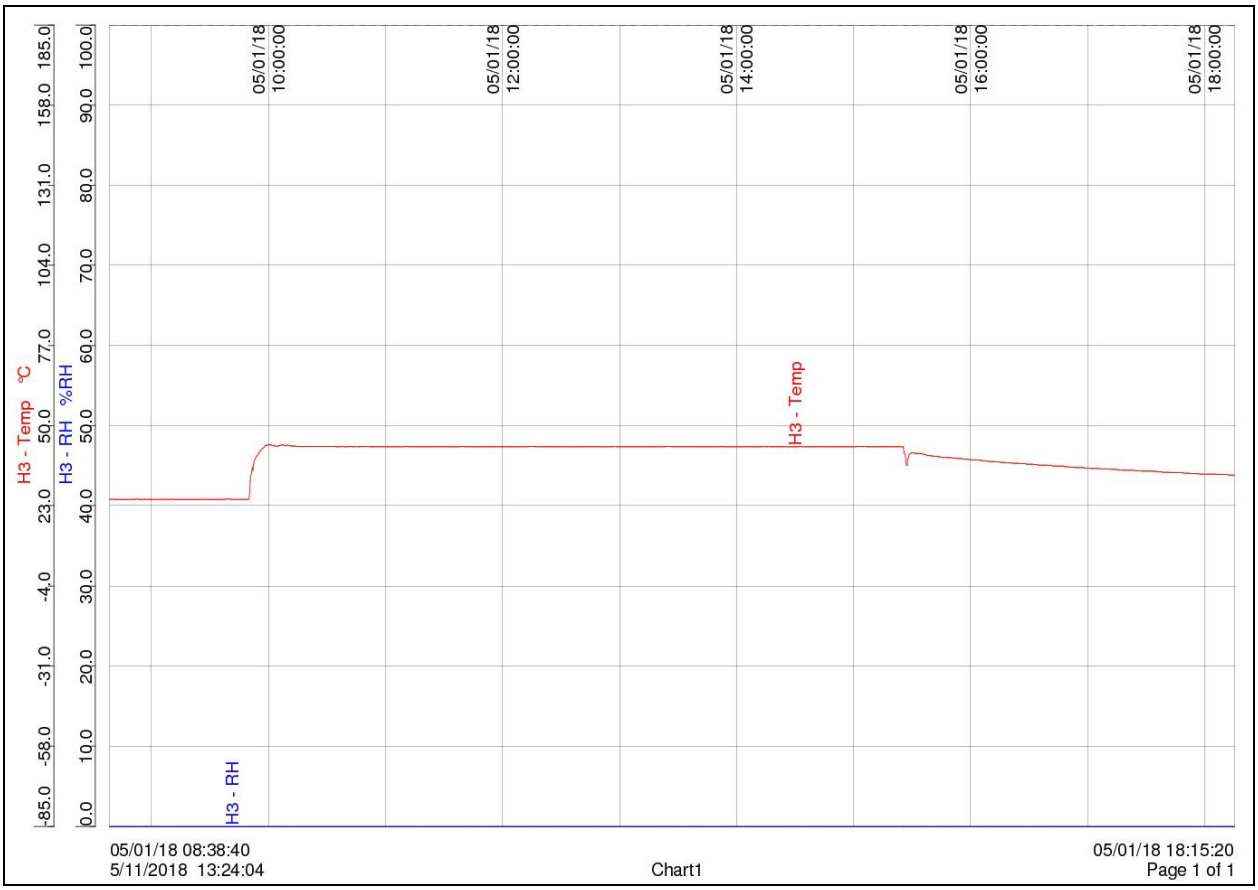
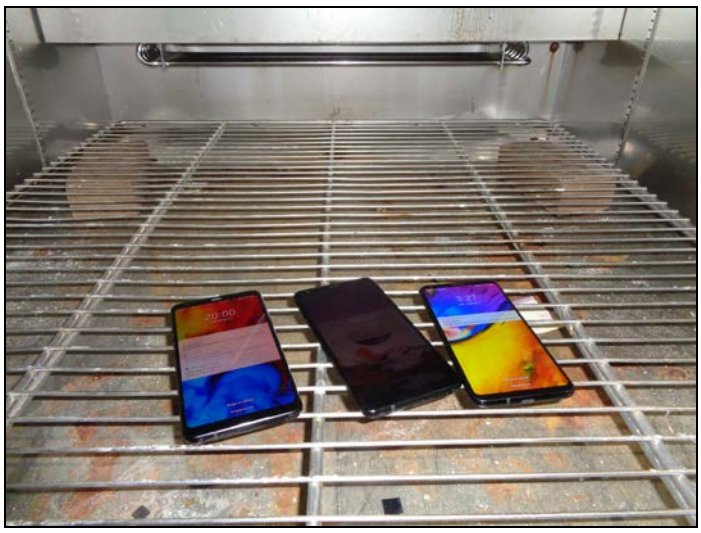



**Chart 3. High Temperature, Procedure II – Operation, Test Results**



**Photograph 3. High Temperature, Procedure II – Operation, Test Setup**

# V. METHOD 502.5 LOW TEMPERATURE

## A. Low Temperature, Procedure I - Storage (MIL-STD-810G, Method 502.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance as a result of being exposed to the Low Temperature test as described in MIL-STD-810G Method 502.5, Procedure I.

**Test Procedure:**

**A.** The EUT functionality was evaluated at ambient temperature and humidity level (25°C +/-5°C, 55%RH).

**B.** With the EUT non-operating, the chamber temperature was decreased to -33°C.

**C.** The chamber temperature was held at -33°C for 24 hours.

**D.** At the conclusion of the test, the chamber temperature was increased to ambient conditions.

**E.** The EUT functionality was evaluated at ambient temperature and humidity level (25°C, 55%RH).

**Test Results:** The EUT was **compliant** with Low Temperature, Procedure I – Storage. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Date:** May 1, 2018

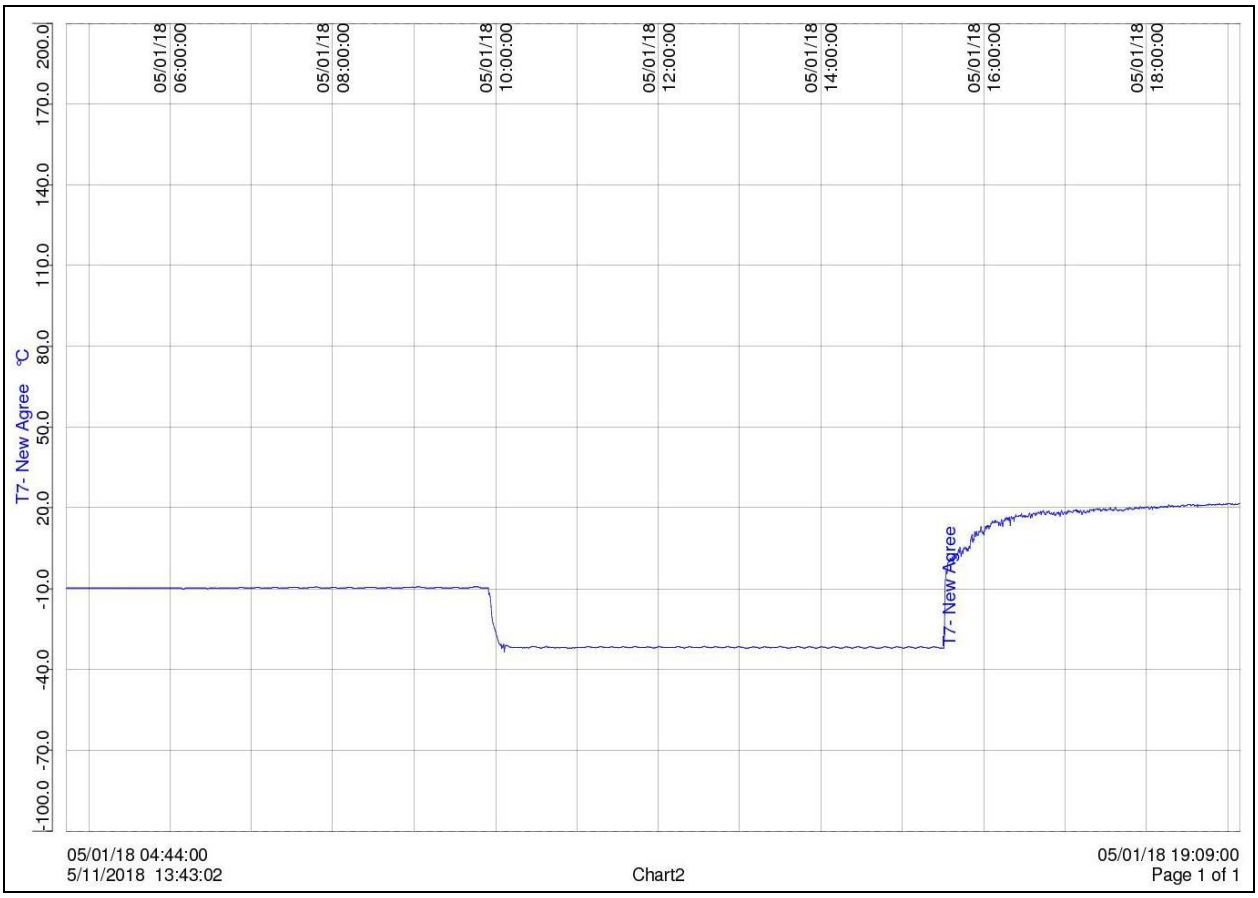



**Chart 4. Low Temperature, Procedure I – Storage, Test Results**

**Photograph 4. Low Temperature, Procedure I – Storage, Test Setup**

## B. Low Temperature, Procedure II - Operation (MIL-STD-810G, Method 502.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance as a result of being exposed to the low temperature test as described in MIL-STD-810G Method 502.5, Procedure II.

**Test Procedure:**

**A.** The operational EUT was installed in the test chamber and the chamber air temperature was adjusted to -21°C.

**B.** This temperature was maintained for at least two hours following the temperature stabilization of the EUT.

**C.** The EUT was visually inspected.

**D.** The chamber air temperature was adjusted to standard ambient and maintained until temperature stabilization of the EUT was achieved.

**Test Results:** The EUT was **compliant** with Low Temperature, Procedure II - Operational. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Date:** May 2, 2018

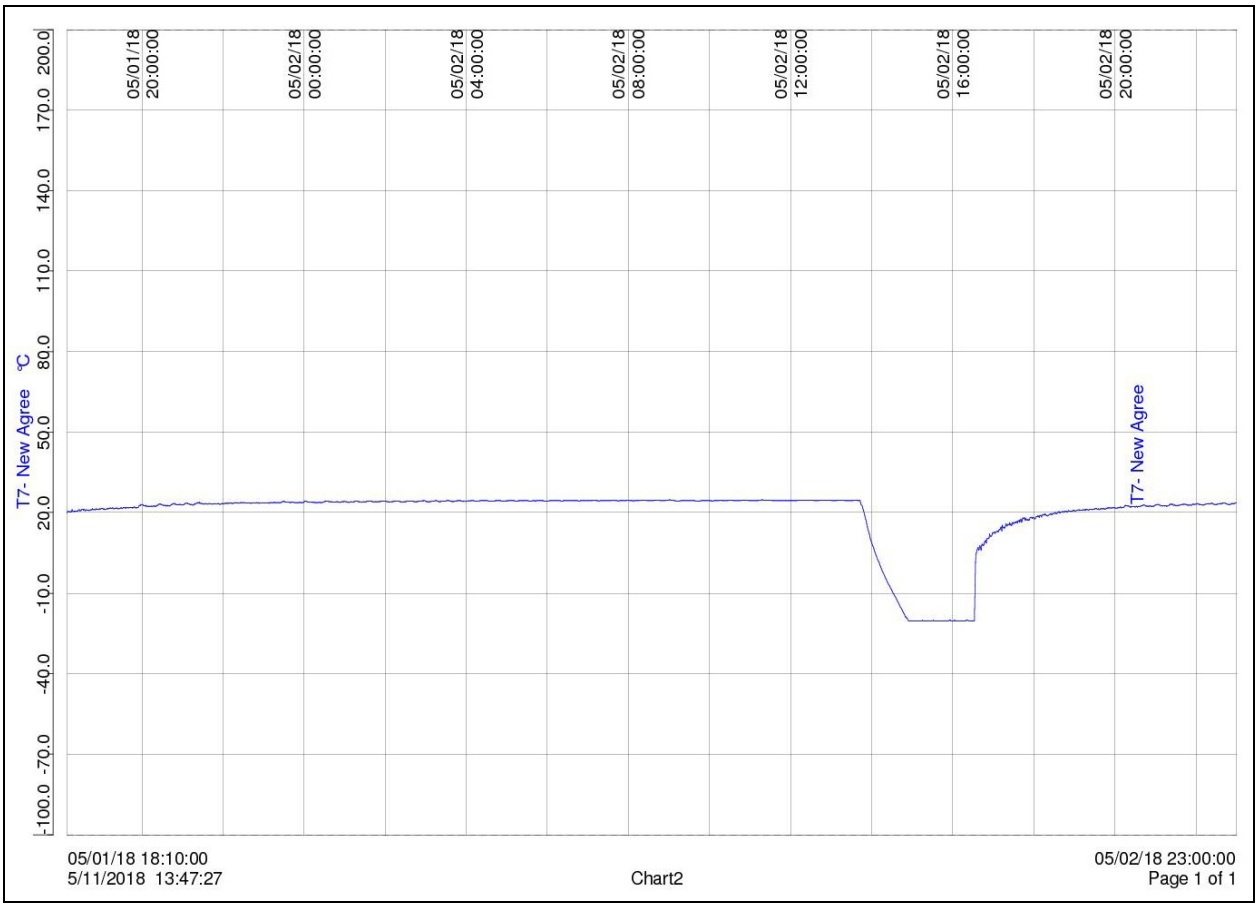
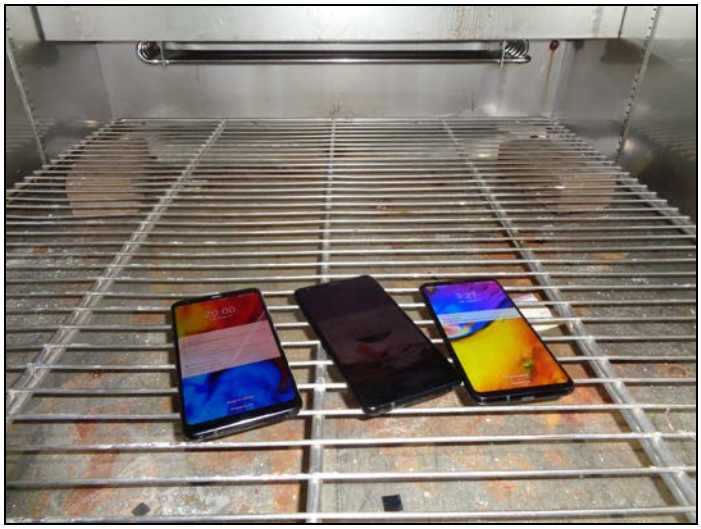



**Chart 5. Low Temperature, Procedure II – Operation, Test Results**



**Photograph 5. Low Temperature, Procedure II – Operation, Test Setup**

# VI. METHOD 503.5 TEMPERATURE SHOCK

## Temperature Shock, Procedure I-C – Multi-Cycle Shocks

**Test Requirement(s):** The equipment **shall not** sustain any damage or deterioration of functional performance during its operating life when operated within the conditions of MIL-STD-810G, Method 503.5, Procedure I-C – Multi-Cycle Shocks.

**Test Procedure:**

**A.** The EUT was placed in the chamber and subjected to a temperature shock in **Figure 1**. The temperature was maintained for a period of 1 hours. The EUT was allowed to stabilize.

**B.** The EUT temperature was increased to 43°C in no more than one minute. This temperature was maintained for a period of 2 hours. The EUT was allowed to stabilize.

**C.** The temperature was changed to -21°C in no more than one minute. This temperature was maintained for a period of 2 hours. The EUT was allowed to stabilize.

**D.** The chamber temperature was cycled for a total of 3 cycles.

**E.** The EUT was returned to standard ambient conditions after the final cycle.

**F.** The EUT was visually inspected and functionally evaluated.

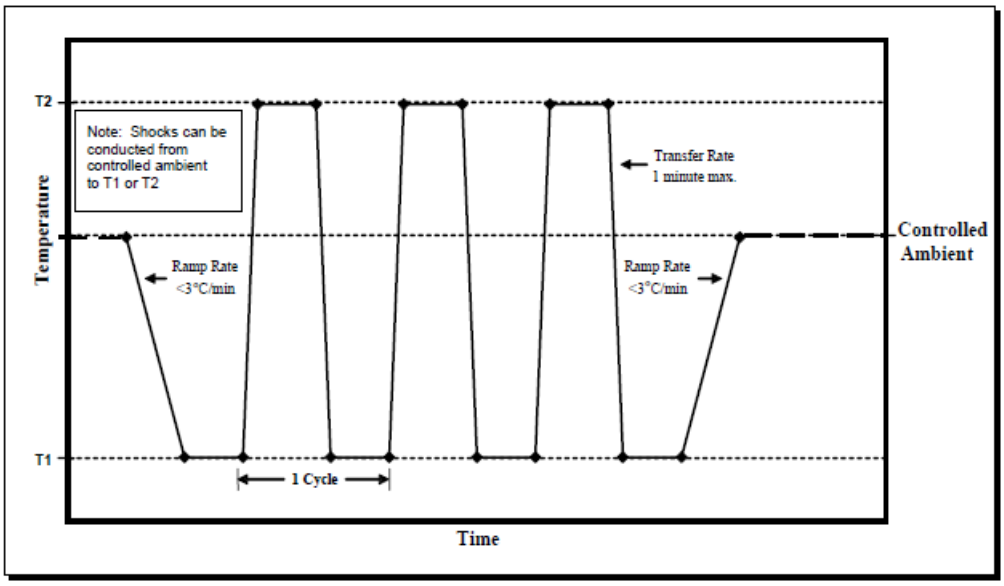



Figure 503.5-3. Multi-cycle shocks.

**Figure 1. Method 503.5, Procedure I-C – Multi-Cycle Shocks**

**Test Results:** The EUT was **compliant** with Temperature Shock, Procedure I-C. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Dates:** May 2 – 3, 2018

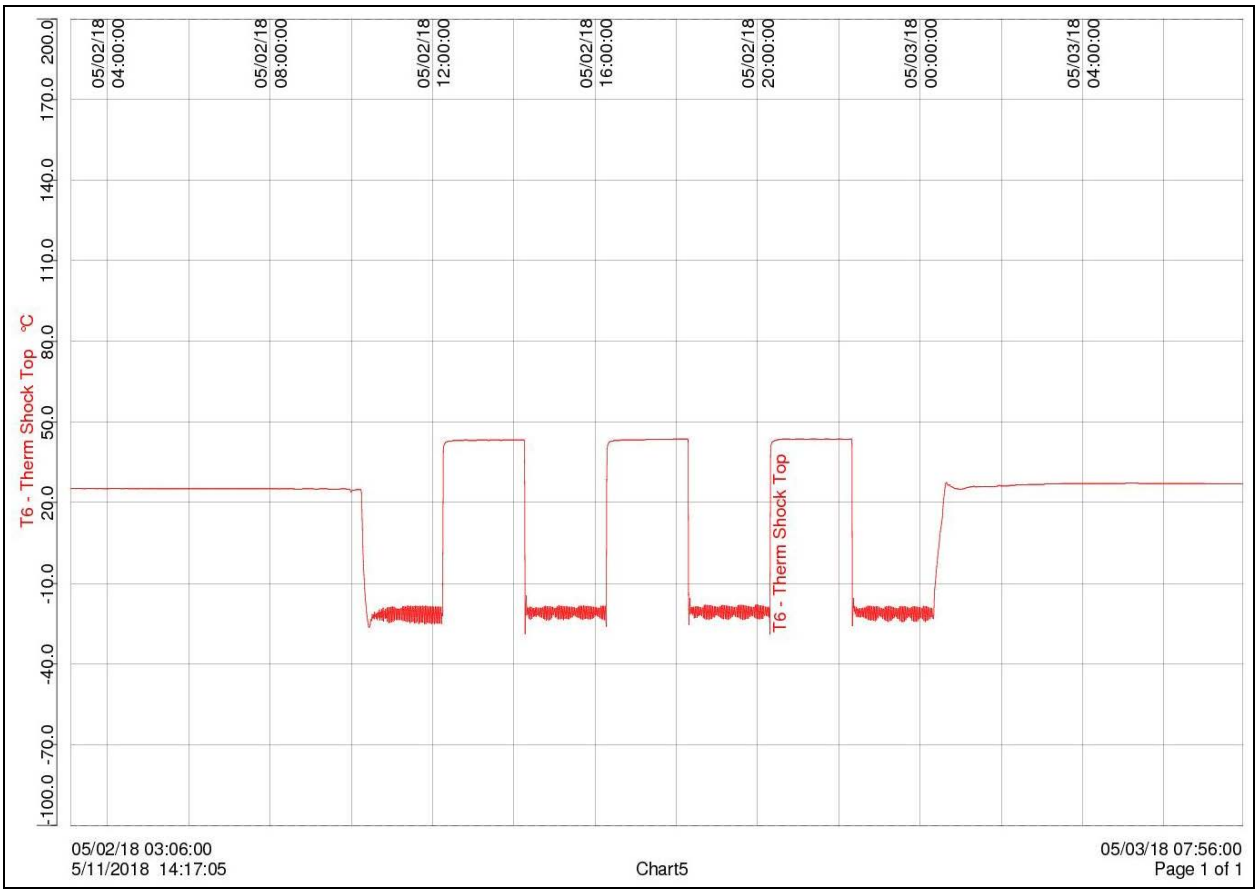



**Chart 6. Temperature Shock, Procedure I-C – Multi-Cycle Shocks, Test Results**

**Photograph 6. Temperature Shock, Procedure I-C – Multi-Cycle Shocks, Test Setup**

# VII. METHOD 505.5 SOLAR RADIATION (SUNSHINE)

## Solar Radiation (Sunshine), Procedure I, Cycling (MIL-STD-810G, Method 505.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance as a result of being exposed to the contamination by fluids test as described in MIL-STD-810G Method 505.5, Procedure I.

**Test Procedure:**

**A.** The chamber air temperature was adjusted to the minimum value of the temperature cycle at which radiation was nonexistent.

VALUES ARE FROM STANAG 2895 - Temperatures of categories A1, A2 and A3 in $^{o}$C; solar radiation in W/m$^2$

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 35 | 34 | 34 | 33 | 33 | 32 | 33 | 35 | 38 | 41 | 43 | 44 | 47 | 48 | 48 | 49 | 48 | 48 | 46 | 42 | 41 | 39 | 38 | 37 |
| A2 | 33 | 32 | 32 | 31 | 30 | 30 | 31 | 34 | 37 | 39 | 41 | 42 | 43 | 44 | 44 | 44 | 43 | 42 | 40 | 38 | 36 | 35 | 34 | 33 |
| A3 | 30 | 29 | 29 | 28 | 28 | 28 | 29 | 30 | 31 | 34 | 36 | 37 | 38 | 38 | 39 | 39 | 38 | 37 | 35 | 34 | 34 | 32 | 32 | 31 |
| W | 0 | 0 | 0 | 0 | 0 | 55 | 270 | 505 | 730 | 915 | 1040 | 1120 | 1120 | 1040 | 915 | 730 | 505 | 270 | 55 | 0 | 0 | 0 | 0 | 0 |

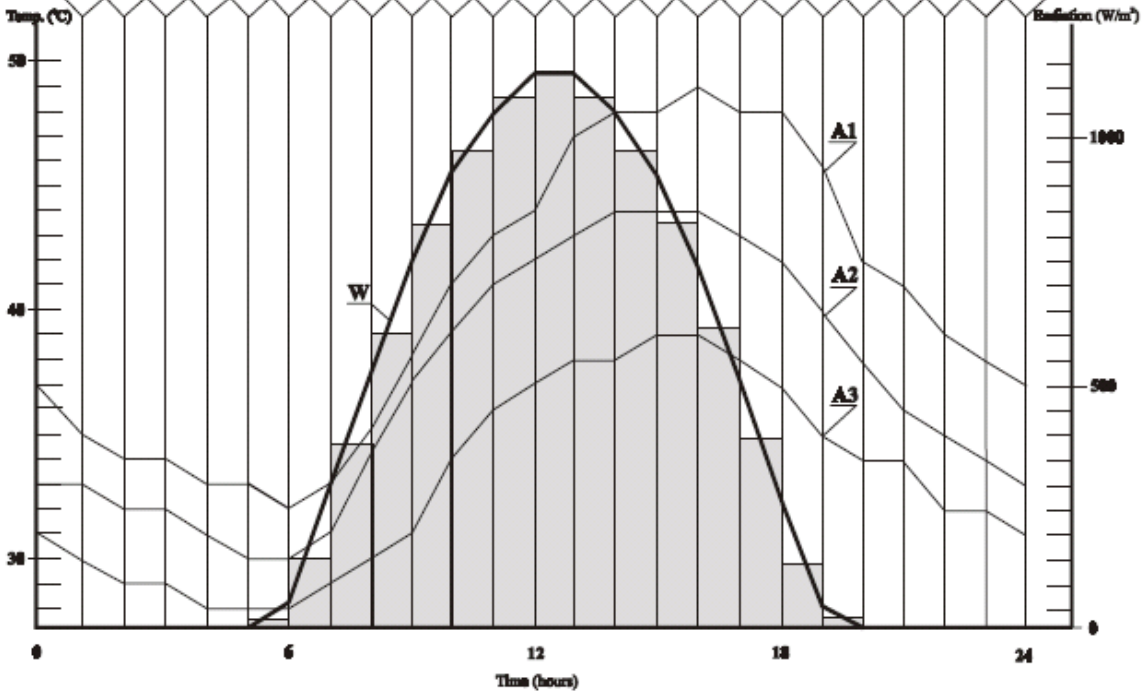



FIGURE 505.4-1. Procedure I - Cycling Test.

**B.** The EUT was exposed to continuous 24-hour cycles of controlled simulated solar radiation and dry bulb temperature as indicated on **Figure 505.5-1**.

a. The minimum necessary to ensure the peak response temperature of the most critical area of the EUT achieved during a cycle is within 2°C of the peak response temperature achieved during the previous 24-hour cycle, or

b. Three continuous cycles, or

c. The number of cycles as identified by the requirements document (not to exceed 7 cycles).

**C.** The EUT **was not** operated throughout the test.

**D.** The chamber air temperature was adjusted to standard ambient conditions and maintained until temperature stabilization of the EUT was achieved.

**E.** The EUT was visually inspected.

**F.** The EUT was functionally verified.

**Test Results:** The EUT was **compliant** with Solar Radiation, Procedure I. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Dates:** May 8- 12, 2018

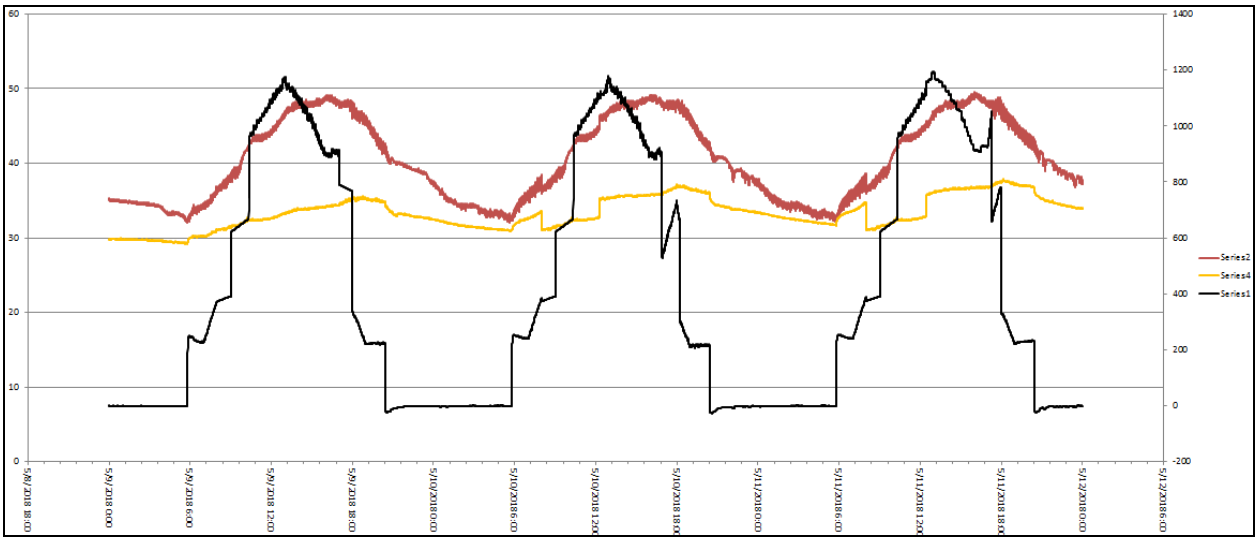



**Chart 7. Solar Radiation (Sunshine), Procedure I, Cycling, Test Results**

**Plot 1. Solar Radiation (Sunshine), Procedure I, Cycling, Test Setup**

# VIII. METHOD 506.5 RAIN

## Rain, Procedure III, Drip (MIL-STD-810G, Method 506.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance as a result of being exposed to the rain test as described in MIL-STD-810G Method 506.5, Procedure III.

**Test Procedure:**

**A.** The EUT was installed in its operational configuration. The temperature differential between the EUT and the water was ensured to be 10°C or greater.

**B.** With the EUT operating, it was subjected to water falling from a height no less than 1 meter (3 feet) for 15 minutes.

**C.** At the conclusion of the 15-minute exposure, the EUT was removed.

**D.** The EUT was visually inspected for evidence of water ingress.

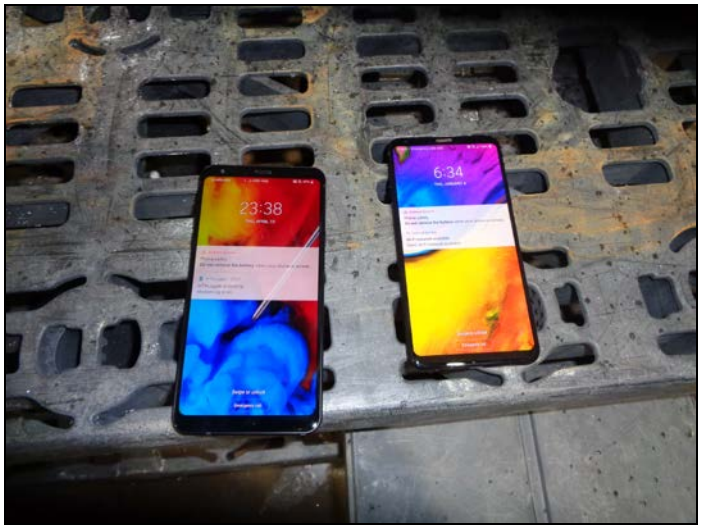
**E.** The EUT was functionally verified.

**Test Results:** The EUT was **compliant** with Rain, Procedure III. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Date:** May 3, 2018

**Photograph 7. Rain, Procedure III, Drip, Test Setup**




**Photograph 8. Rain, Procedure III, Drip, Post, Test Setup**

# IX. METHOD 507.5 HUMIDITY

## Humidity (MIL-STD-810G, Method 507.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance during or after it has been exposed to the environment described in MIL-STD-810G, Method 507.5.

**Test Procedure:**

**A.** The EUT was functionally evaluated at ambient temperature and humidity levels (25°C ± 5°C, 55%RH).

**B.** With the test item installed in the test chamber in its required configuration, the temperature was adjusted to 23 ± 2°C and 50 ± 5% RH, and maintained for 24 hours.

**C.** The chamber temperature was adjusted to 30°C and the RH to 95%.

**D.** The EUT was subjected to ten 24-hour cycles (**Figure 2**). Near the end of the fifth and tenth cycles, a EUT performance check was conducted. If the test item fails to operate as intended, stop the test and go to Step F below. Otherwise, continue with Step E.

**E.** In order to prevent unrealistic drying, within 15 minutes of Step D being completed, an operational performance check was conducted.

**F.** The temperature and humidity was adjusted to standard ambient conditions.

**G.** The EUT was visually inspected and functionally verified.

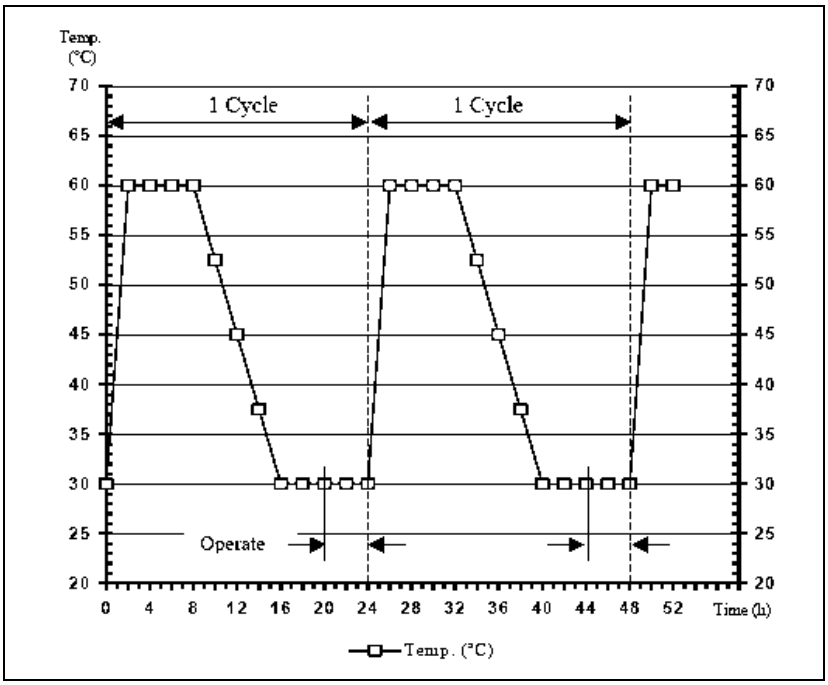



**Figure 2. Humidity – Cycle**

**Test Results:** The EUT was **compliant** with Humidity. No anomalies were observed. A cycle was lost due to a chamber failure and so the profile was extended to compensate.

**Test Engineer:** Kevin Lynn

**Test Dates:** May 2 – 16, 2018

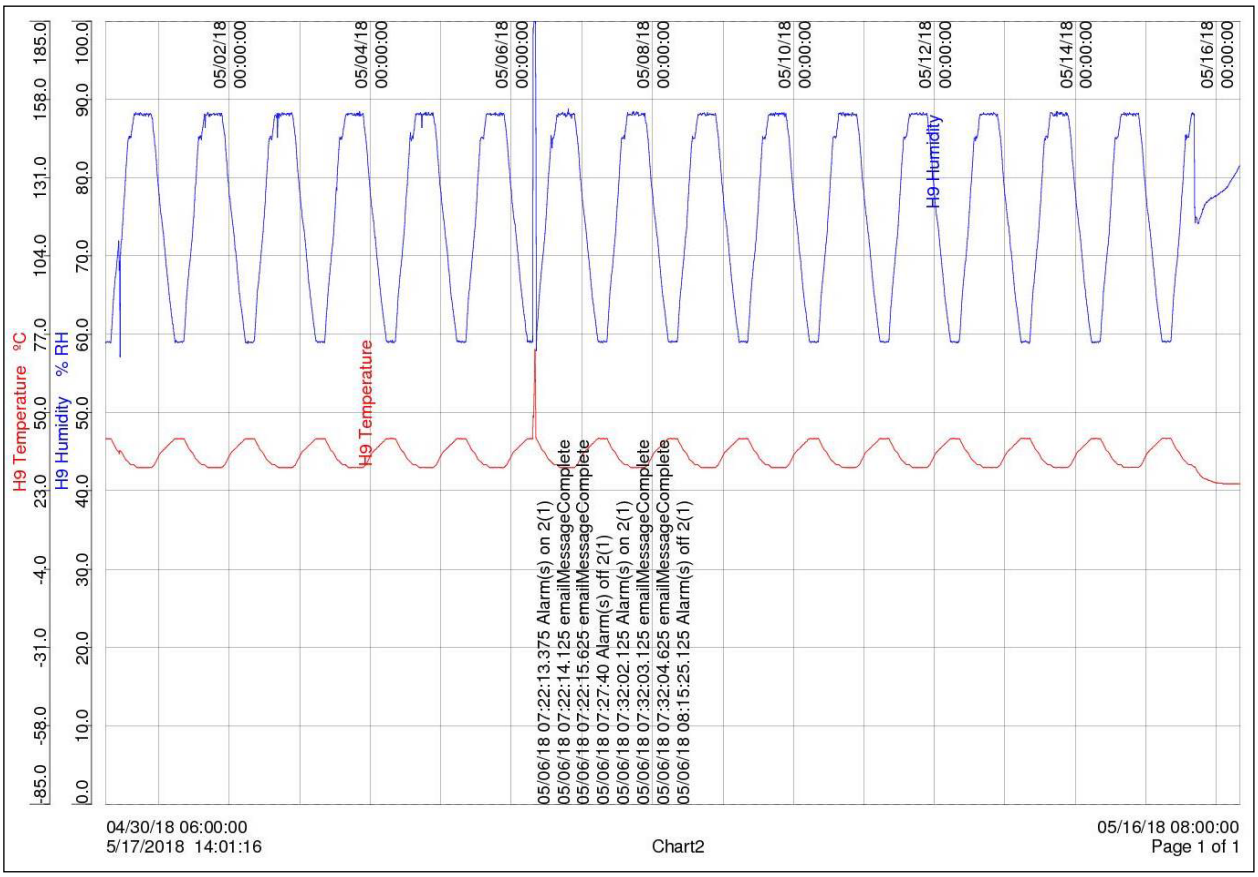



**Chart 8. Humidity, Test Results**

**Photograph 9. Humidity, Test Setup**

# X. METHOD 509.5 SALT FOG

## Salt Fog (MIL-STD-810G, Method 509.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance during or after it has been exposed to the environment described in MIL-STD-810G, Method 509.5.

**Test Procedure:**

**A.** A functional test of the EUT was performed.

**B.** A 5 +/- 1% (by weight) non-iodized salt solution was prepared before testing.

**C.** The pretest relative density (specific gravity) and temperate of the salt solution were checked to insure that it corresponded to the tolerance limits in of MIL-STD-810G.

**D.** A calibration run at 35°C (95°F) was performed on the test chamber to insure a fog collection of 0.5 to 3.0 milliliters per hour for each 80 square centimeters of horizontal collection area.

**E.** Any surface scratches or nicks on the EUT were noted.

**F.** After the calibration was verified, the EUT was placed in the salt fog test chamber.

**G.** The EUT was allowed to soak at 35°C (95°F) for 2 hours.

**H.** The salt solution was started and continuously atomized for 48 hours.

**I.** At the conclusion of the 48 hour exposure the EUT was removed from the salt fog chamber and allowed to dry for 48 hours.

**J.** The EUT was then visually inspected for signs of corrosion or degradation and tested for functionality.

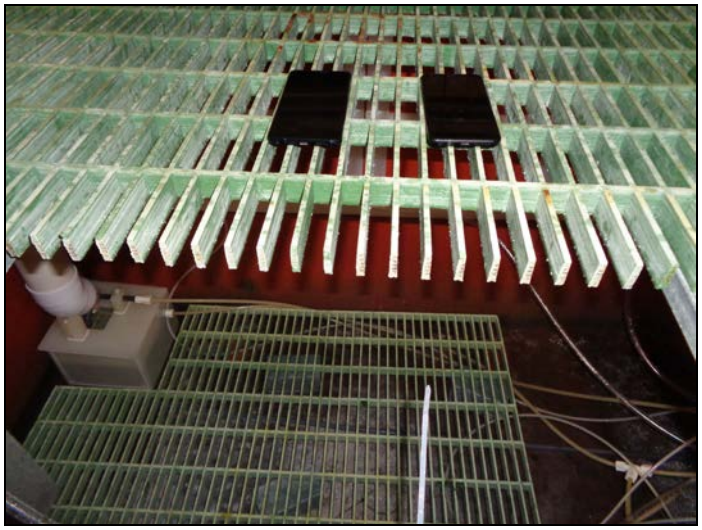
**Test Results:** The EUT was **compliant** with Salt Fog. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Dates:** May 3 – 6, 2018

| | Tower | Cylinder 1 | Cylinder 2 | Hours | Avg. Collection Rate | | Pre Test | Pre Test | Collection | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time and Date | Pressure | (mL) | (mL) | | (mL/80 cm2/hr) | | Spec. Grav. | pH @ 25C | pH @ 25C | | Spec. Grav. |
| 5/3/2018 13:00 | | Start | Start | Start | Start | | | 6.91 | | | |
| 5/4/2018 13:00 | | 27 | 22 | 24 | 1.020833333 | Compliant | | | 6.62 | Compliant | |
| | | | | | #DIV/0! | #DIV/0! | | | | N/A | |
| 5/5/18 13:00 | | | | | #DIV/0! | #DIV/0! | | | | N/A | |
| 5/6/18 13:00 | | 29 | 31 | 24 | 1.25 | Compliant | | | 6.78 | Compliant | |

**Table 1. Salt Fog, Test Results**



**Photograph 10. Salt Fog, Test Setup (1)**

**Photograph 11. Salt Fog, Test Setup (2)**

# XI. METHOD 510.5 SAND AND DUST

## Sand and Dust, Procedure I, Blowing Dust (MIL-STD-810G, Method 510.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance during or after it has been exposed to the environment described in MIL-STD-810G, Method 510.5, Procedure I.

**Test Procedure:**

**A.** With the EUT in the chamber, the temperature was adjusted to standard ambient conditions and the air velocity to 8.9 ± 1.3 m/s. The test section relative humidity was set to less than 30% and was maintained throughout the test.

**B.** The dust feed control was adjusted to a dust concentration of 10 ± 7 g/m3.

**C.** These conditions were maintained for 6 hours. The EUT was rotated at 1 hour intervals to allow exposure to all surfaces.

**D.** The dust feed was stopped. The air velocity was reduced to approximately 1.5 m/s and the temperature was adjusted to 43 °C.

**E.** These conditions were maintained for 1 hour following test temperature stabilization.

**F.** The air velocity was adjusted to that used in Step A. The dust feed was restarted to maintain the dust concentration as in Step B.

**G.** The exposure was continued for at least 6 hours. The EUT was rotated at 1 hour intervals to allow exposure to all surfaces.

**H.** The EUT was allowed to return to standard ambient conditions, and the dust was allowed to settle.

**I.** Accumulated dust was removed from the EUT by brushing, wiping or shaking.

**J.** An operational check was performed to the EUT.

**K.** The EUT was inspected for dust penetration, giving special attention to bearings, grease seals, lubricants, filters, ventilation points, etc.

**Test Results:** The EUT was **compliant** with Sand and Dust, Procedure I. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Dates:** May 8, 2018

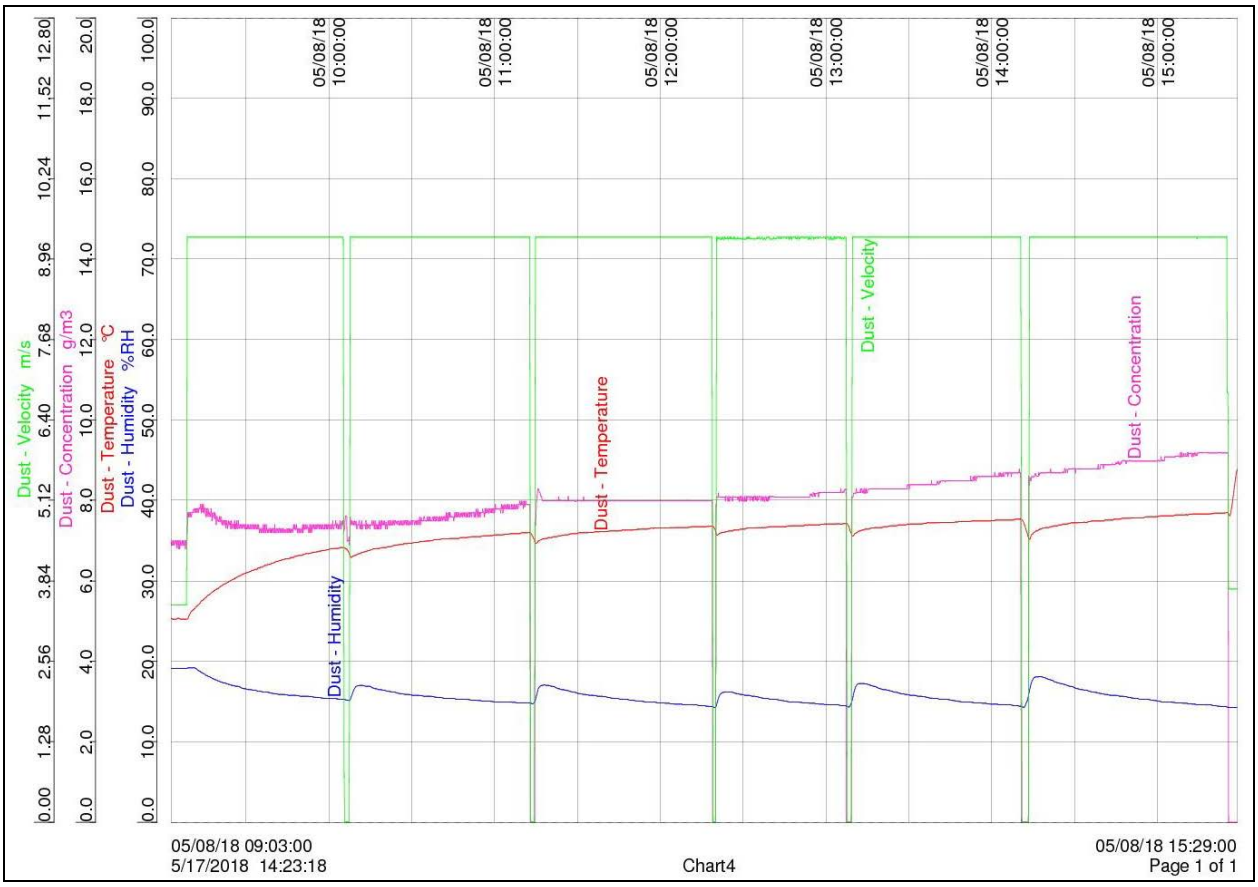



**Chart 9. Sand and Dust, Procedure I, Blowing Dust, Ambient Dust**

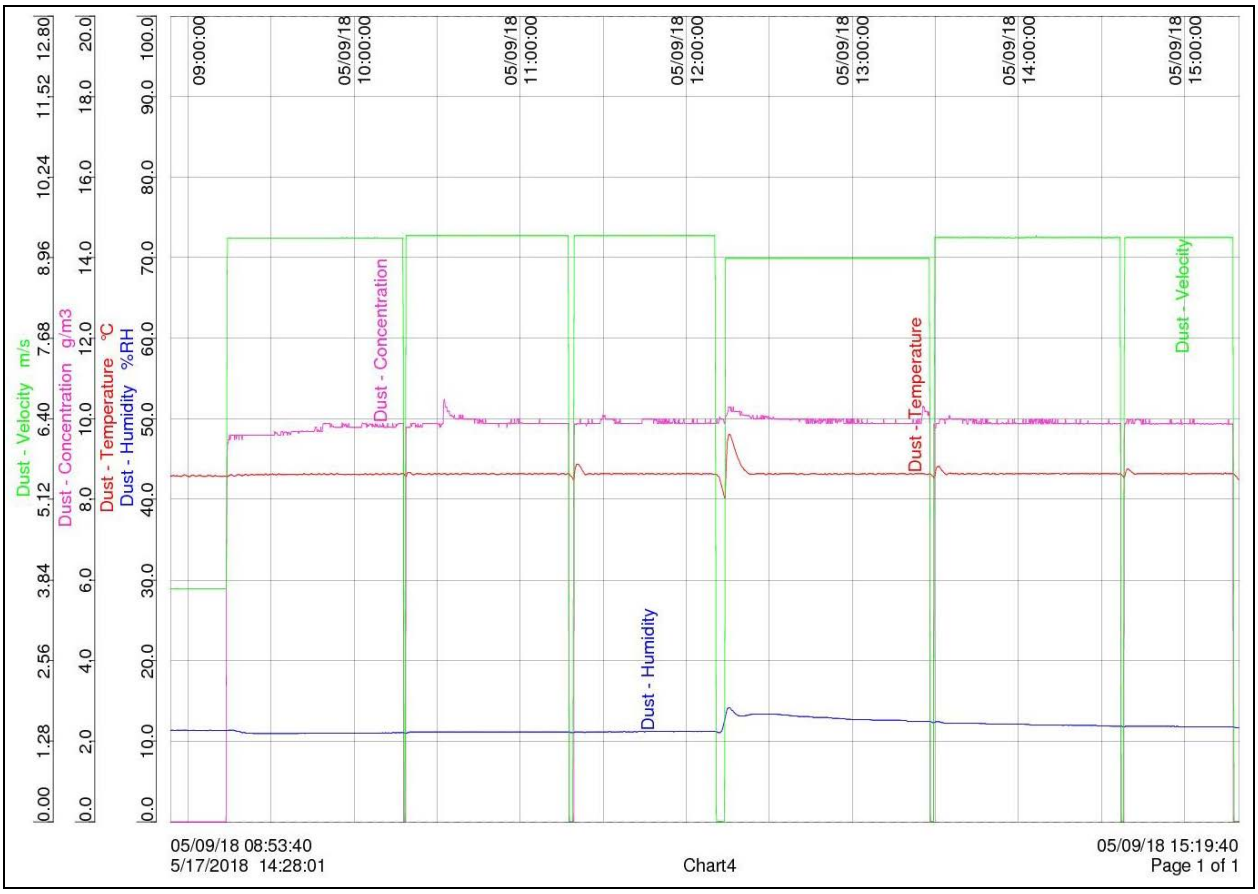



**Chart 10. Sand and Dust, Procedure I, Blowing Dust, High Dust**

**Photograph 12. Sand and Dust, Procedure I, Blowing Dust, Test Setup**

# XII. METHOD 512.5 IMMERSION

## Immersion, Procedure I, Immersion (MIL-STD-810G, Method 512.5)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance during or after it has been exposed to the environment described in MIL-STD-810G, Method 512.5, Procedure I.

**Test Procedure:**

**A.** Three times immediately before the test, all doors and covers were opened and closed.

**B.** The immersion water temperature was measured and recorded.

**C.** The EUT was conditioned and the conditioning temperature and duration was recorded.

**D.** All sealed areas and valves were closed. The EUT was assembled in its test configuration. As quickly as possible, the EUT was immersed in water so that the uppermost point of the EUT was 1 ±0.1m below the surface of the water. The orientation of the EUT represented that of its most severe expected in-service orientation.

**E.** Following a 30-minute immersion period, the EUT was removed from the water. The exterior surfaces were wiped dry.

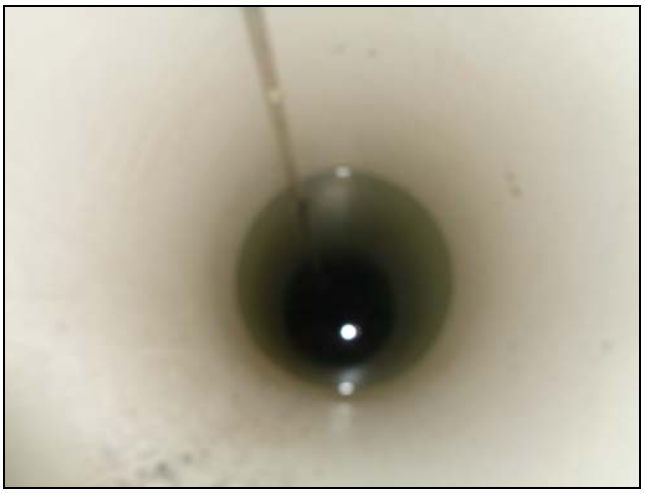
**F.** The EUT was opened and the interior was examined for evidence of and quantity of any leakage, and for probable areas of entry, if leakage occurred.

**G.** The EUT was functionally verified.

**Test Results:** The EUT was **compliant** with Immersion, Procedure I. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Date:** May 11, 2018



**Photograph 13. Immersion, Procedure I, Immersion, Test Setup**

# XIII. METHOD 514.6 VIBRATION

## Procedure I - General Vibration (MIL-STD-810G, Method 514.6)

### Category 4, Truck/Trailer/Tracked – Restrained Cargo

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance during or after it has been exposed to the environment described in the customer specifications.

**Test Procedure:**

**A.** The EUT was installed on the vibration test fixture.

**B.** An input (control) accelerometer was mounted to the base of the test fixture.

**C.** The proper operation of the EUT was verified. Unless otherwise noted the EUT was in an operational mode during testing.

**D.** The EUT was subjected to a random vibration as indicated in the **Figure 4** below for a period of 60 minutes in each of the three orthogonal axes.

**E.** Before, during, and after each axis of vibration the performance of the EUT was evaluated.

**Test Results:** The EUT was **compliant** with Vibration, Category I, General Vibration. No anomalies were observed.

**Test Engineer:** Kevin Lynn

**Test Date:** May 9, 2018

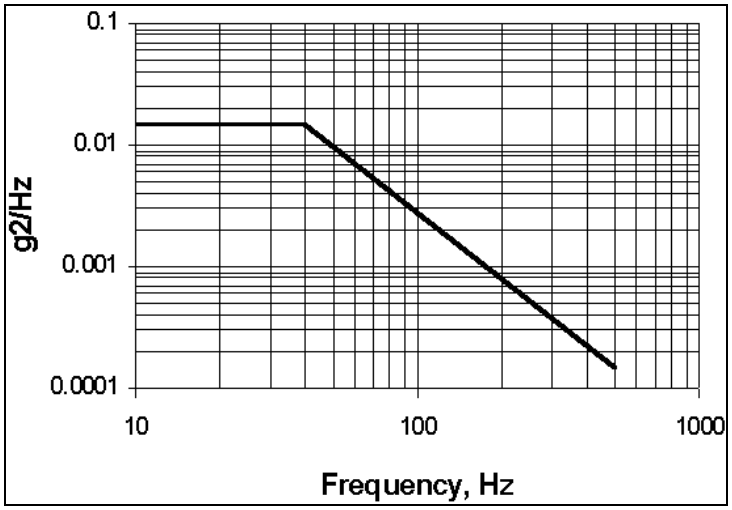



**Figure 3. Vibration Test Profile**

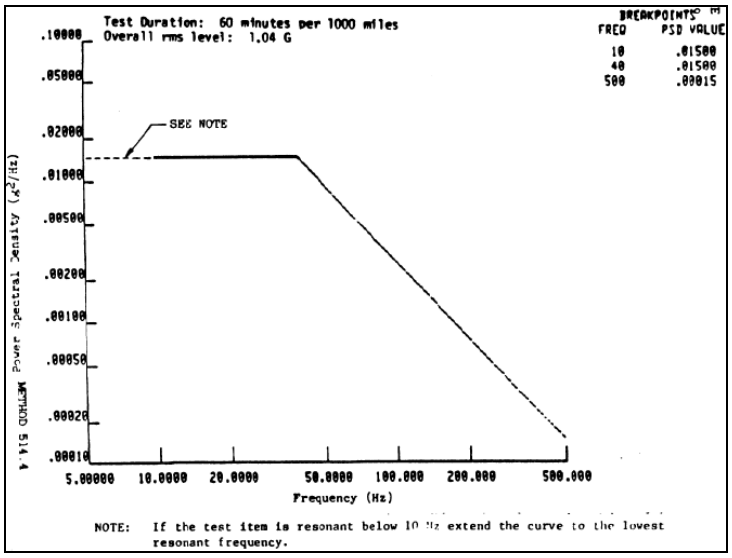



**Figure 4. Vibration Profile – Basic Transportation**

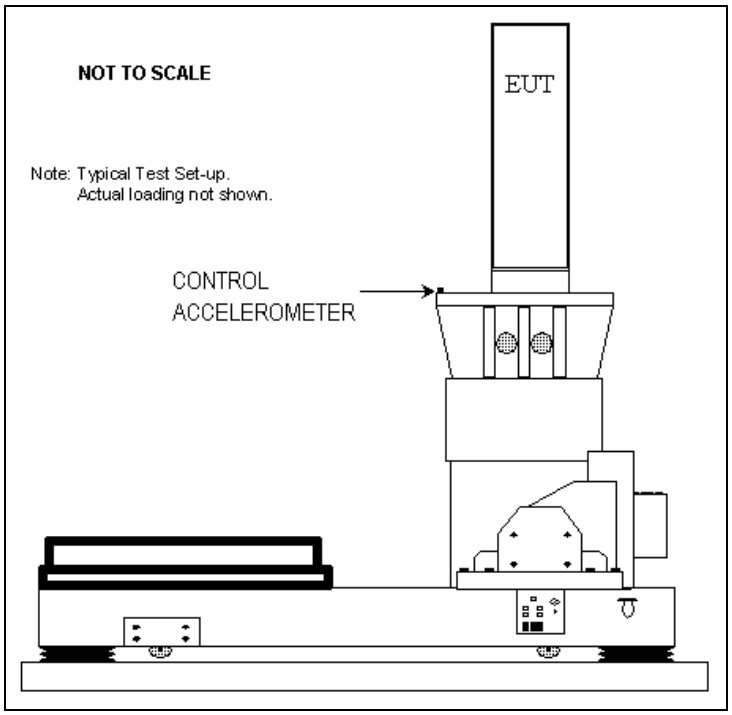



**Figure 5. Vibration Test Set-up (Vertical Axis)**

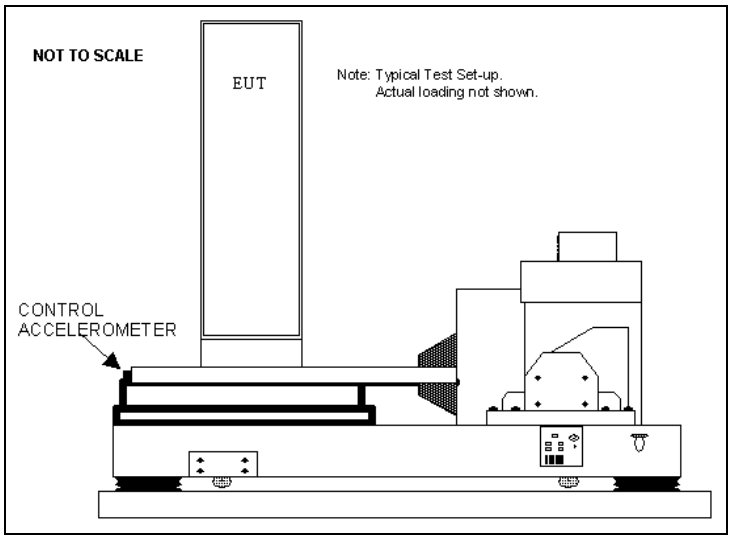



**Figure 6. Vibration Test Set-up (Longitudinal and Transverse Axes)**

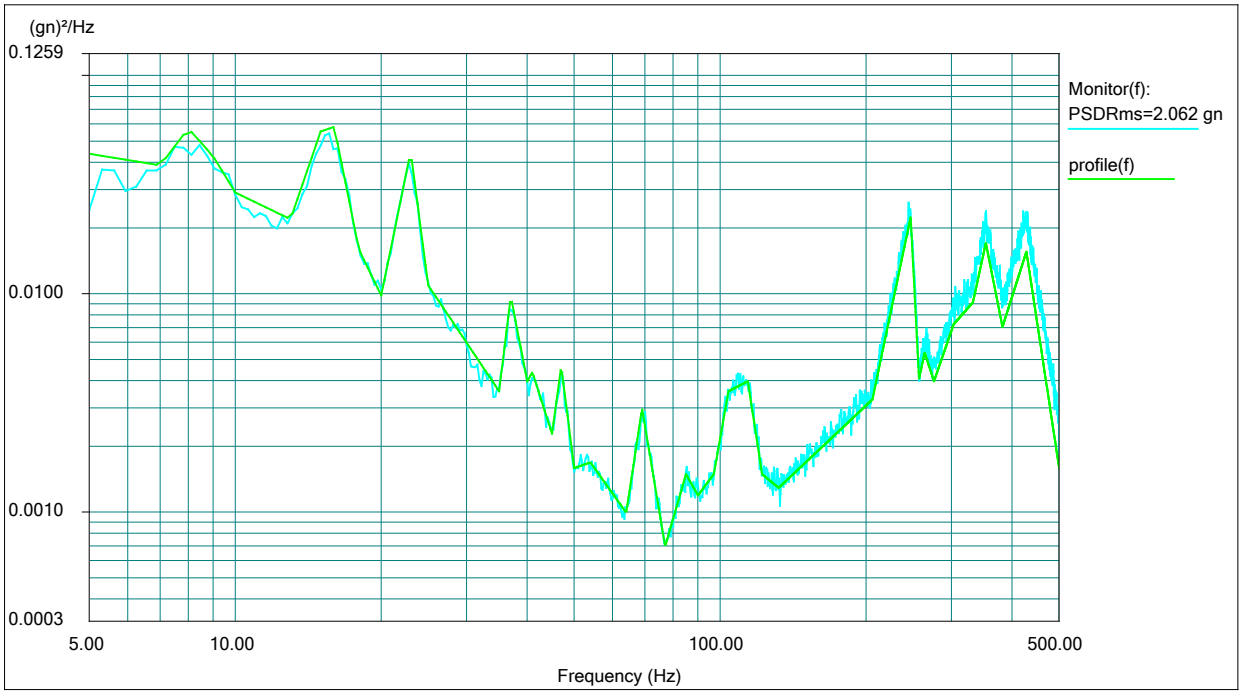



**Chart 11. Procedure I - General Vibration, Longitudinal, Monitor**

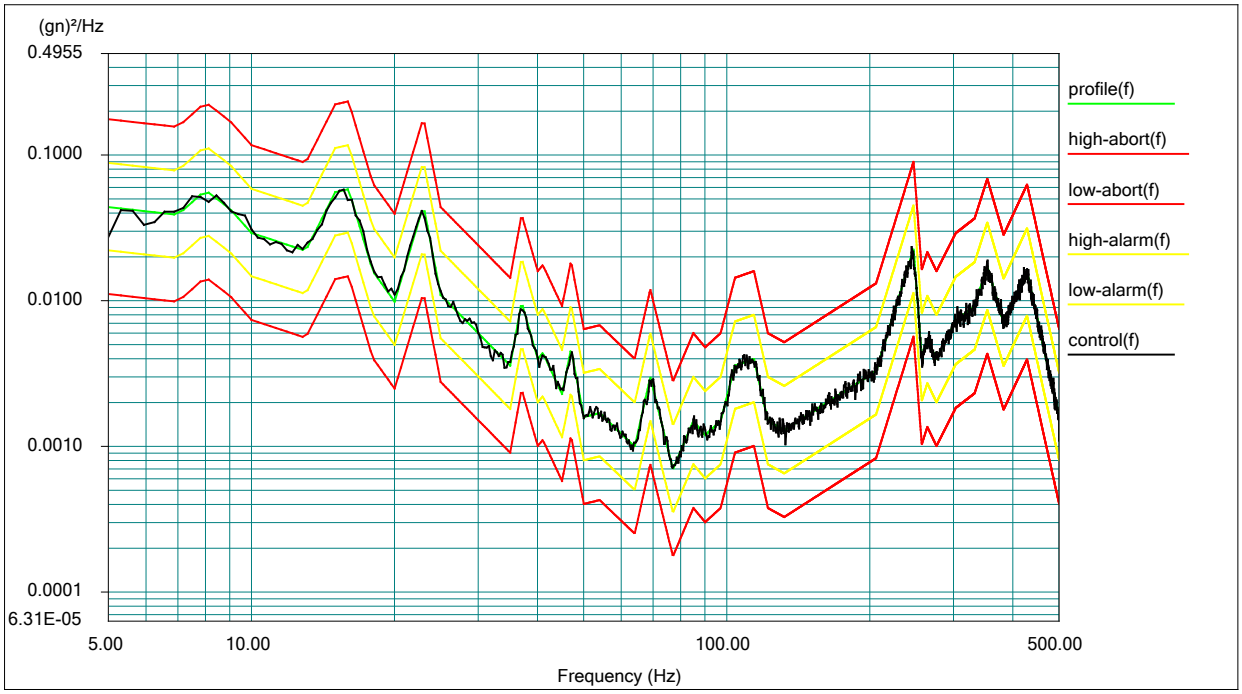



**Chart 12. Procedure I - General Vibration, Longitudinal, Profile**

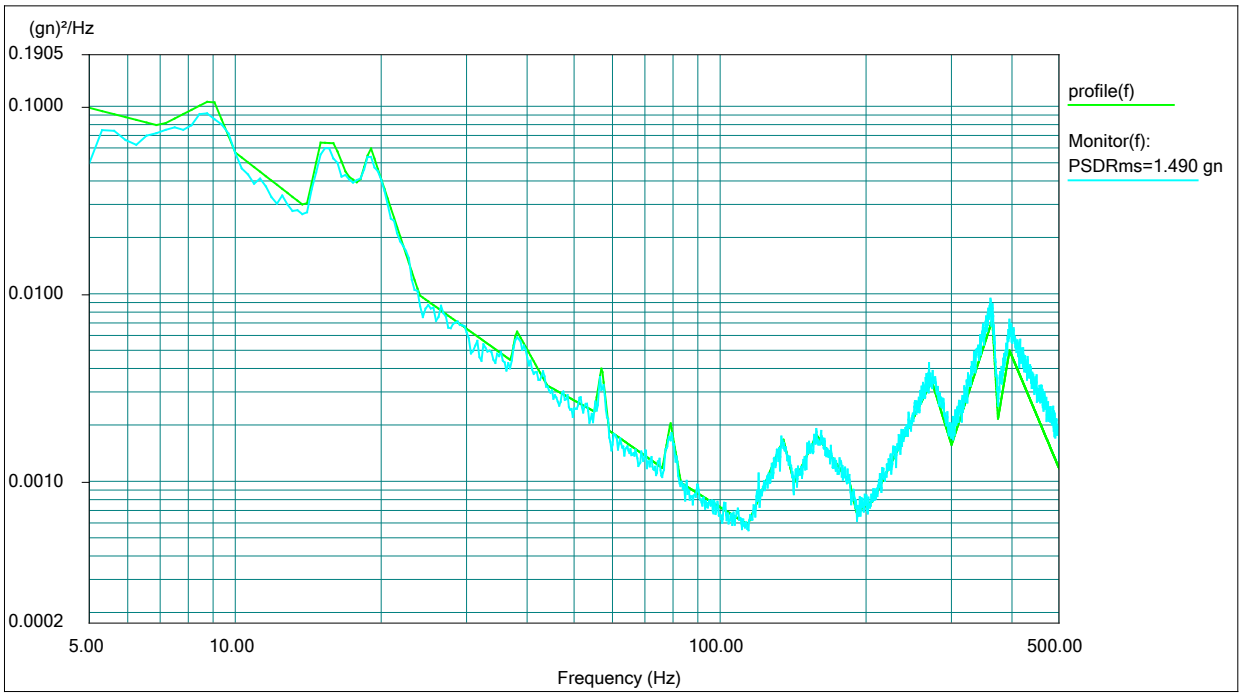



**Chart 13. Procedure I - General Vibration, Transverse, Monitor**

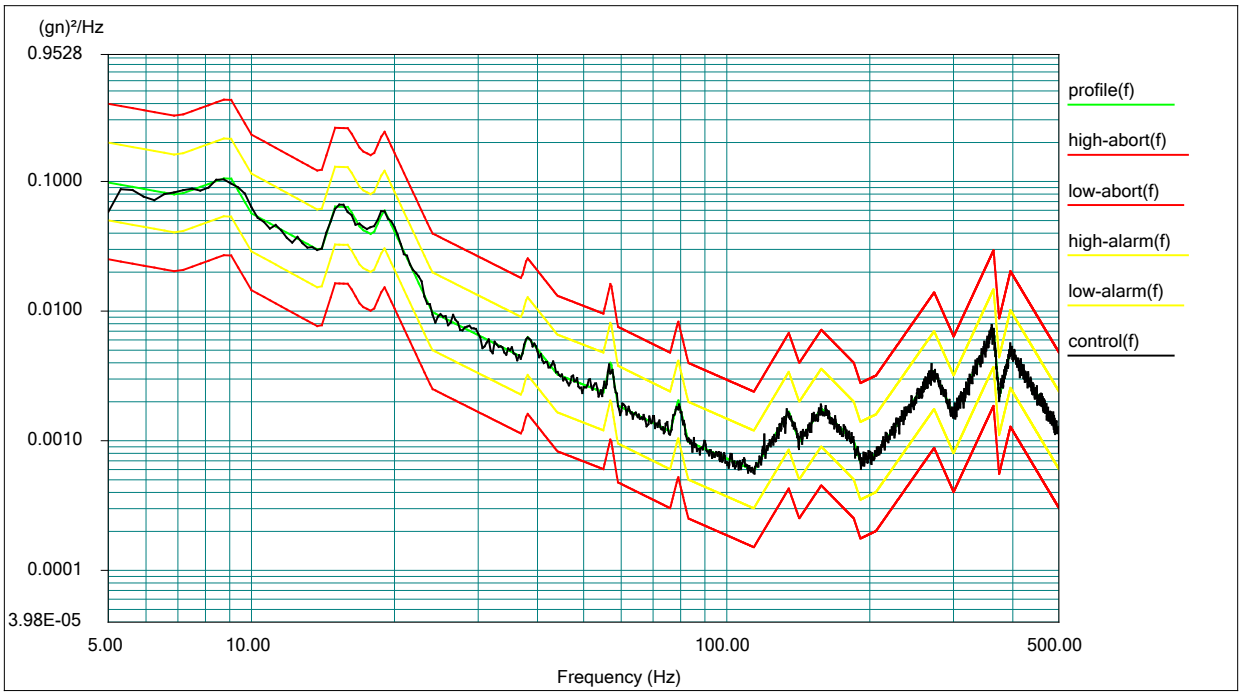



**Chart 14. Procedure I - General Vibration, Transverse, Profile**

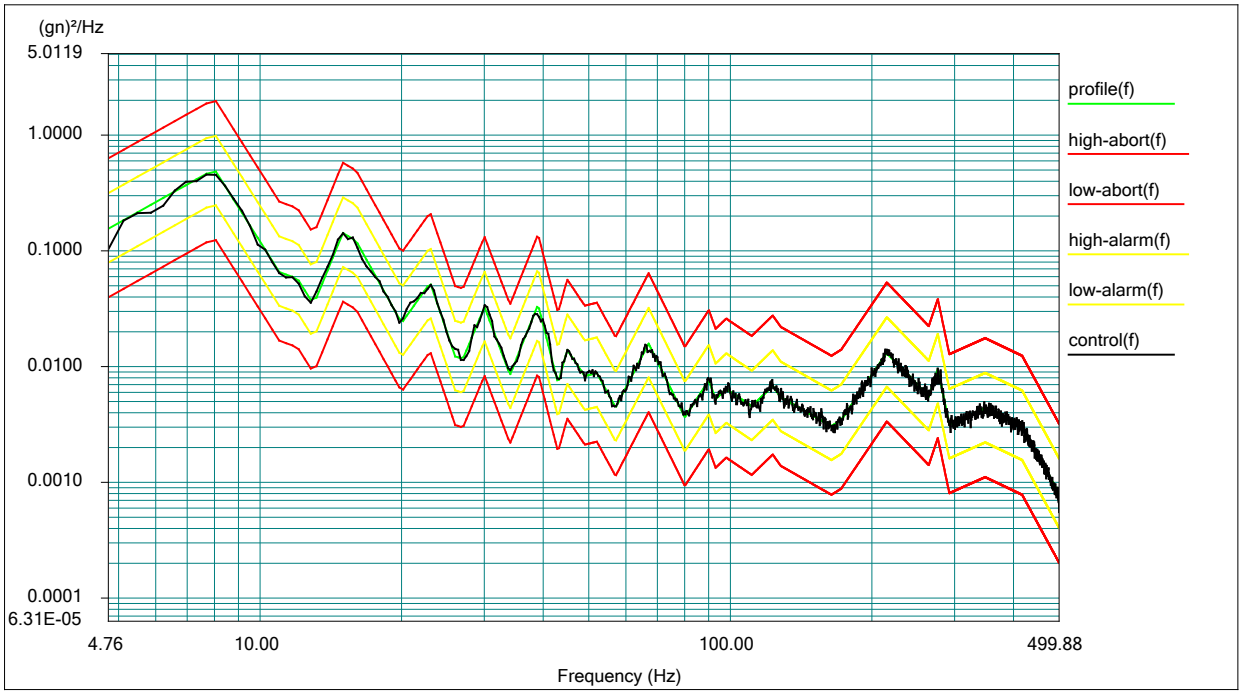



**Chart 15. Procedure I - General Vibration, Vertical, Profile**

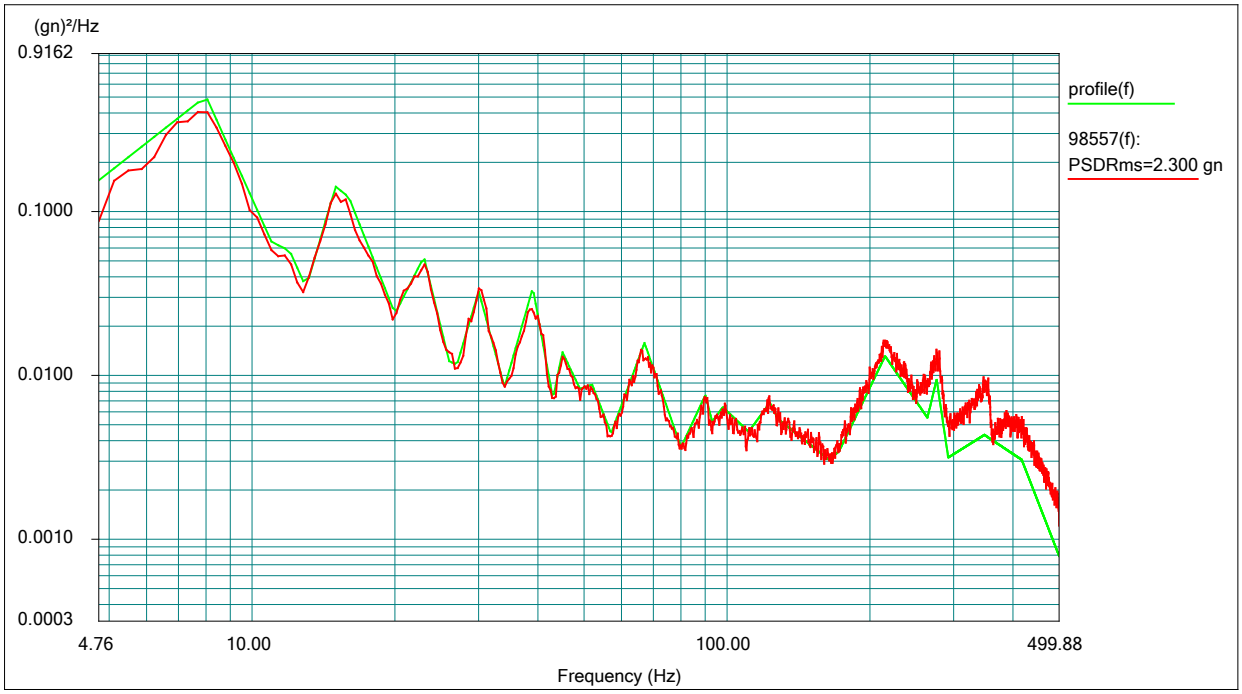
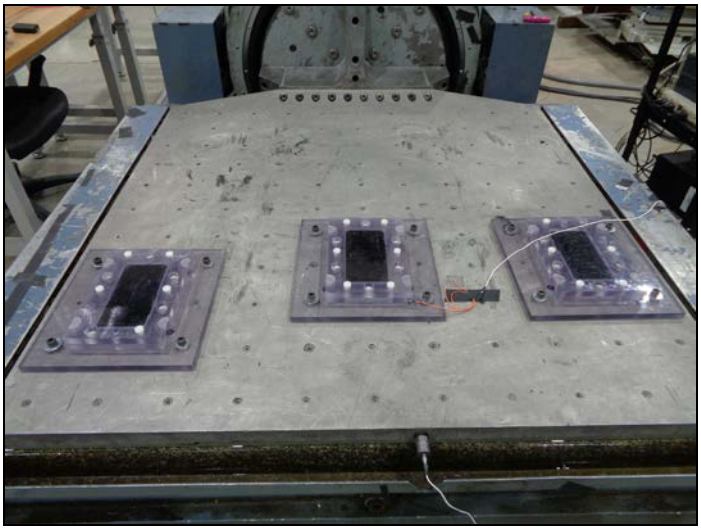
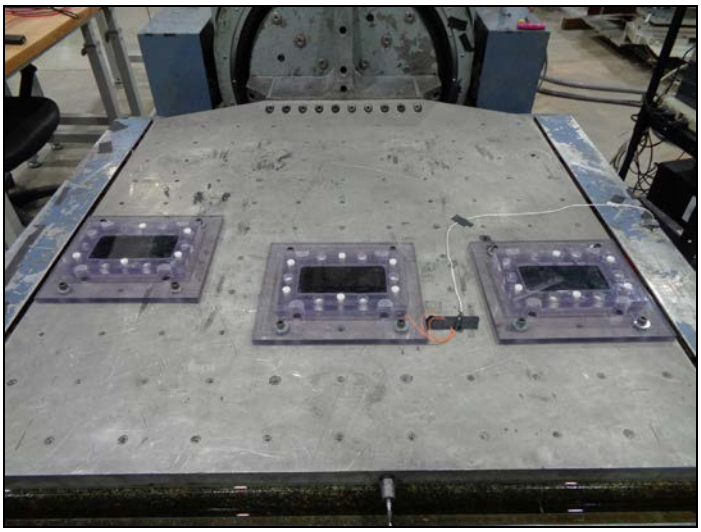



**Chart 16. Procedure I - General Vibration, Vertical, PSDRms=2.300 gn**

**Photograph 14. Procedure I - General Vibration, Test Setup (1)**



**Photograph 15. Procedure I - General Vibration, Test Setup (2)**



**Photograph 16. Procedure I - General Vibration, Test Setup (3)**

# XIV. METHOD 516.6 SHOCK

## Shock, Procedure IV – Transit Drop (MIL-STD-810G, Method 516.6)

**Test Requirement(s):** The equipment **shall not** sustain any damage or deteriorate in functional performance during or after it has been exposed to the environment described in MIL-STD-810G Method 516.6, Procedure IV.

**Test Procedure:**

**A.** The test was performed on an unpackaged EUT. The EUT was subjected to drops as per **Table 516.6-VI** (shown below)

**Table 516.6-VI. Transit drop test.**

| Weight of Test Item & Case kg (lbs) | Largest Dimension, cm (in) | Notes | Height of Drop, h cm (in) | Number of Drops |
|---|---|---|---|---|
| Under 45.4 (100 ) Manpacked or man-portable | Under 91 (36) | A/ | 122 (48) | Drop on each face, edge and corner; total of 26 drops D/ |
| | 91 & over | A/ | 76 (30) | |
| 45.4 - 90.8 (100 – 200 ) inclusive | Under 91 | A/ | 76 (30) | Drop on each corner; total of eight drops |
| | 91 & over | A/ | 61 (24) | |
| 90.8-454 (200 – 1000 ) inclusive | Under 91 | A/ | 61 (24) | |
| | 91 – 152 (36 – 60) | B/ | 61 (24) | |
| | Over 152 | B/ | 61 (24) | |
| Over 454 | No limit | C/ | 46 (18) | Drop on each bottom edge. Drop on bottom face or skids; total of five drops |

**B.** The test was performed on a 2-inch wood floor.

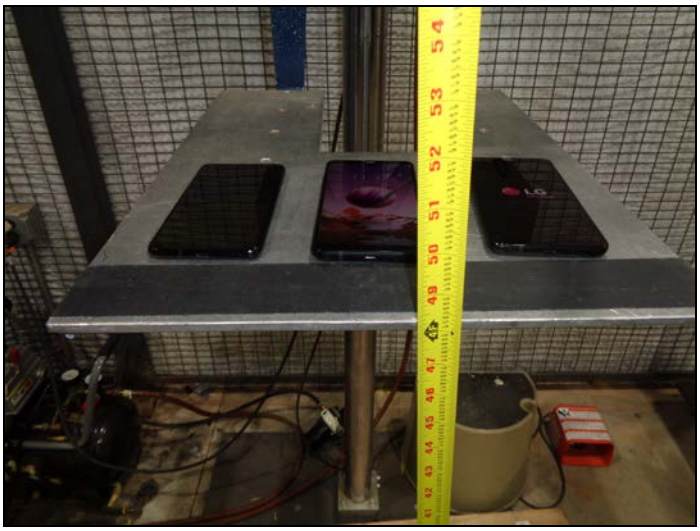
**C.** The EUT was dropped from a quick release and hand held method.

**D.** The drops were divided between 5 units.

**Test Results** The EUT was compliant with the requirements of MIL-STD-810G, Method 516.6, Procedure IV – Transit Drop.

**Test Engineer:** Kevin Lynn

**Test Date:** May 9, 2018



**Photograph 17. Shock, Procedure IV – Transit Drop, Test Setup**

# XV. Test Equipment

| Test Name: Low Pressure (Altitude) | | | | Test Date: May 4, 2018 | |
|---|---|---|---|---|---|
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T8147 | ALTITUDE/TEMP/ RH CHAMBER | TENNEY | WI-STR-60100 | 03-MAY-17 | 03-MAY-18 |
| **Test Name: High Temperature** | | | | **Test Dates: April 30 – May 1, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T5566 | TEMP/RH CHAMBER (H3) | THERMOTRON | SM-32C | 21-JUN-17 | 21-JUN-18 |
| **Test Name: Low Temperature** | | | | **Test Dates: May 1 -2, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T5915 | TEMPERATURE CHAMBER/ ALARM/ CONTROLLER | ENVIROTRONICS | F-70-2-30/ TEMP SENTRY 0120011/ SYSTEMS PLUS 386 | 28-MAR-18 | 28-MAR-19 |
| **Test Name: Temperature Shock** | | | | **Test Dates: May 2 – 3, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T5654 | 3-ZONE TEMP. SHOCK CHAMBER (T6) | THERMOTRON | ATS 1040-DD30-25LNZ | 31-OCT-17 | 31-OCT-18 |
| **Test Name: Solar Radiation (Sunshine)** | | | | **Test Dates: May 8 – 12, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T8021 | DATA ACQUISITION/SWITCH UNIT | AGILENT TECHNOLOGIES | 34970A | 21-NOV-17 | 21-MAY-19 |
| 2T5902 | 20 CHANNEL MULTIPLEXER | AGILENT TECHNOLOGIES | 34901A | 25-MAR-17 | 25-SEP-18 |
| 2T8269 | PYRANOMETER | KIPP & ZONEN | CMP6 | 20-JUN-17 | 20-JUN-18 |
| **Test Name: Rain** | | | | **Test Date: May 3, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T8295 | 3-CHANNEL ALARM TIMER | CONTROL COMPANY | 06-662-5 | 28-NOV-16 | 28-NOV-18 |
| **Test Name: Humidity** | | | | **Test Dates: May 2 – 16, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T5923 | TEMP/RH CHAMBER (H9) | THERMOTRON/ THERMOTRON/ VAISALA | SM-8/ 2800/ HMM30C | 06-MAR-18 | 06-MAR-19 |
| **Test Name: Salt Fog** | | | | **Test Dates: May 3 – 6, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T5925 | CORROSION TEST CHAMBER | SINGLETON CORPORATION | SCCH23 | 08-FEB-18 | 08-FEB-19 |
| **Test Name: Sand and Dust** | | | | **Test Date: May 8, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T8055 | BLOWING DUST CHAMBER | ED&D PRODUCT SAFETY SOLUTIONS | DTC-MIL-09 | 15-FEB-17 | 15-FEB-19 |
| **Test Name: Immersion** | | | | **Test Date: May 11, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T8295 | 3-CHANNEL ALARM TIMER | CONTROL COMPANY | 06-662-5 | 28-NOV-16 | 28-NOV-18 |
| **Test Name: Vibration Contents** | | | | **Test Date: May 9, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T9600 | LDS V9 SHAKER | LDS | V9 | FUNC VERIFY | |
| 2T9572 | 4 CHANNEL VIEW VIBRATION CONTROLLER | VIBRATION RESEARCH CORPORATION | VR9500 | 26-SEP-17 | 26-SEP-18 |
| 2T8235 | ACCELEROMETER (VOLTAGE MODE) | DYTRAN INSTRUMENTS | 3225F2 | 16-FEB-18 | 16-FEB-19 |
| 2T8290 | ACCELEROMETER | PCB PIEZOTRONICS | J353B32 | 01-AUG-17 | 01-AUG-18 |
| **Test Name: Shock** | | | | **Test Date: May 9, 2018** | |
| **MET #** | **Equipment** | **Manufacturer** | **Model #** | **Last Cal** | **Cal Due** |
| 2T8179 | PDT DROP TEST SYSTEM | LANSMONT CORPORATION | PDT-56ED | FUNC VERIFY | |

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.