

National Technical Systems Test Report for Environmental Testing of the EMS 4.4

Prepared For

Pro V&V, Inc. | 6705 Odyssey Dr NW Ste C | Huntsville, AL 35806

Prepared By

National Technical Systems | 1601 Dry Creek Drive #2000 | Longmont, CO. 80503 | (303) 776-7249 | www.nts.com

A handwritten signature in black ink, appearing to read "Greg Gagne".

Greg Gagne
Technical Writer

A handwritten signature in black ink, appearing to read "Robert Polverari".

Robert Polverari
ENV Department Manager



This report and the information contained herein represent the results of testing articles/products identified and selected by the client. The tests were performed to specifications and/or procedures approved by the client. National Technical Systems (NTS) makes no representations expressed or implied that such testing fully demonstrates efficiency, performance, reliability, or any other characteristic of the articles being tested, or similar products. This report should not be relied upon as an endorsement or certification by NTS of the equipment tested, nor does it represent any statement whatsoever as to its merchantability or fitness of the test article or similar products for a particular purpose. This document shall not be reproduced except in full without written approval from NTS.



Revision History

Rev.	Description	Issue Date
0	TR-PR108417-00	12/20/2019

Table of Contents

1.0	Introduction	5
2.0	References	5
3.0	Product Selection and Description	5
3.1	Security Classification	5
4.0	General Test Requirements	5
4.1	Test Equipment	5
4.2	Notice of Deviation	5
5.0	Test Descriptions and Results.....	5
5.1	Humidity.....	7
5.1.1	Test Result.....	7
5.1.2	Test Procedure.....	7
5.1.3	Test Datasheets.....	7
5.1.4	Test Photographs	8
5.1.5	Test Data	9
5.1.6	Test Equipment List	12
5.2	Low Temperature	13
5.2.1	Test Result.....	13
5.2.2	Test Procedure.....	13
5.2.3	Test Datasheets.....	13
5.2.4	Test Photographs	14
5.2.5	Test Data	15
5.2.6	Test Equipment List	16
5.3	High Temperature.....	17
5.3.1	Test Result.....	17
5.3.2	Test Procedure.....	17
5.3.3	Test Datasheets.....	17
5.3.4	Test Photographs	18
5.3.5	Test Data	19
5.3.6	Test Equipment List	20
5.4	Bench Handling	21
5.4.1	Test Result.....	21
5.4.2	Test Datasheets.....	21
5.4.3	Test Photographs	21
5.4.4	Test Equipment List	22
5.5	Transportation Vibration	23
5.5.1	Test Result.....	23
5.5.2	Test Procedure.....	23
5.5.3	Test Datasheets.....	23
5.5.4	Test Photographs	24
5.5.5	Test Data	25
5.5.6	Test Equipment List	28
5.6	Temperature/Power Variation	29
5.6.1	Test Result.....	29
5.6.2	Test Procedure.....	29
5.6.3	Test Datasheets.....	29
5.6.4	Test Photographs	30
5.6.5	Test Data	31
5.6.6	Test Equipment List	32



List of Tables

Table 3.0-1: Product Identification - Equipment Under Test (EUT).....	5
Table 5.0-1: Summary of Test Information & Results	5
Table 5.0-2: System Components	6
Table 5.1-1: Humidity Test Equipment List	12
Table 5.2-1: Low Temperature Test Equipment List.....	16
Table 5.3-1: High Temperature Test Equipment List	20
Table 5.4-1: Bench Handling Test Equipment List	22
Table 5.5-1: Transportation Vibration Test Equipment List.....	28
Table 5.6-1: Temperature/Power Variation Test Equipment List.....	32

1.0 Introduction

This document presents the test procedures used and the results obtained during the performance of an Environmental test program. The test program was conducted to assess the ability of the specified Equipment Under Test (EUT) to successfully satisfy the requirements listed in Section 2.0.

2.0 References

The following references listed below form a part of this document to the extent specified herein.

- Pro V&V, Inc. Purchase Order(s) 2019-013, dated 10/30/2019
- National Technical Systems (NTS) Quote(s) , dated
- NTS Corporate Quality Policy Manual, Revision 9, dated 9/20/2018
- ISO/IEC 17025:2017(E) *General Requirements for the Competence of Testing and Calibration Laboratories*, dated 11/1/2017
- Test Specification: MIL STD 810

3.0 Product Selection and Description

Pro V&V, Inc. selected and provided the test sample(s) to be used as the Equipment Under Test. Details below:

Table 3.0-1: Product Identification - Equipment Under Test (EUT)

Item	Qty.	Name/Description	Part Number	Serial Number
1	1	EMS 4.4	Infinity Panel (Rev E)	14010

3.1 Security Classification

Non-classified

4.0 General Test Requirements

4.1 Test Equipment

NTS-provided equipment is calibrated according to ISO/IEC 17025:2017(E) and calibration is traceable to the National Institute of Standards and Technology (NIST). Calibration records are maintained on file at NTS.

4.2 Notice of Deviation

In accordance with NTS' quality procedures, when the EUT is observed to exceed or display susceptibility, a Notice of Deviation (NOD) document is generated by the technician performing the test. This NOD documents the requirement, how the EUT deviated from the requirement, and allows room for resolution of the deviation.

This document is reviewed and approved by the NTS Program Manager or Engineer and the NTS Quality Assurance Representative, and then forwarded to the customer contact. Once mitigated (or passed over), the steps taken to correct the deviation (or simply instruction from the customer to continue testing) are recorded in the NOD and a copy of the NOD is integrated into the body of the report, in the appropriate location.

5.0 Test Descriptions and Results

Table 5.0-1: Summary of Test Information & Results

Section	Test	Specification	Test Facility	Test Date	Part #	Serial #	Test Result
5.1	Humidity	MIL STD 810	Longmont	11/11/2019 - 11/22/2019	Infinity Panel (Rev E)	14010	N/A
5.2	Low Temperature	MIL STD 810	Longmont	12/02/2019 - 12/03/2019	Infinity Panel (Rev E)	14010	N/A
5.3	High Temperature	MIL STD 810	Longmont	12/03/2019 - 12/04/2019	Infinity Panel (Rev E)	14010	N/A
5.4	Bench Handling	MIL STD 810	Longmont	12/04/2019 - 12/04/2019	Infinity Panel (Rev E)	14010	N/A
5.5	Transportation Vibration	MIL STD 810	Longmont	12/05/2019 - 12/05/2019	Infinity Panel (Rev E)	14010	N/A
5.6	Temperature/Power Variation	MIL STD 810	Longmont	12/09/2019 - 12/12/2019	Infinity Panel (Rev E)	14010	N/A

Table 5.0-2: System Components

EMS Ver. 4.4 System Components			
Qty	Part Name	Part Number	Serial Number
1	Infinity Panel (Rev D)	N/A	11183
1	Infinity Panel (Rev D)	N/A	11755
1	Infinity Panel (Rev E)	N/A	14009
1	Infinity Panel (Rev E)	N/A	14010
1	VVPAT	N/A	001011
1	VVPAT	N/A	001100
1	VVPAT	N/A	001082
1	VVPAT	N/A	001073
1	DoubleTalk & Headphone	N/A	MVT-DT-001
1	DoubleTalk & Headphone	N/A	MVT-DT-002
1	DoubleTalk & Headphone	N/A	MVT-DT-003
1	DoubleTalk & Headphone	N/A	MVT-DT-004
1	Minuteman EP1000 LCD	N/A	AK11190890004
1	Minuteman EP1000 LCD	N/A	AK11190890013
1	APC BN1100M2	N/A	3B1925X63177
1	APC BN1100M2	N/A	3B1925X63227
1	Tripp Lite TRAVELCUBE	N/A	MVT-TC-002
1	Tripp Lite TRAVELCUBE	N/A	MVT-TC-004
1	Tripp Lite TRAVELCUBE	N/A	MVT-TC-005
1	Tripp Lite TRAVELCUBE	N/A	MVT-TC-006



5.1 Humidity

5.1.1 Test Result

N/A

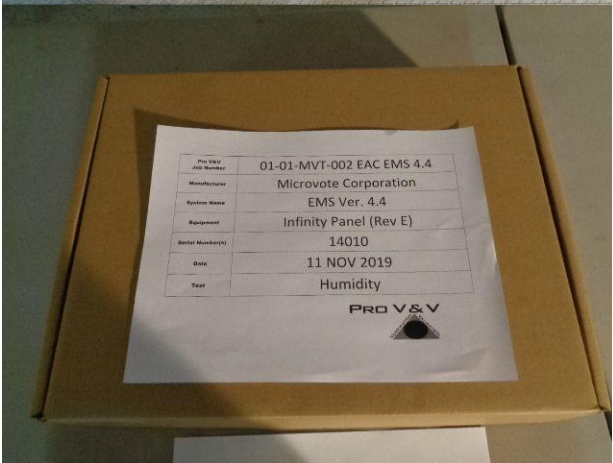
5.1.2 Test Procedure

See below.

5.1.3 Test Datasheets

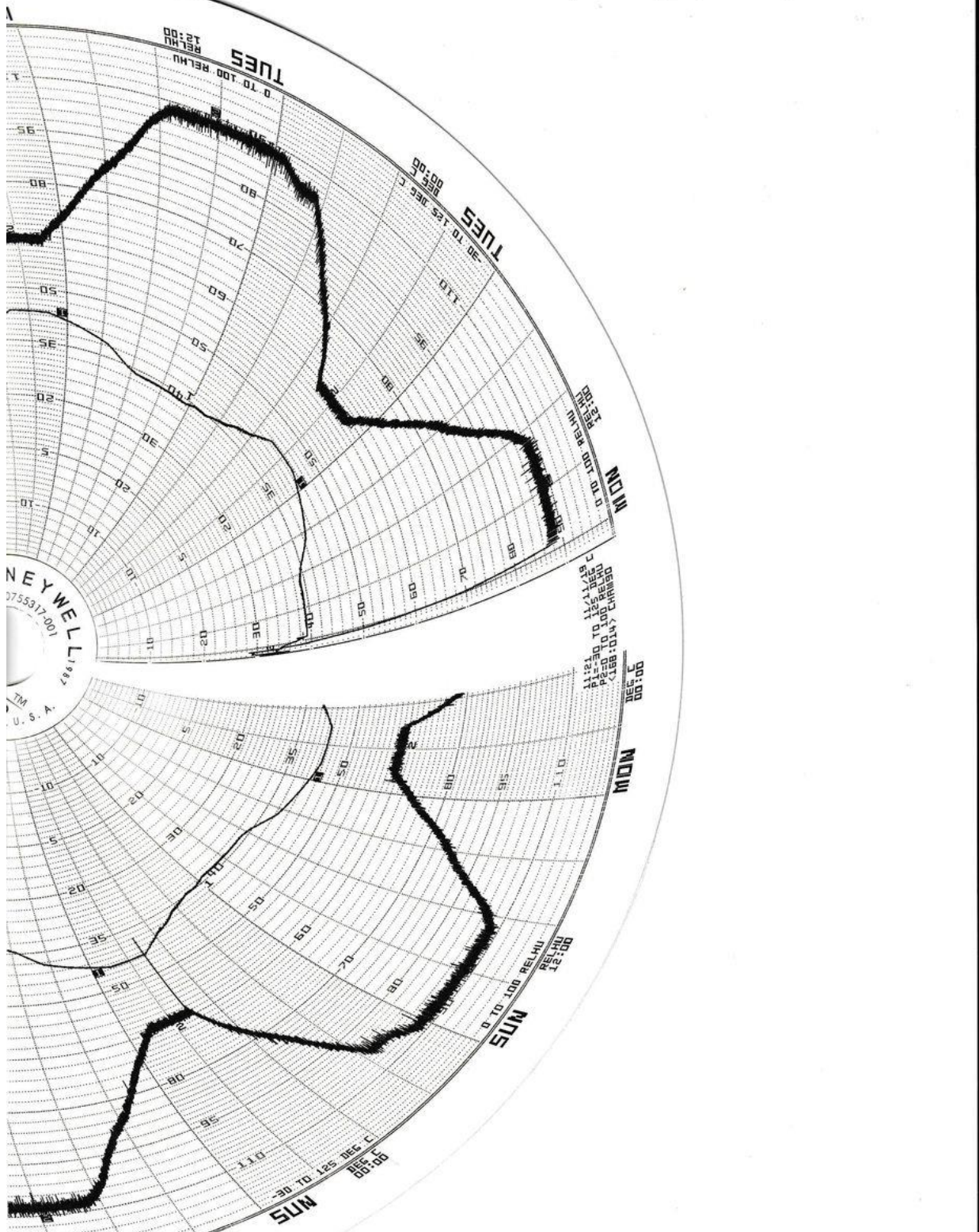
Start Date: 11/11/19		End Date: 11/22/19	MJO No: PR108417-00
Customer: Pro V&V		Test Performed: 10 Day Temperature/Humidity Test	Test By: KM
Part Name: Infinity Panel (Rev E)		Serial No & Name: 14010 , EMS Ver 4.4	Customer Witness: N/A
Page 1 of 1		Test Specification: MIL-STD_810D	Temp: +31c to +41c Humidity: 59% RH to 88% RH
Date	Time	Remarks	Initials
11/11/19	10:30	Customer performed pre-test functional test on UUT	KM
11/11/19	11:15	Install UUT in chamber	KM
11/11/19	11:30	Start test profile mil-810 hot hum 10 day test	KM
11/21/19	13:15	Test has completed mil-810 hot hum 10 day test	KM
11/21/19	13:25	Chamber at +23c ambient	KM
11/21/19	13:30	Open chambers doors	KM
11/22/19	12:30	Customer inspected UUT and performed post-test functional test on UUT	KM
11/22/19	13:30	Test complete	KM
		Note: All test pass or fail determinations decided by Pro V&V Inc.	

5.1.4 Test Photographs

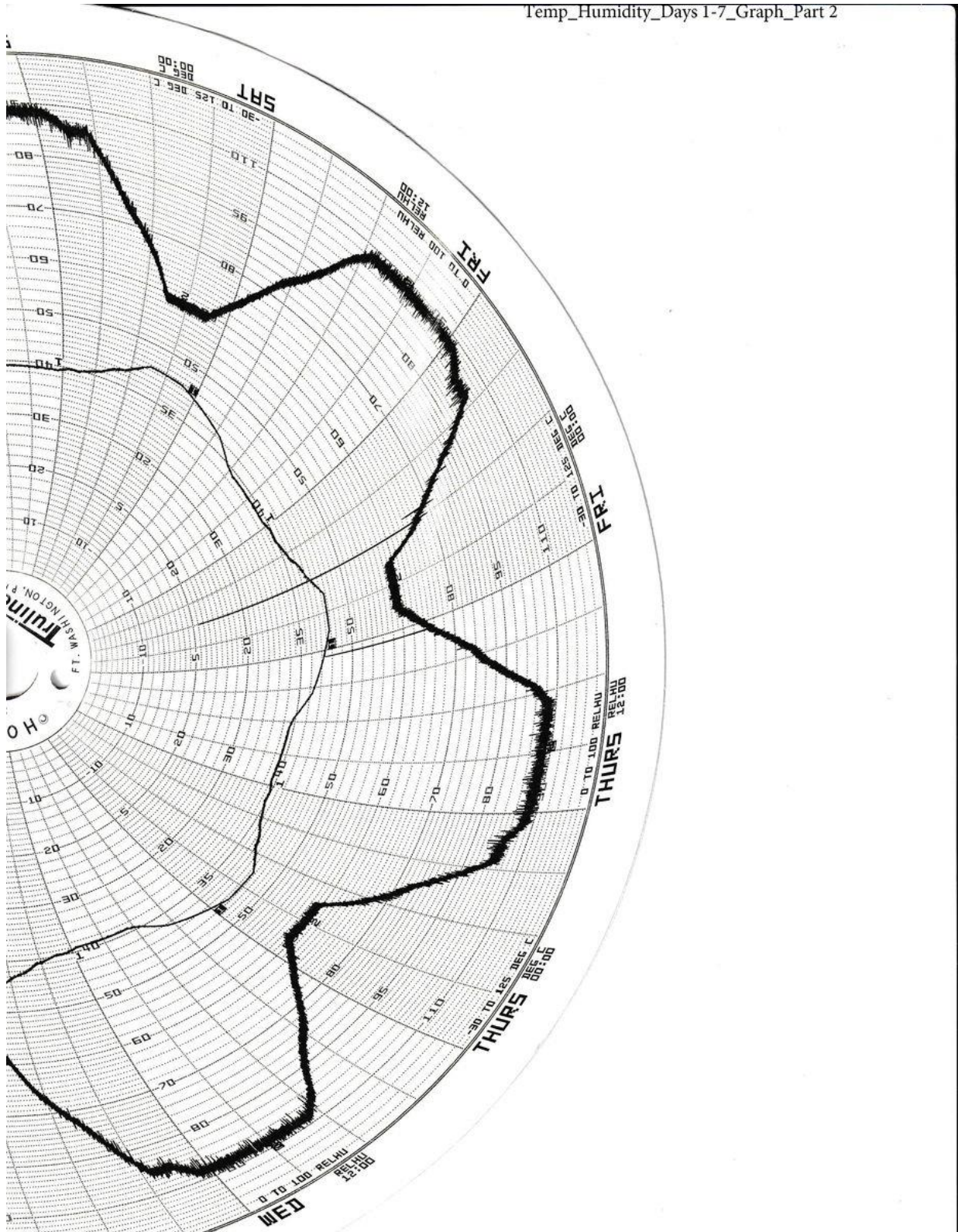


5.1.5 Test Data

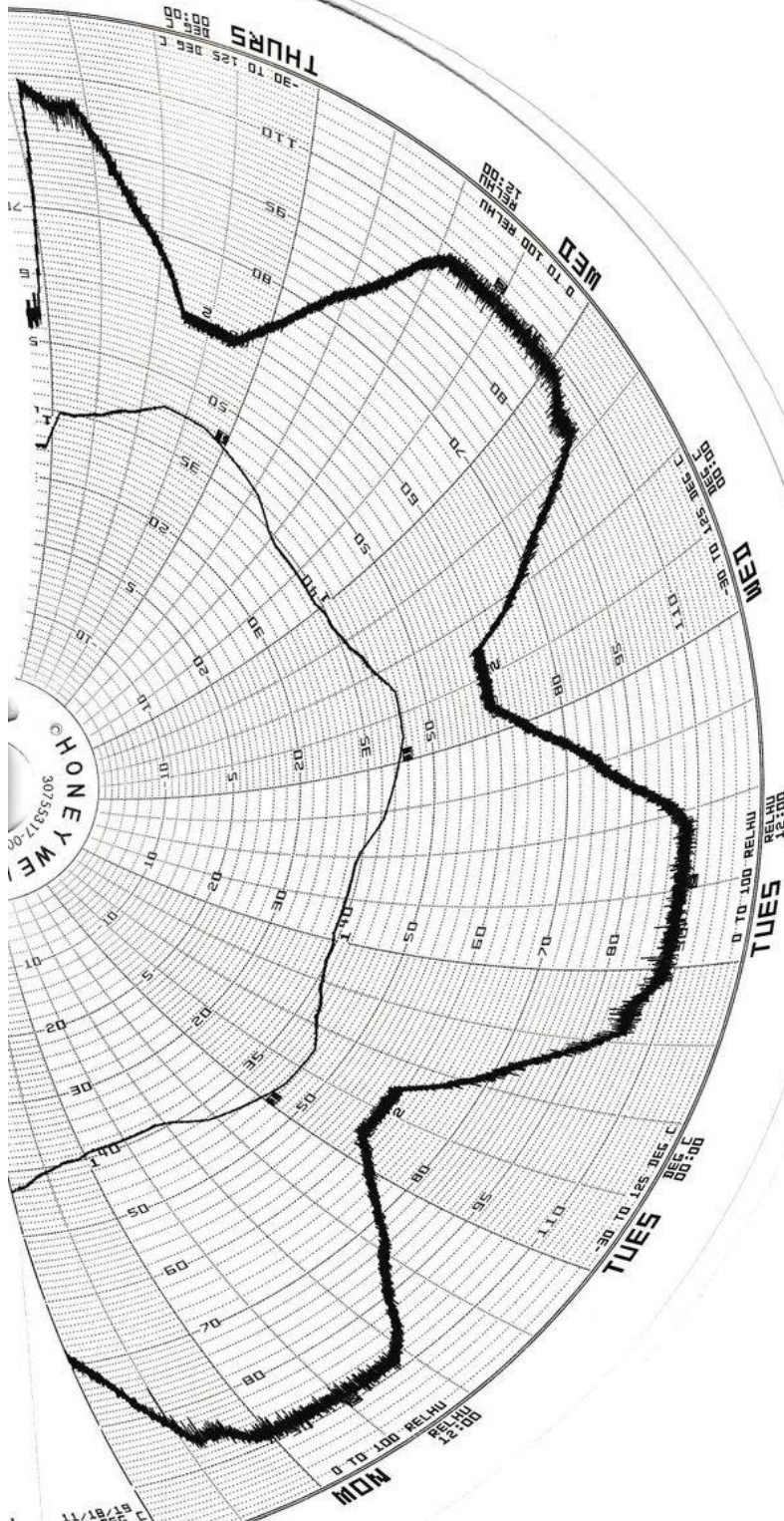
Temp_Humidity_Days 1-7_Graph_Part 1



Temp_Humidity_Days 1-7_Graph_Part 2



Temp_Humidity_Days 7-10_Graph





5.1.6 Test Equipment List

Table 5.1-1: Humidity Test Equipment List

Asset Number	Manufacturer	Description	M/N	S/N	Range	Start Date	End Date	Last Calibration	Cal Interval (Months)	Cal Due	Notes
WC061556	American Cooler Technologies	Walk-In temp/humidity chamber, CH 90	N/A	23-9349		11/11/2019	11/21/2019	09/18/2019	12	09/18/2020	
WC061557	Watlow	TEMPERATURE CONTROLLER	F4	'005179	Multi / Mfg	11/11/2019	11/21/2019	09/18/2019	12	09/18/2020	
WC061558	Honeywell	CHART RECORDER	DR4500	9836Y8 380203 00006	Multi / Mfg	11/11/2019	11/21/2019	09/18/2019	12	09/18/2020	

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Re



5.2 Low Temperature

5.2.1 Test Result

N/A

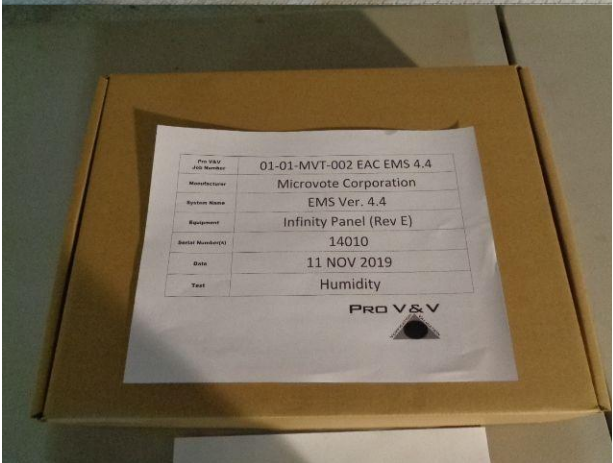
5.2.2 Test Procedure

See below.

5.2.3 Test Datasheets

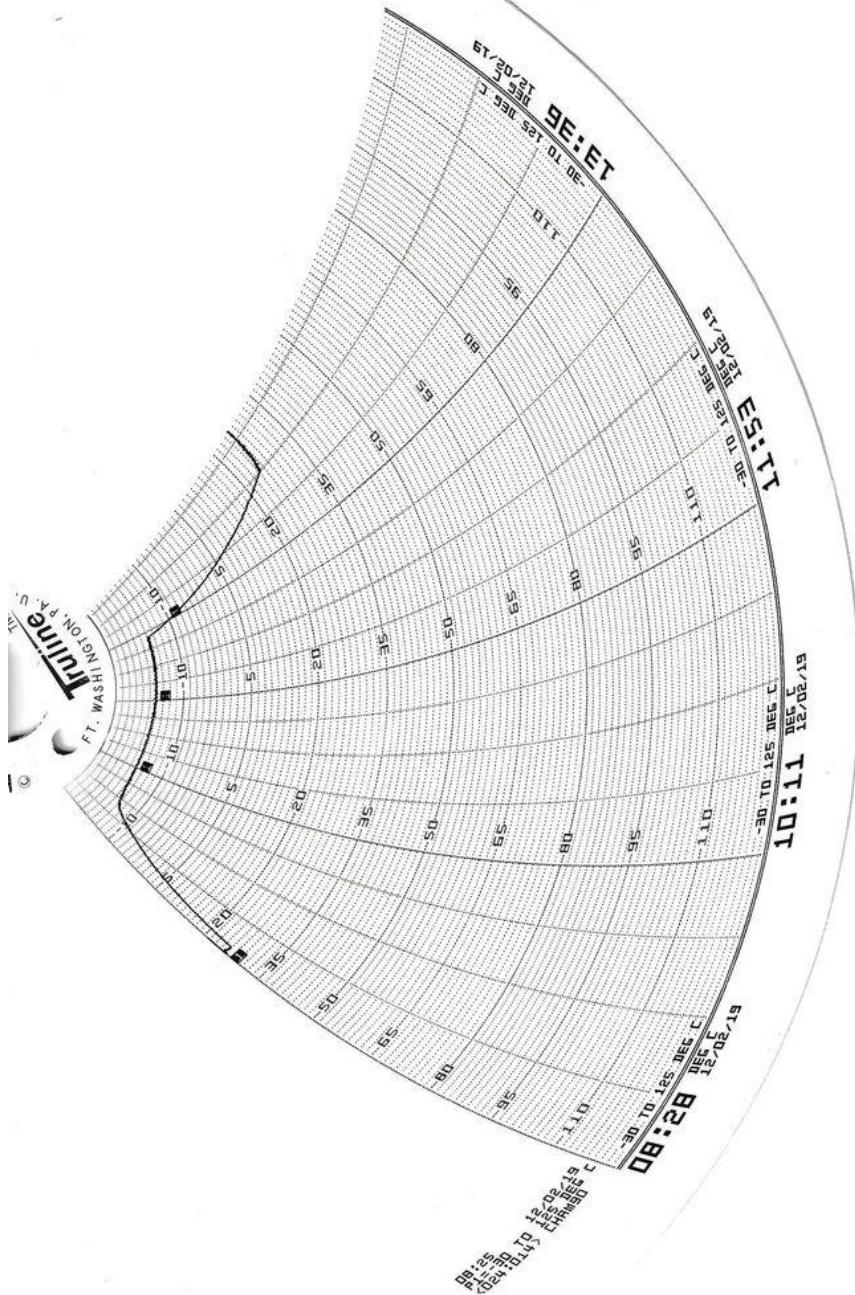
Start Date: 12/02/19		End Date: 12/03/19	MJO No: PR108417-00
Customer: Pro V&V		Test Performed: High Temperature Test	Test By: KM
Part Name: Infinity Panel (Rev E)		Serial No & Name: 14010, EMS Ver 4.4	Customer Witness: N/A
Page 1 of 1		Test Specification: MIL-STD_810D	Temp: -20c Humidity: N/A
Date	Time	Remarks	Initials
12/02/19	08:35	Start the following test profile	KM
		Ramp to +23c	
		Ramp to -20c	
		Dwell at -20 for 4hrs	
		Ramp to +23c	
12/03/19	09:15	Customer inspected UUT and performed post-test functional test on UUT	KM
12/03/19	10:00	Test complete	KM
		Note: All test pass or fail determinations decided by Pro V&V Inc.	

5.2.4 Test Photographs



5.2.5 Test Data

Low_Temperature_Test_Graph





5.2.6 Test Equipment List

Table 5.2-1: Low Temperature Test Equipment List

Asset Number	Manufacturer	Description	M/N	S/N	Range	Start Date	End Date	Last Calibration	Cal Interval (Months)	Cal Due	Notes
WC061556	American Cooler Technologies	Walk-In temp/humidity chamber, CH 90	N/A	23-9349		11/22/2019	11/22/2019	09/18/2019	12	09/18/2020	
WC061557	Watlow	TEMPERATURE CONTROLLER	F4	'005179	Multi / Mfg	11/22/2019	11/22/2019	09/18/2019	12	09/18/2020	
WC061558	Honeywell	CHART RECORDER	DR4500	9836Y8 380203 00006	Multi / Mfg	11/22/2019	11/22/2019	09/18/2019	12	09/18/2020	

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Required



5.3 High Temperature

5.3.1 Test Result

N/A

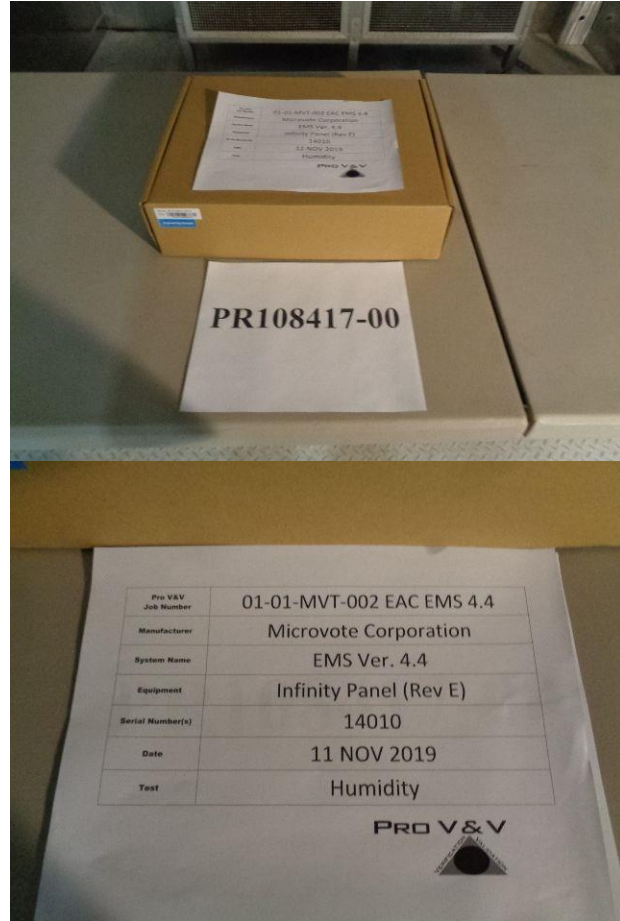
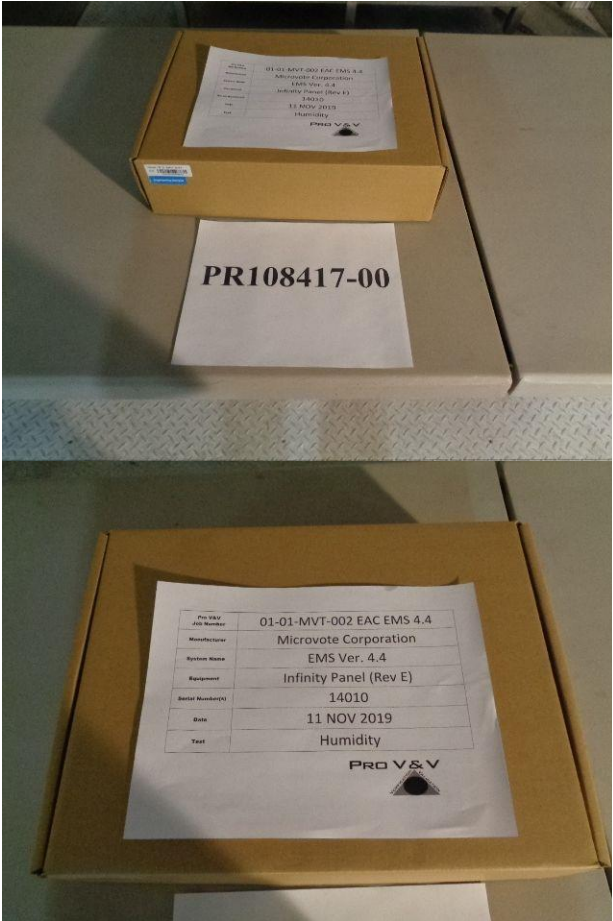
5.3.2 Test Procedure

See below.

5.3.3 Test Datasheets

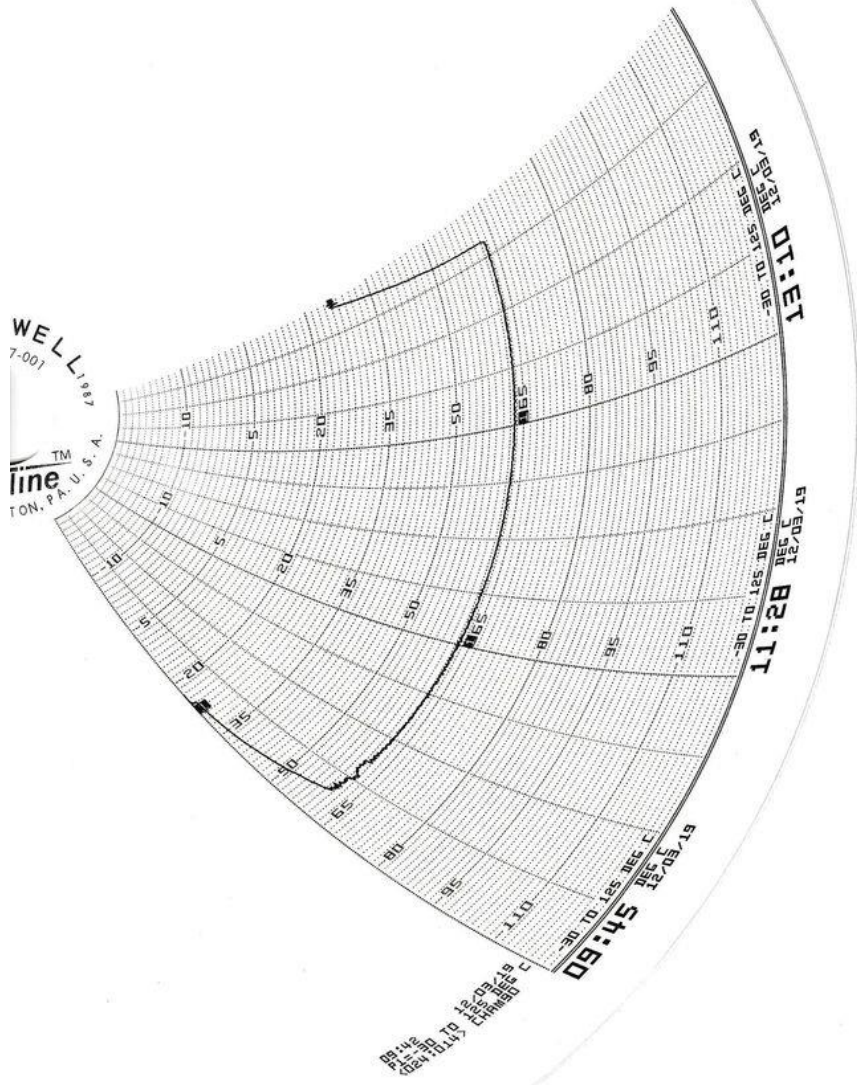
Start Date: 12/03/19		End Date: 12/04/19	MJO No: PR108417-00	
Customer: Pro V&V		Test Performed: High Temperature Test		Test By: KM
Part Name: Infinity Panel (Rev E)		Serial No & Name: 14010, EMS Ver (Rev E)		Customer Witness: N/A
Page 1 of 1		Test Specification: MIL-STD_810D		Temp: +60c Humidity: N/A
Date	Time	Remarks	Initials	
12/03/19	10:00	Start the following test profile	KM	
		Ramp to +23c		
		Ramp to +60c		
		Dwell at +60 for 4hrs		
		Ramp to +23c		
12/04/19	10:00	Customer inspected UUT and performed post-test functional test on UUT	KM	
12/04/19	10:30	Test complete	KM	
		Note: All test pass or fail determinations decided by Pro V&V Inc.		

5.3.4 Test Photographs



5.3.5 Test Data

High_Temperature_Test_Graph





5.3.6 Test Equipment List

Table 5.3-1: High Temperature Test Equipment List

Asset Number	Manufacturer	Description	M/N	S/N	Range	Start Date	End Date	Last Calibration	Cal Interval (Months)	Cal Due	Notes
WC061556	American Cooler Technologies	Walk-In temp/humidity chamber, CH 90	N/A	23-9349		12/02/2019	12/02/2019	09/18/2019	12	09/18/2020	
WC061557	Watlow	TEMPERATURE CONTROLLER	F4	'005179	Multi / Mfg	12/02/2019	12/02/2019	09/18/2019	12	09/18/2020	
WC061558	Honeywell	CHART RECORDER	DR4500	9836Y8 380203 00006	Multi / Mfg	12/02/2019	12/02/2019	09/18/2019	12	09/18/2020	

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Required

5.4 Bench Handling

5.4.1 Test Result

N/A

5.4.2 Test Datasheets

Start Date: 12/04/19		End Date: 12/04/19		MJO No: PR108417-00	
Customer: Pro V&V			Test Performed: Bench Test		Test By: KM
Part Name: Infinity Panel (Rev E)			Serial No & Name: 14010, EMS Ver 4.4		Customer Witness: N/A
Page of		Test Specification: MIL-STD_810D		Temp: N/A Humidity: N/A	
Date	Time	Remarks			Initials
12/04/19	09:30	Start 6 drops per corner of UUT from 4 inches			KM
12/04/19	10:30	Total of 24 drops from 4 inches for UUT complete			KM
12/04/19	11:00	Test Complete			KM
		Note: All test pass or fail determinations decided by Pro V&V Inc.			

5.4.3 Test Photographs





5.4.4 Test Equipment List

Table 5.4-1: Bench Handling Test Equipment List

ID Number	Manufacturer	Model #	Serial #	Description	Cal Date	Cal Due
N/A	N/A	N/A	N/A	4 inch wooden block	NCR	NCR

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required



5.5 Transportation Vibration

5.5.1 Test Result

N/A

5.5.2 Test Procedure

See below.

5.5.3 Test Datasheets

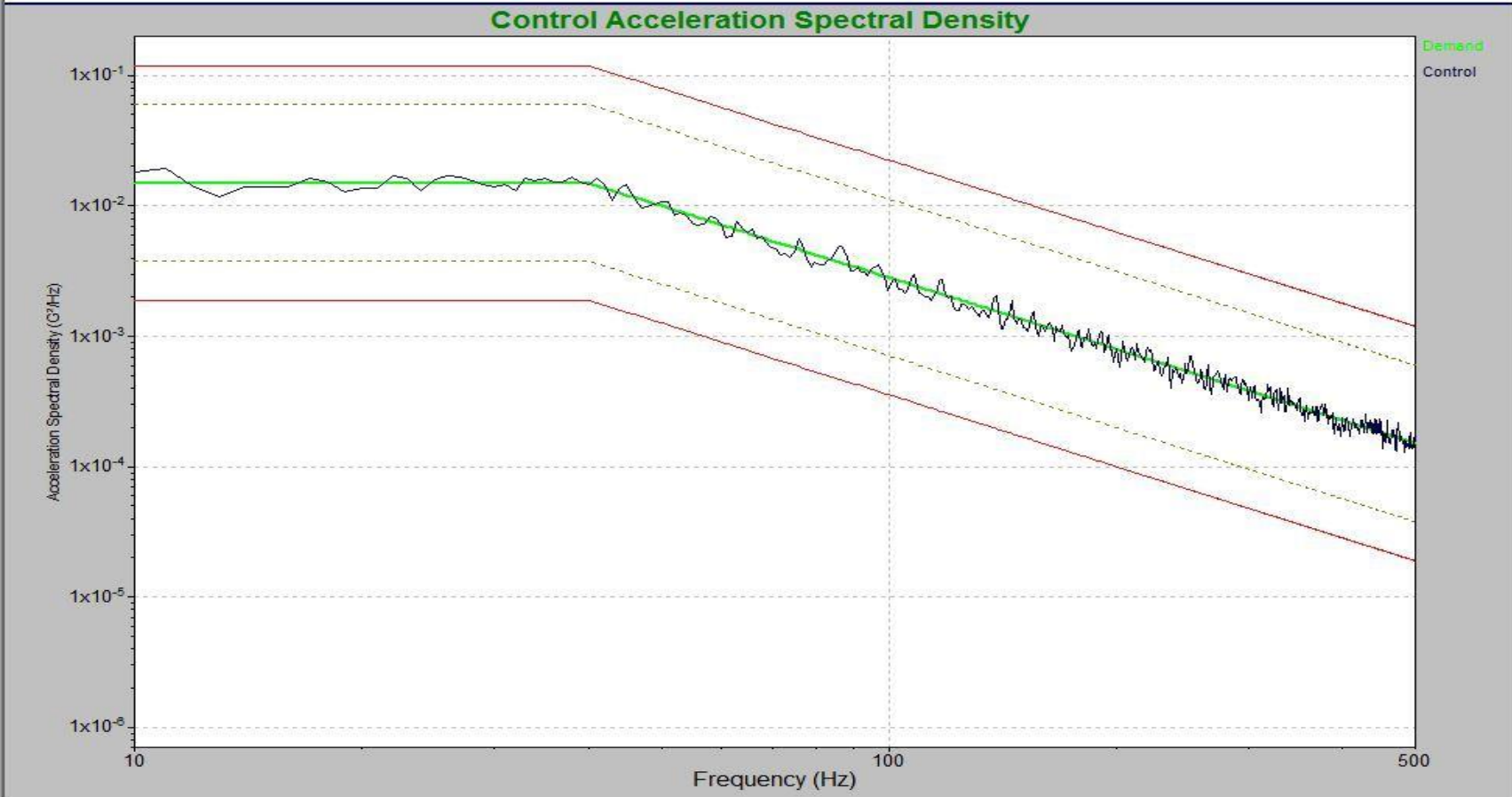
Start Date: 12/5/19		End Date: 12/5/19		MJO No: PR108417-00		
Customer: Pro V&V		Test Performed: Random Vibration		Test Engineer: Michael Nash		
Part Name: Infinity Panel Rev. E		Serial numbers: 14010		Customer Witness: n/a		
Page of		Test Specification: Customer SOW & MIL-STD-810D		Temp: 70° Humidity: 25%		
Date	Time	Axis	Plot No.	Serial No.	Remarks	Initials
12/5/19		Vert			Setup UUT on shaker HYD06 in the Vertical-Axis	MN
	1037		Run 1		Run 1.04 gRMS common carrier random profile on the UUT in the Vertical-Axis	MN
		Trans			Setup UUT on shaker HYD06 in the Transverse -Axis	MN
	1146		Run 2		Run 0.2 gRMS common carrier random profile on the UUT in the Transverse-Axis	MN
		Long			Setup UUT on shaker HYD06 in the Longitudinal -Axis	MN
	1252		Run 3		Run 0.74 gRMS common carrier random profile on the UUT in the Longitudinal-Axis	MN
					Testing complete	MN

5.5.4 Test Photographs

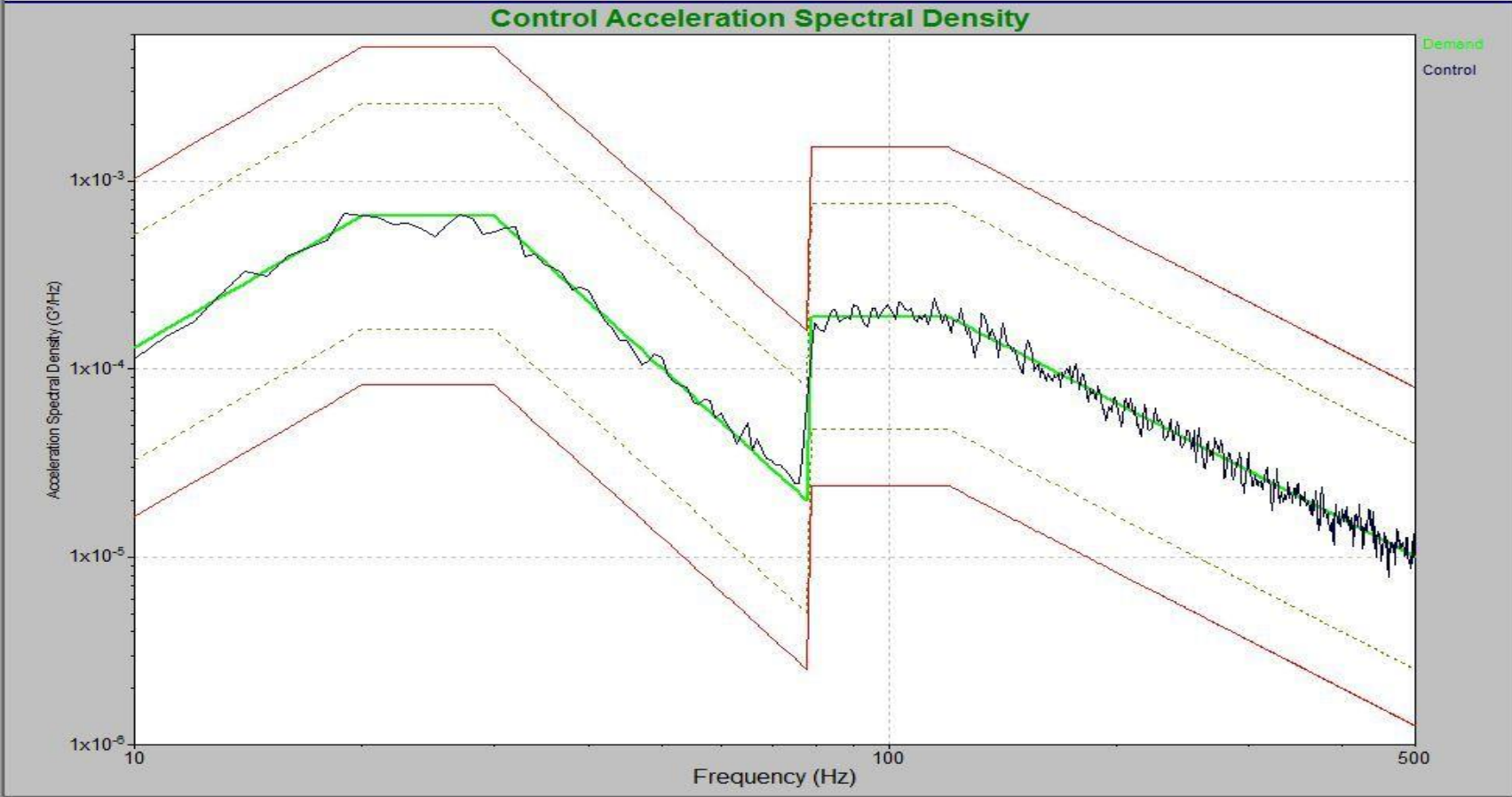


5.5.5 Test Data

NTS Longmont, CO	Level Time: 1:00:00	Demand: 1.047 G RMS	Pro V&V
Job#: PR108417-00	Total Time: 1:00:11	Control: 1.051 G RMS	UUT: Infinity Panel Rev. E
Dec 05, 2019 10:37:21	Run 1	Test axis: Vertical	SN: 14010



NTS Longmont, CO	Level Time: 1:00:00	Demand: 0.2038 G RMS	Pro V&V
Job#: PR108417-00	Total Time: 1:00:08	Control: 0.2026 G RMS	UUT: Infinity Panel Rev. E
Dec 05, 2019 11:46:42	Run 2	Test axis: Transverse	SN: 14010





NTS Longmont, CO

Level Time: 1:00:00

Demand: 0.7428 G RMS

Pro V&V

Job#: PR108417-00

Total Time: 1:00:11

Control: 0.7466 G RMS

UUT: Infinity Panel Rev. E

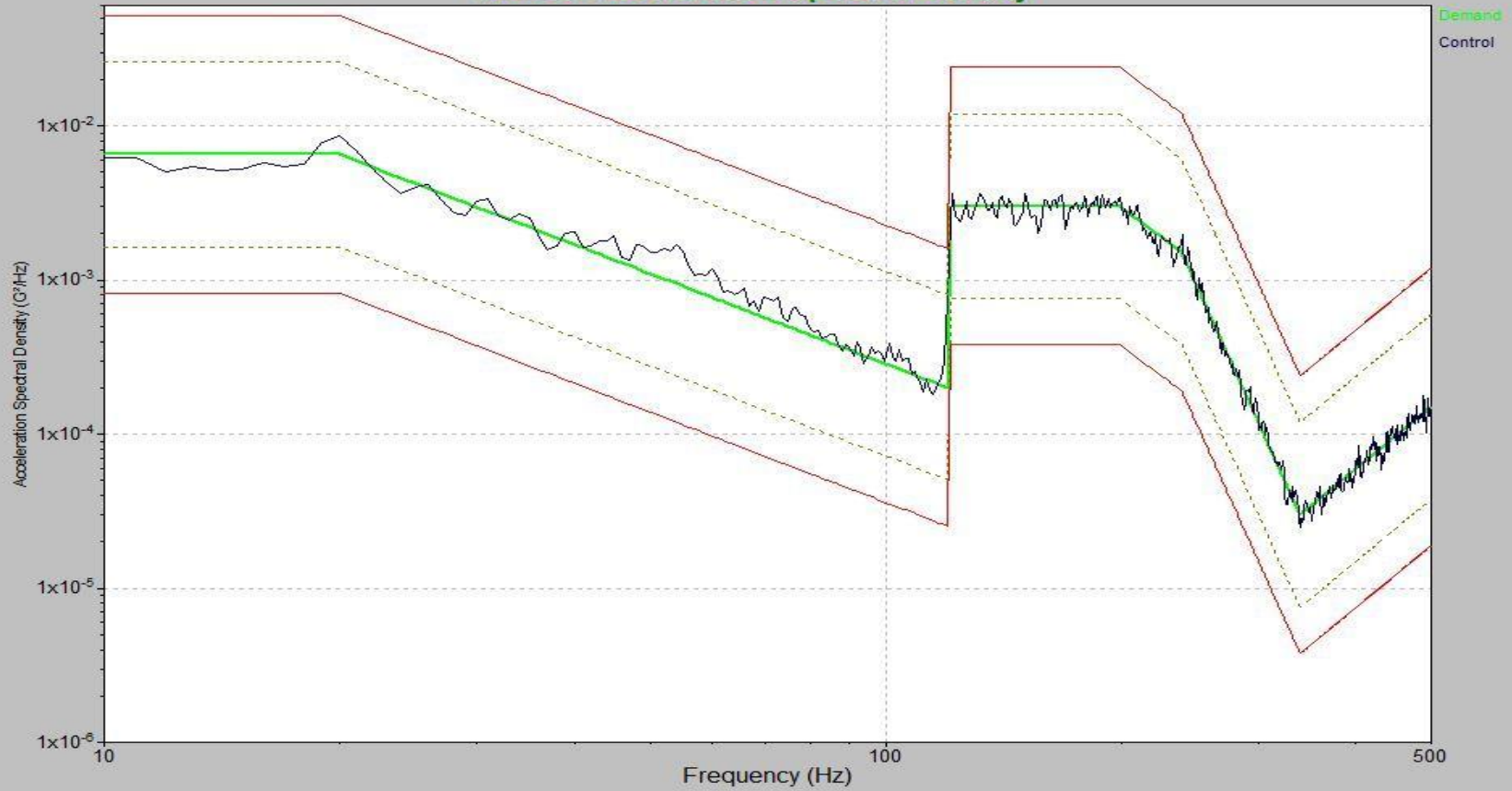
Dec 05, 2019 12:52:47

Run 3

Test axis: Longitudinal

SN: 14010

Control Acceleration Spectral Density





5.5.6 Test Equipment List

Table 5.5-1: Transportation Vibration Test Equipment List

Asset Number	Manufacturer	Description	M/N	S/N	Range	Start Date	End Date	Last Calibration	Cal Interval (Months)	Cal Due	Notes
WC061429	Team Corporation	vertical electro hydraulic shaker , HYD 06	80/10.5	544		12/04/2019	12/04/2019		12	NCR	
WC059875	Vibration Research	VR9500	VR9500	95268B57	Multi / Mfg	12/04/2019	12/04/2019	05/31/2019	12	05/30/2020	
WC061505	PCB Piezotronics	ACCELEROMETER	353B32	112995	Range: 1 Hz to 5000 Hz / Accuracy: ± 5%	12/04/2019	12/04/2019	04/10/2019	12	04/10/2020	
WC070243	PCB Piezotronics	Accelerometer	353B32	205235	Range: 1 Hz to 5000 Hz / Accuracy: ± 5%	12/04/2019	12/04/2019	04/25/2019	12	04/25/2020	
WC070466	Fluke	Humidity & Temperature Meter	971	3620647	Mfg / Mfg	12/04/2019	12/04/2019	04/24/2019	12	04/24/2020	

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Required



5.6 Temperature/Power Variation

5.6.1 Test Result

N/A

5.6.2 Test Procedure

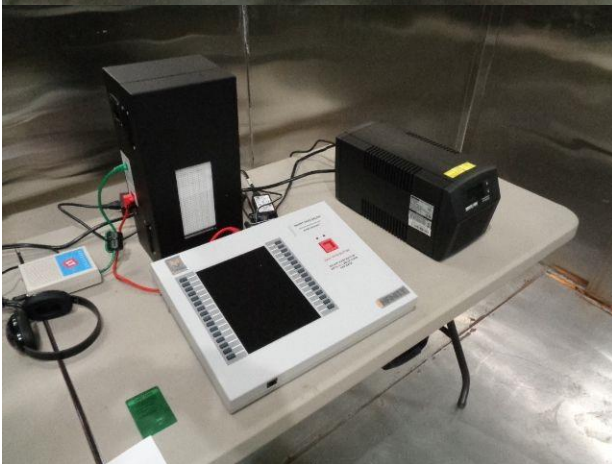
See below.

5.6.3 Test Datasheets

Start Date: 12/09/19		End Date: 12/12/19	MJO No: PR108417-00
Customer: Pro V&V (Chamber 59)		Test Performed: Temperature Power Variation Test	Test By: KM
Part Name: EMS Ver. 4.4 System		Serial No & Name: See UUT Details Sheet	Customer Witness: N/A
Page 1 of 1		Test Specification: MIL-STD_810D	Temp: +10c to +35c Voltage: 105vlts to 129vlts
Date	Time	Remarks	Initials
12/09/19	09:05	Set VAC to 117vlts & ramp to +10c	RSP
	09:22	Start dwell at 117vlts & +10c for 4hrs	RSP
	13:22	Lower VAC to 105vlts & dwell for 4hrs	RSP
	17:22	Raise VAC to 129vlts & dwell for 4hrs	KM
	21:22	Lower VAC to 117vlts & Raise temperature to +35c & dwell for 4hrs	KM
12/10/19	01:22	Lower VAC to 105vlts & dwell for 4hrs	KM
	05:22	Raise VAC to 129vlts & dwell for 4hrs	GW
	09:22	Lower VAC to 117vlts & Lower temperature to +10c & dwell for 4hrs	RSP
	13:22	Lower VAC to 105vlts & dwell for 4hrs	RSP
	17:22	Raise VAC to 129vlts & dwell for 4hrs	KM
	21:22	Lower VAC to 117vlts & Raise temperature to +35c & dwell for 4hrs	KM
12/11/19	01:22	Lower VAC to 105vlts & dwell for 4hrs	KM
	05:22	Raise VAC to 129vlts & dwell for 4hrs	GM
	09:22	Lower VAC to 117vlts & ramp to +23c ambient	GM
	09:22	Temperature and power variation portion of test has completed	KM
	09:22	Test will continue to run at +23c ambient for another 37hrs	KM
12/12/19	22:00	All Testing complete for a total of 85hrs	KM

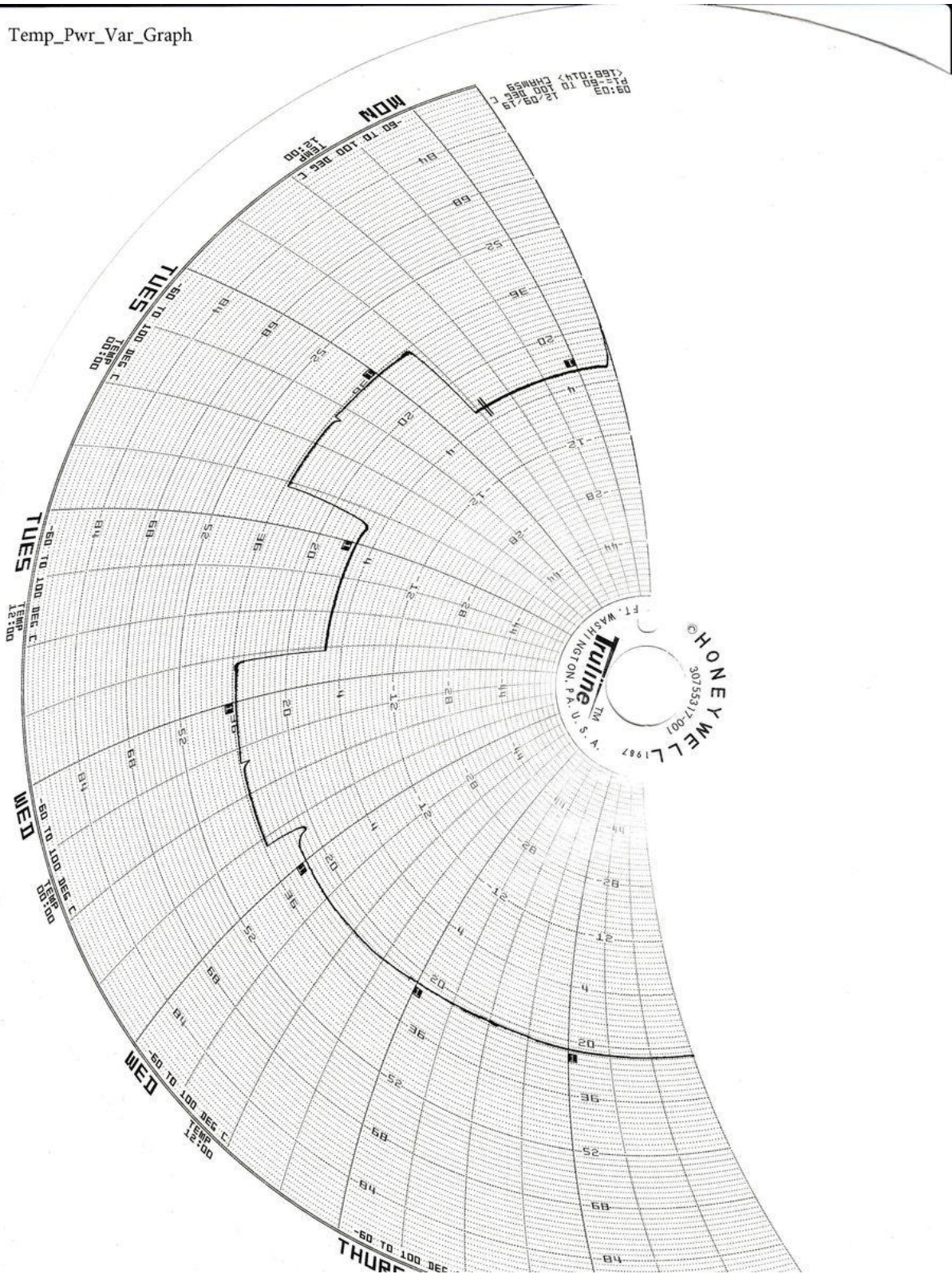
	Note: All test pass or fail determinations decided by Pro V&V Inc.	
--	--	--

5.6.4 Test Photographs



5.6.5 Test Data

Temp_Pwr_Var_Graph





5.6.6 Test Equipment List

Table 5.6-1: Temperature/Power Variation Test Equipment List

ID Number	Manufacturer	Model #	Serial #	Description	Cal Date	Cal Due
1732	American Cooler	N/A	N/A	Chamber 90	NCR	NCR
1645	Watlow	F4	N/A	Controller	09/18/19	09/18/20
1646	Honeywell	N/A	N/A	Chart Recorder	09/18/19	09/18/20

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Required



End of Report