Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

CERTIFICATE OF TEST 16602

Customer: Radio Amateur Satellite Corporation 712 H Street, Suite 1653 Washington, DC 20002	**Test:** Sinusoidal Sweep Vibration
	Test Completion Date: 09 June 2022
	Purchase Order Number: 100001

Test Unit Description

One (1) Reaction Wheel Prototype

Specification

NASA GSFC-STD-7000B dated 4-28-2021, Section 2.4.3, Sinusoidal Sweep Vibration Qualification.

Equipment

Equipment Name	Description	Model #	Calibration Due
ETL #106	ETS Solutions I1045A Vibration System	HVA3415/I1045A/GT1200M	CNR
ETL #111	Unholtz-Dickie Vibration System	12000.44	CNR
ETL #1401	Vibration Research Controller	VR9500 Revolution	01 October 2022
ETL #1534	PCB Piezotronics Accelerometer	352A21	14 March 2023
ETL #1535	PCB Piezotronics Accelerometer	352A21	13 March 2023
ETL #1717	PCB Piezotronics Accelerometer	352A21	04 November 2022
Digital Camera	Canon Digital Camera	PowerShot D10	CNR

Procedure

The test unit was mounted to the vibration table. The test unit was subjected to Vibration testing in accordance with the specification.

Results

Radio Amateur Satellite Corporation personnel present to witness testing. The test unit was subjected to Sinusoidal Sweep Vibration testing in accordance with the specification. A visual examination of the test unit was performed following testing and no external damage was observed. The test results are to be determined by Radio Amateur Satellite Corporation personnel. The test unit was returned to Radio Amateur Satellite Corporation for further evaluation. Test completed 09 June 2022.

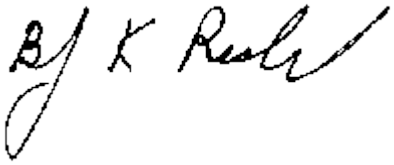
Traceability

This Certificate of Test certifies that the above test was run in accordance with applicable specifications and that all instrumentation was in calibration and is traceable to the NATIONAL INSTITUTE OF STANDARDS and TECHNOLOGY or other recognized calibration sources when applicable.

Accreditation

This test is accredited and meets the requirements of NASA GSFC-STD-7000B dated 4-28-2021, Section 2.4.3, Sinusoidal Sweep Vibration Qualification. as verified by ANSI National Accreditation Board (ANAB) to ISO/IEC 17025:2017. Refer to Certificate of Accreditation and Scope of Accreditation Certificate Number: AT-1787. This document cannot be reproduced without the approval of the Laboratory.

Respectfully,
ENVIRONMENTAL TESTING LABORATORY, INC.



2022-12238
BKR/ckr

Brady Richard
President

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

JOB #: 16602	**CUSTOMER:** Radio Amateur Satellite Corporation
TEST: Sinusoidal Sweep Vibration	
TEST UNIT: One (1) Reaction Wheel Prototype	
SPECIFICATION: NASA GSFC-STD-7000B dated 4-28-2021, Section 2.4.3, Sinusoidal Sweep Vibration Qualification.	

EQUIPMENT LIST		
1. Digital Camera	6. ETL #1535	11.
2. ETL #106	7. ETL #1717	12.
3. ETL #111	8.	13.
4. ETL #1401	9.	14.
5. ETL #1534	10.	15.

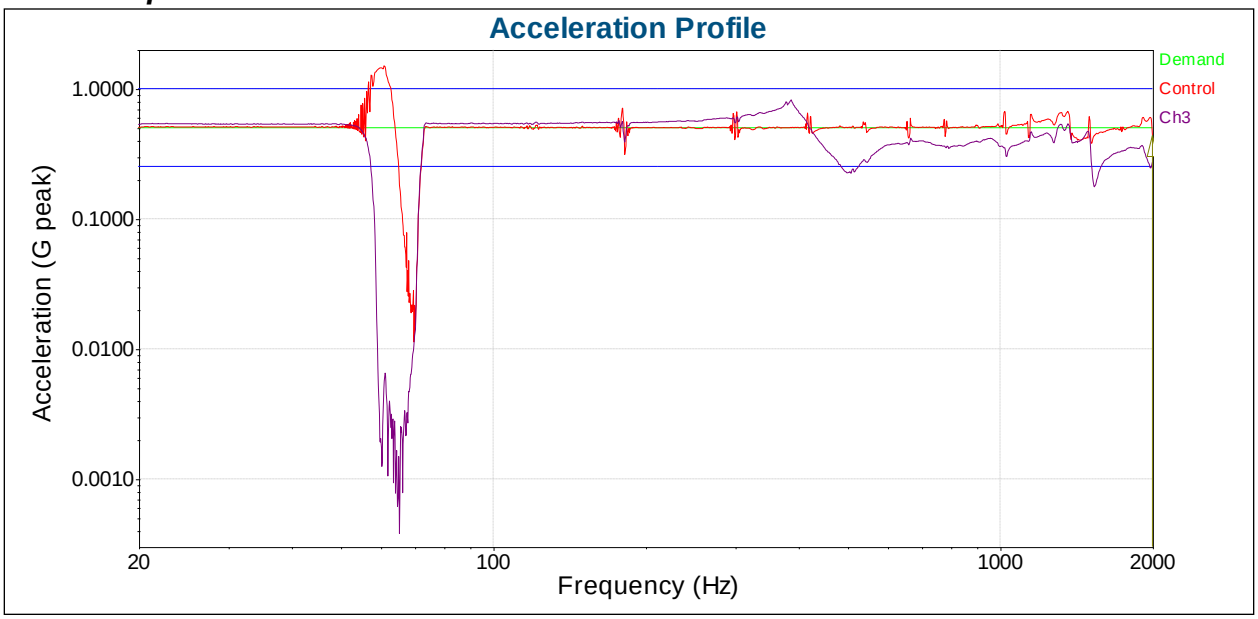
DATE	TIME	LOG AND OBSERVATIONS
05/16/22		Checked calibration dates.
		A visual examination of the test unit was performed before testing. No damage was observed.
		The test unit was non-operational.
		Radio Amateur Satellite Corporation representative was present to witness test.
	10:24	Start X Axis Pre-Test Sine Sweep.
	10:27	Start X Axis Random Vibration per supplied profile.
	10:30	Start X Axis Post-Test Sine Sweep.
	10:42	Start Y Axis Pre-Test Sine Sweep.
	10:46	Start Y Axis Random Vibration per supplied profile.
	10:48	Start Y Axis Post-Test Sine Sweep.
	11:43	Start Z Axis Pre-Test Sine Sweep.
	11:50	Start Z Axis Random Vibration per supplied profile.
		UUT Failure Customer to repair and return at later date.
06/09/22	08:52	Start Z Axis Pre-Test Sine Sweep retest.
	08:59	Start Z Axis Random Vibration per supplied profile retest.
	09:01	Start Z Axis Post-Test Sine Sweep retest.
06/09/22	09:02	Test completed.
		A visual examination of the test unit was performed after testing.
		No damage was observed.
		The test unit was returned to Radio Amateur Satellite Corporation.
		The test unit passed the requirements of the specification.
Technician		Charles Hoppe.

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Pre-Sine Sweep, X Axis.

End of Sweep Test



Breakpoint table

Start Freq.	Amplitude	End Freq.	Amplitude
20 Hz	0.5 G	2000 Hz	0.5 G

Test level schedule:

	Duration	Level
1)	1 sweeps	100 %

** Test started May 16, 2022 10:24:04, running for 0:02:26
** Current level: 1, running at 100 %, 1 of 1 sweeps complete

Current Measurements:

Demand: 0.5 G at 2000 Hz	Ch1: 0.4334 G
Control: 0.4348 G	Ch2: 0.3561 G
Control Vel.: 0.01336 in/s	Ch3: 0.2723 G
Control Disp.: 2.126e-06 in	Ch4: 7.062e-05 G

Channel Measurements:

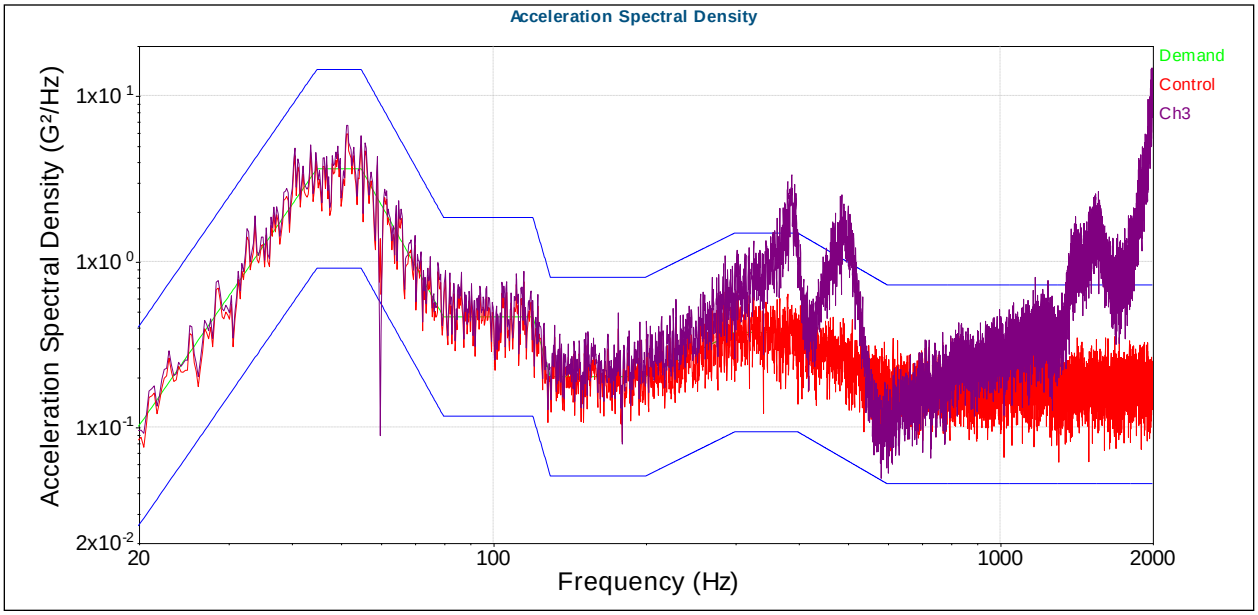
	Accel	*Velocity*	*Displacement*
Ch1	0.4334 G	0.01332 in/s	2.119e-06 in
Ch2	0.3561 G	0.01332 in/s	2.119e-06 in
Ch3	0.2723 G	0.008365 in/s	1.331e-06 in

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Random Vibration, X Axis.

End of Test



Breakpoint table

Frequency	G²/Hz	dB/Octave
20 Hz	0.1	13.3
45 Hz	3.6	0
55 Hz	3.6	-16.53
80 Hz	0.46	0
120 Hz	0.46	-31.32
130 Hz	0.2	0
200 Hz	0.2	4.567
300 Hz	0.37	0
400 Hz	0.37	-5.35
600 Hz	0.18	0
2000 Hz	0.18	

Test level schedule:

	Duration	Level
1)	0:01:00	100 %

** Test started May 16, 2022 10:27:38, running for 0:02:05
** Current level: 1, running at 100 % for 0:01:00 of 0:01:00

Measurements:

Demand: 22.49 G RMS	0.3092 in pk-pk
Control: 22.36 G RMS	0.3076 in pk-pk

Channel Measurements:

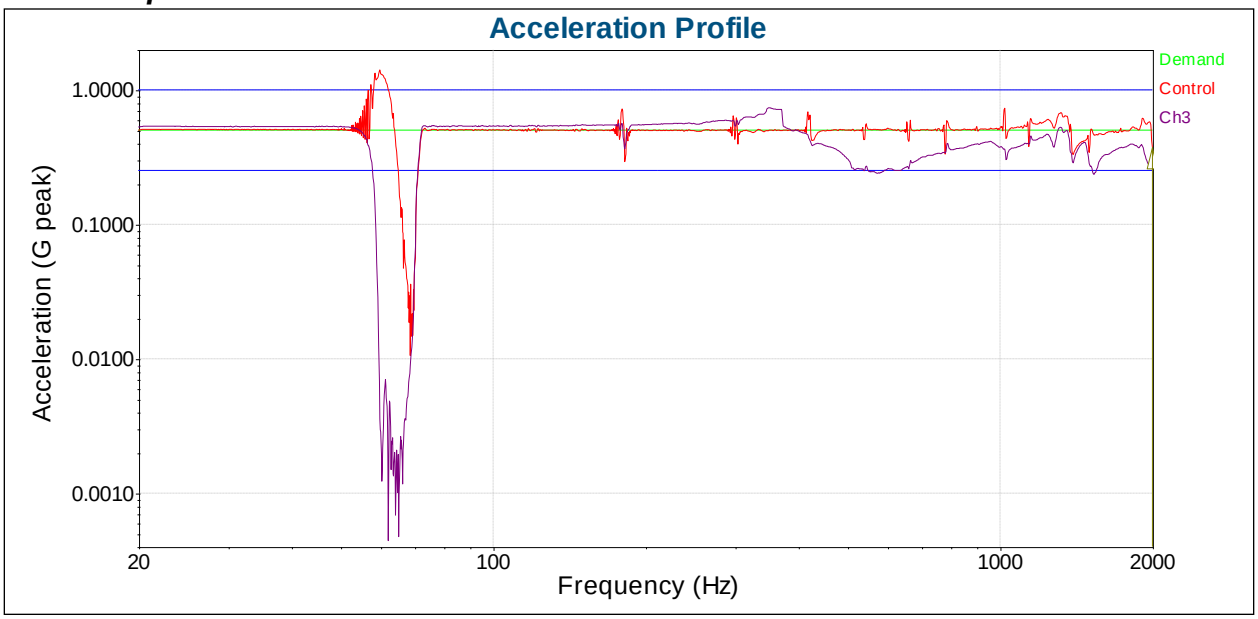
	(Overall)	(InBand)
Ch1	19.71 G RMS	19.6 G RMS
Ch2	25 G RMS	24.82 G RMS
Ch3	77.24 G RMS	41.5 G RMS

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Post-Sine Sweep, X Axis.

End of Sweep Test



Breakpoint table

Start Freq.	Amplitude	End Freq.	Amplitude
20 Hz	0.5 G	2000 Hz	0.5 G

Test level schedule:

	Duration	Level
1)	1 sweeps	100 %

** Test started May 16, 2022 10:30:02, running for 0:02:27
** Current level: 1, running at 100 %, 1 of 1 sweeps complete

Current Measurements:

Demand: 0.5 G at 2000 Hz	Ch1: 0.3053 G
Control: 0.3702 G	Ch2: 0.3705 G
Control Vel.: 0.01138 in/s	Ch3: 0.3349 G
Control Disp.: 1.81e-06 in	Ch4: 0.0002523 G

Channel Measurements:

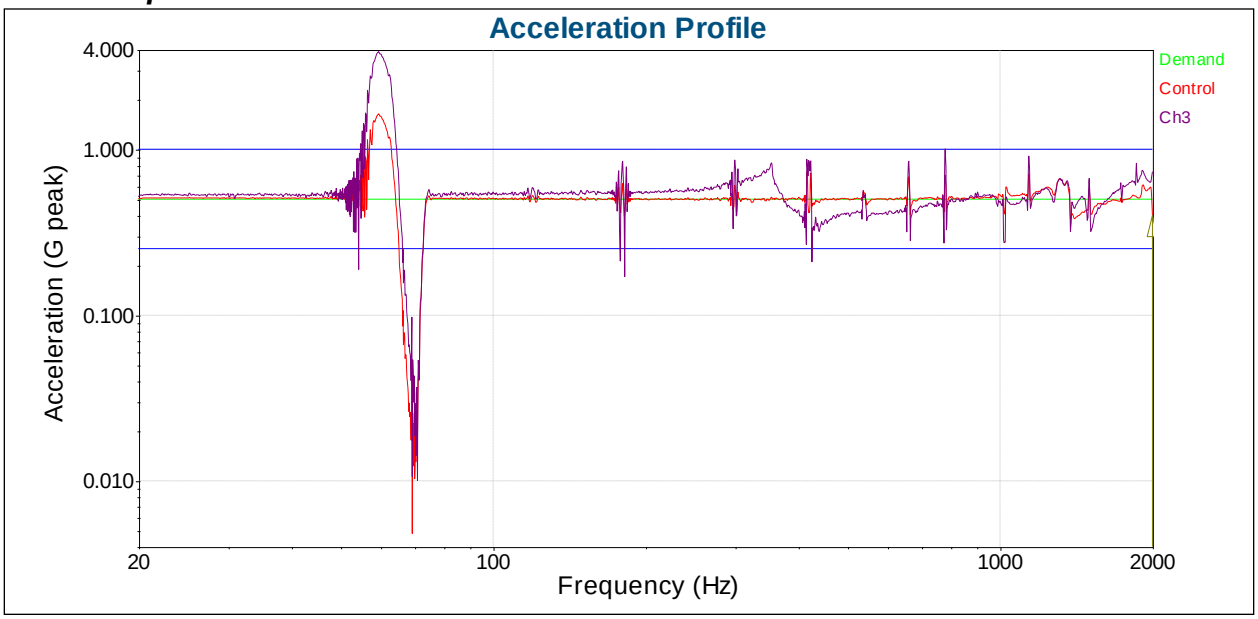
	Accel	*Velocity*	*Displacement*
Ch1	0.3053 G	0.009379 in/s	1.493e-06 in
Ch2	0.3705 G	0.009379 in/s	1.493e-06 in
Ch3	0.3349 G	0.01029 in/s	1.638e-06 in

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Pre-Sine Sweep, Y Axis.

End of Sweep Test



Breakpoint table

Start Freq.	Amplitude	End Freq.	Amplitude
20 Hz	0.5 G	2000 Hz	0.5 G

Test level schedule:

	Duration	Level
1)	1 sweeps	100 %

** Test started May 16, 2022 10:42:52, running for 0:02:27
** Current level: 1, running at 100 %, 1 of 1 sweeps complete

Current Measurements:

Demand: 0.5 G at 2000 Hz	Ch1: 0.3966 G
Control: 0.3979 G	Ch2: 0.3527 G
Control Vel.: 0.01222 in/s	Ch3: 0.7314 G
Control Disp.: 1.946e-06 in	Ch4: 0.0002994 G

Channel Measurements:

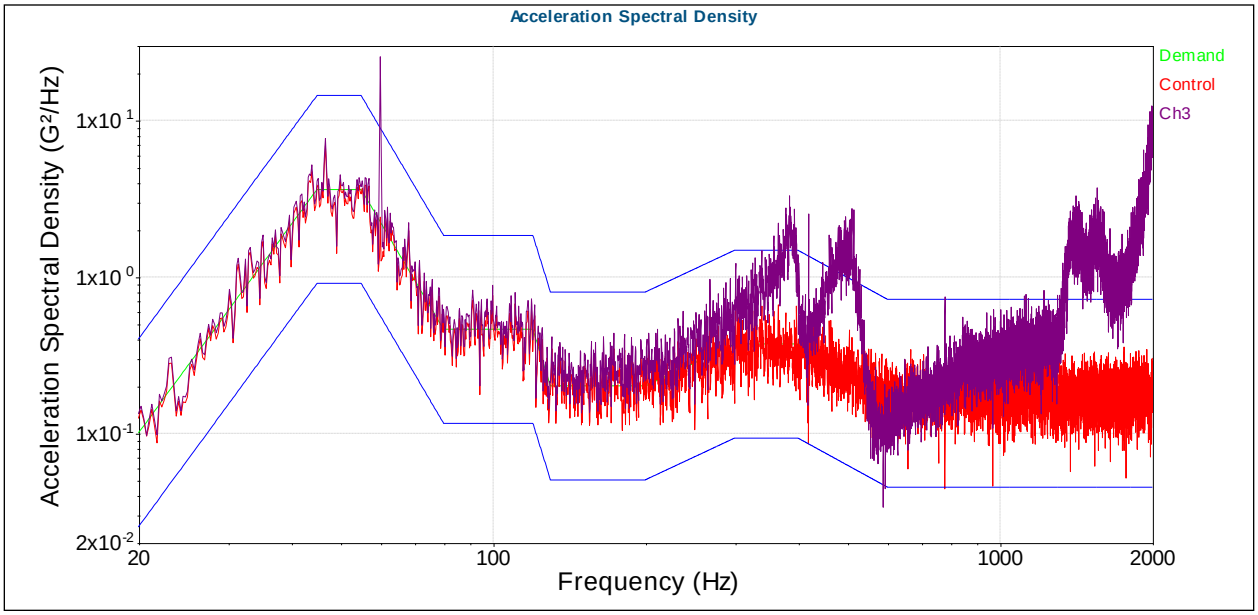
	Accel	*Velocity*	*Displacement*
Ch1	0.3966 G	0.01218 in/s	1.939e-06 in
Ch2	0.3527 G	0.01218 in/s	1.939e-06 in
Ch3	0.7314 G	0.02247 in/s	3.577e-06 in

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Random Vibration, Y Axis.

End of Test



Breakpoint table

Frequency	G²/Hz	dB/Octave
20 Hz	0.1	13.3
45 Hz	3.6	0
55 Hz	3.6	-16.53
80 Hz	0.46	0
120 Hz	0.46	-31.32
130 Hz	0.2	0
200 Hz	0.2	4.567
300 Hz	0.37	0
400 Hz	0.37	-5.35
600 Hz	0.18	0
2000 Hz	0.18	

Test level schedule:

	Duration	Level
1)	0:01:00	100 %

** Test started May 16, 2022 10:46:01, running for 0:01:50
** Current level: 1, running at 100 % for 0:01:00 of 0:01:00

Measurements:

Demand: 22.49 G RMS	0.3092 in pk-pk
Control: 22.25 G RMS	0.3041 in pk-pk

Channel Measurements:

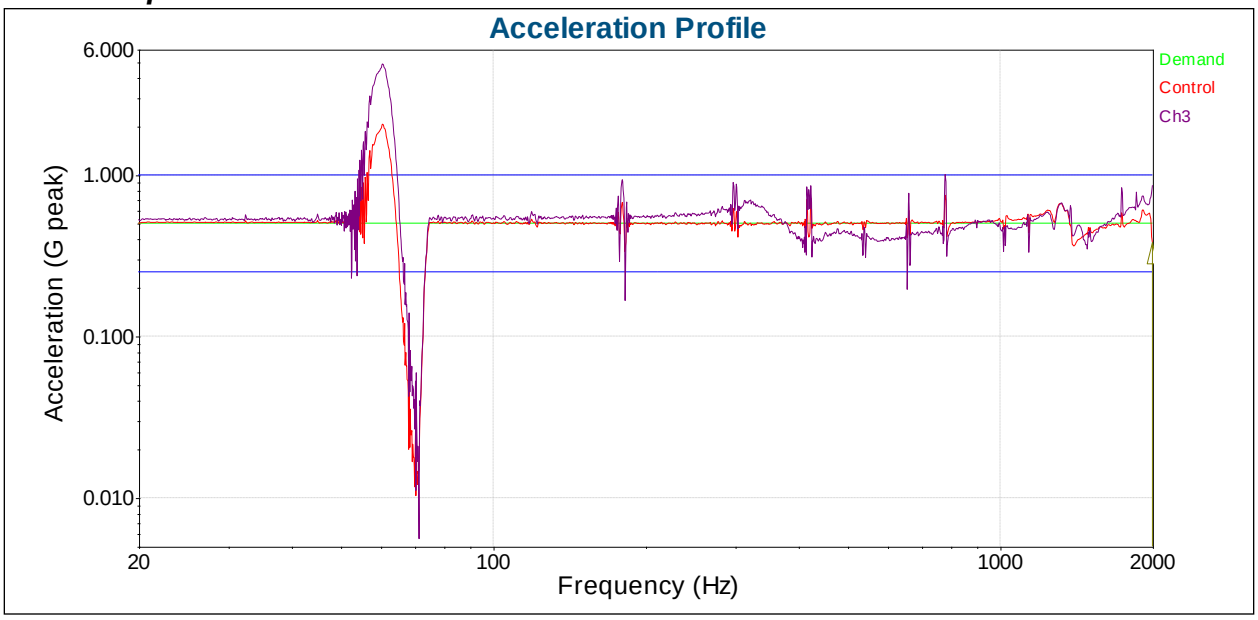
	(Overall)	(InBand)
Ch1	19.78 G RMS	19.44 G RMS
Ch2	25.03 G RMS	24.75 G RMS
Ch3	82.59 G RMS	44.07 G RMS

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Post-Sine Sweep, Y Axis.

End of Sweep Test



Breakpoint table

Start Freq.	Amplitude	End Freq.	Amplitude
20 Hz	0.5 G	2000 Hz	0.5 G

Test level schedule:

	Duration	Level
1)	1 sweeps	100 %

** Test started May 16, 2022 10:48:05, running for 0:02:27
** Current level: 1, running at 100 %, 1 of 1 sweeps complete

Current Measurements:

Demand: 0.5 G at 2000 Hz
Control: 0.3785 G
Control Vel.: 0.01163 in/s
Control Disp.: 1.851e-06 in
Ch1: 0.3056 G
Ch2: 0.3789 G
Ch3: 0.8572 G
Ch4: 0.0009216 G

Channel Measurements:

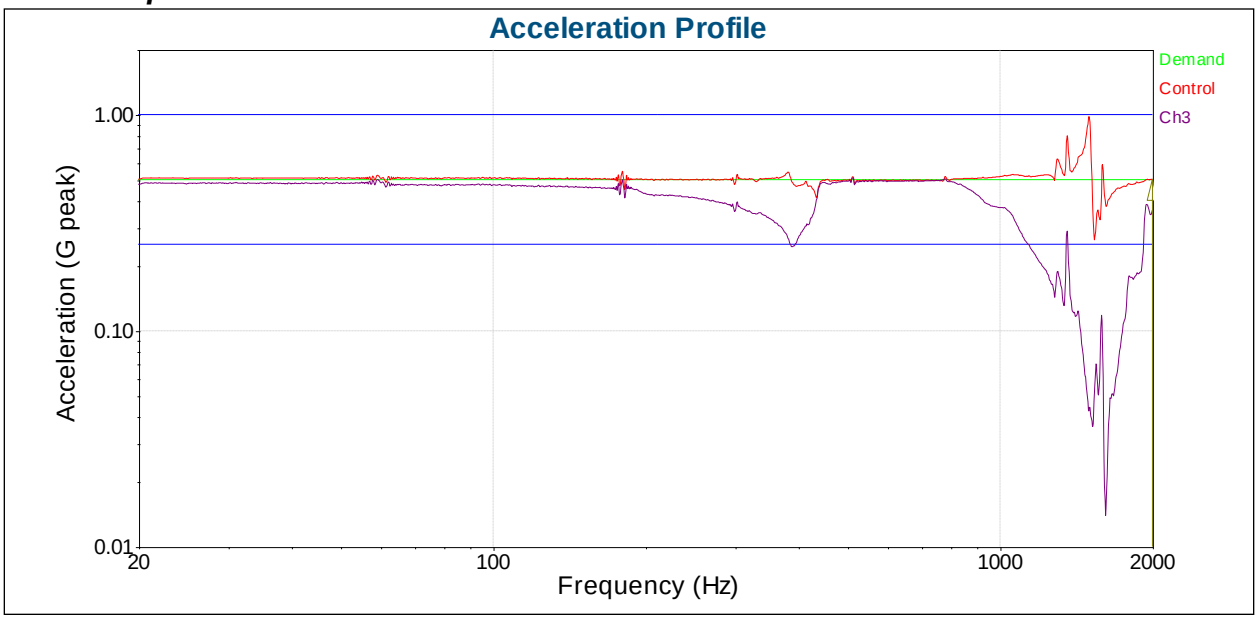
	Accel	*Velocity*	*Displacement*
Ch1	0.3056 G	0.009389 in/s	1.494e-06 in
Ch2	0.3789 G	0.009389 in/s	1.494e-06 in
Ch3	0.8572 G	0.02634 in/s	4.191e-06 in

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Pre-Sine Sweep, Z Axis.

End of Sweep Test



Breakpoint table

Start Freq.	Amplitude	End Freq.	Amplitude
20 Hz	0.5 G	2000 Hz	0.5 G

Test level schedule:

	Duration	Level
1)	1 sweeps	100 %

** Test started May 16, 2022 11:45:43, running for 0:02:28
** Current level: 1, running at 100 %, 1 of 1 sweeps complete

Current Measurements:

Demand: 0.5 G at 2000 Hz	Ch1: 0.5014 G
Control: 0.5014 G	Ch2: 0.3563 G
Control Vel.: 0.0154 in/s	Ch3: 0.3606 G
Control Disp.: 2.452e-06 in	Ch4: 0.0001883 G

Channel Measurements:

	Accel	*Velocity*	*Displacement*
Ch1	0.5014 G	0.0154 in/s	2.452e-06 in
Ch2	0.3563 G	0.0154 in/s	2.452e-06 in
Ch3	0.3606 G	0.01108 in/s	1.763e-06 in

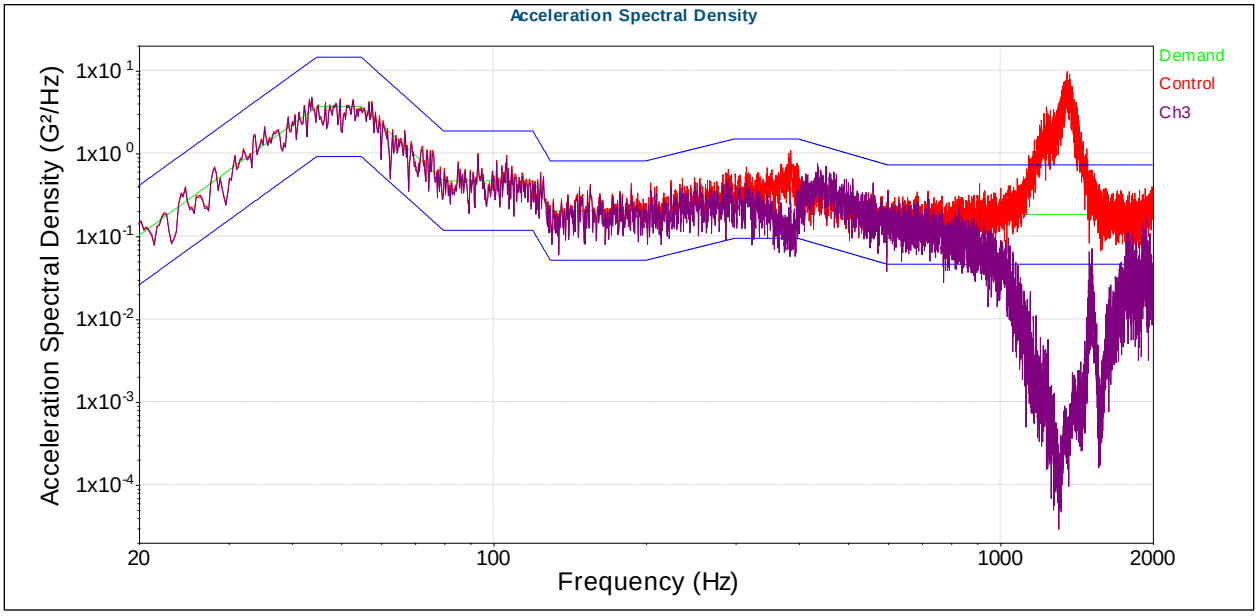
Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Random Vibration, Z Axis.

Stop Button Pressed

Unit Failure



Breakpoint table

Frequency	G²/Hz	dB/Octave
20 Hz	0.1	13.3
45 Hz	3.6	0
55 Hz	3.6	-16.53
80 Hz	0.46	0
120 Hz	0.46	-31.32
130 Hz	0.2	0
200 Hz	0.2	4.567
300 Hz	0.37	0
400 Hz	0.37	-5.35
600 Hz	0.18	0
2000 Hz	0.18	

Test level schedule:

	Duration	Level
1)	0:01:00	100 %

** Test started May 16, 2022 11:50:12, running for 0:01:21
** Current level: 1, running at 100 % for 0:00:40 of 0:01:00

Channel Measurements:

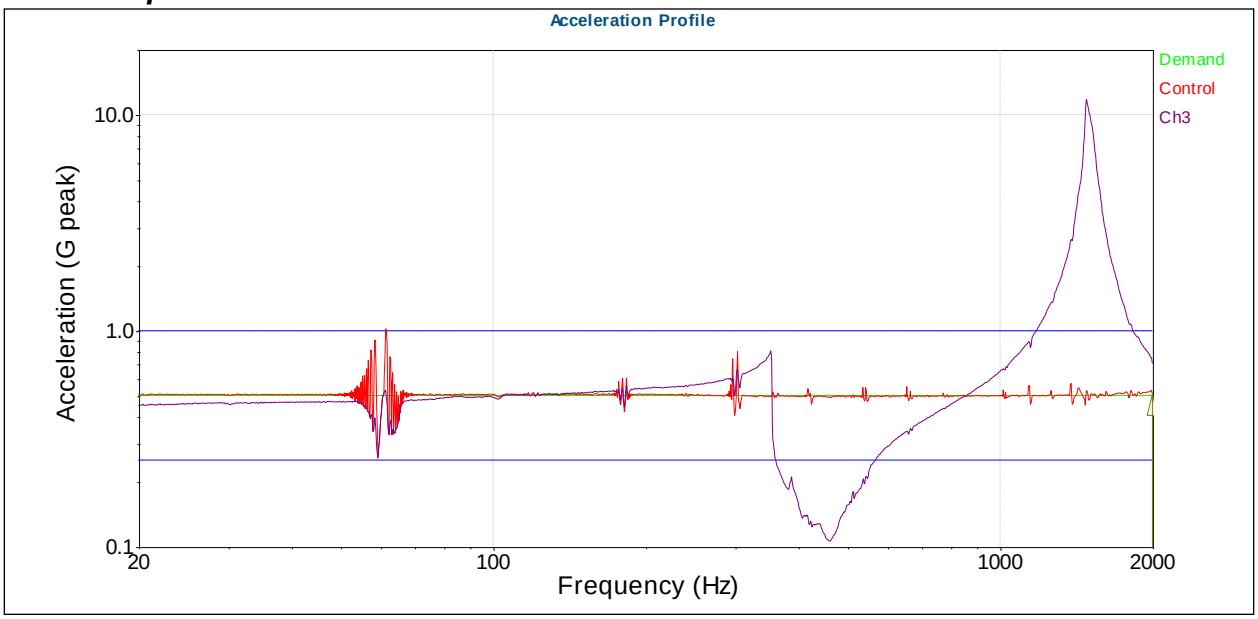
	(Overall)	(InBand)
Ch1	46.11 G RMS	45.47 G RMS
Ch2	16.81 G RMS	16.62 G RMS
Ch3	16.64 G RMS	16.46 G RMS

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Pre-Sine Sweep, Z Axis Re-Test.

End of Sweep Test



Breakpoint table

Start Freq.	Amplitude	End Freq.	Amplitude
20 Hz	0.5 G	2000 Hz	0.5 G

Test level schedule:

	Duration	Level
1)	1 sweeps	100 %

** Test started Jun 09, 2022 08:52:37, running for 0:02:41
** Current level: 1, running at 100 %, 1 of 1 sweeps complete

Current Measurements:

Demand: 0.5 G at 2000 Hz
Control: 0.5058 G
Control Vel.: 0.01554 in/s
Control Disp.: 2.473e-06 in
Ch1: 0.4634 G
Ch2: 0.5057 G
Ch3: 0.7025 G
Ch4: 0.0003088 G

Channel Measurements:

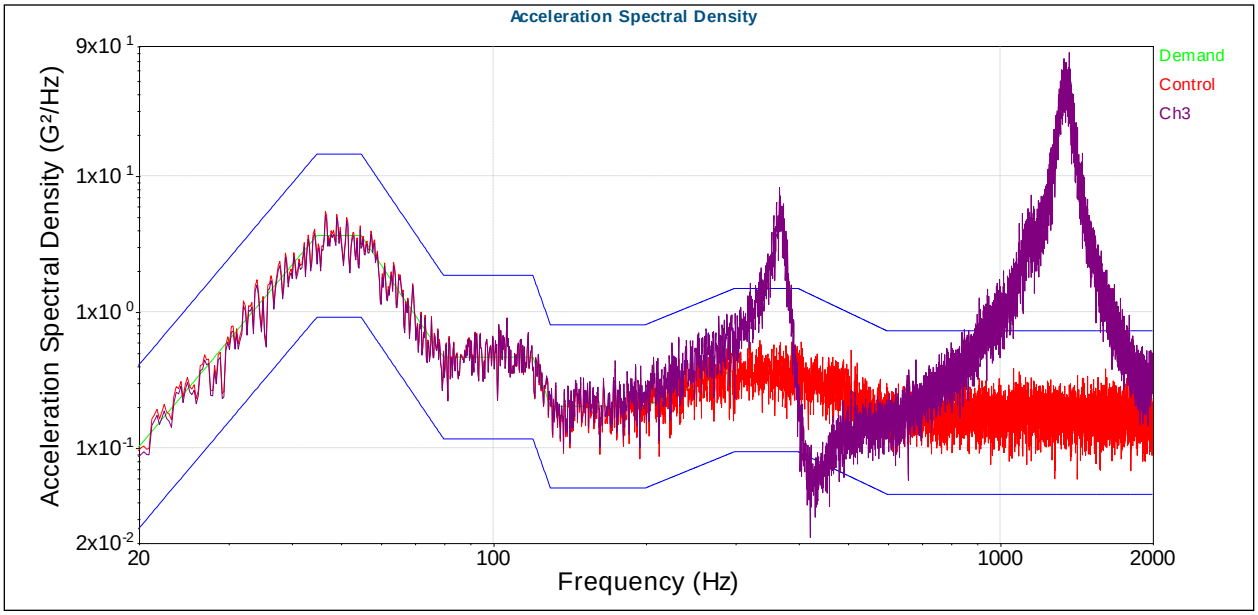
	Accel	*Velocity*	*Displacement*
Ch1	0.4634 G	0.01424 in/s	2.266e-06 in
Ch2	0.5057 G	0.01424 in/s	2.266e-06 in
Ch3	0.7025 G	0.02158 in/s	3.435e-06 in

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Random Vibration, Z Axis Re-Test.

End of Test



Breakpoint table

Frequency	G²/Hz	dB/Octave
20 Hz	0.1	13.3
45 Hz	3.6	0
55 Hz	3.6	-16.53
80 Hz	0.46	0
120 Hz	0.46	-31.32
130 Hz	0.2	0
200 Hz	0.2	4.567
300 Hz	0.37	0
400 Hz	0.37	-5.35
600 Hz	0.18	0
2000 Hz	0.18	

Test level schedule:

	Duration	Level
1)	0:01:00	100 %

** Test started Jun 09, 2022 08:59:26, running for 0:02:16
** Current level: 1, running at 100 % for 0:01:00 of 0:01:00

Measurements:

Demand: 22.49 G RMS	0.3092 in pk-pk
Control: 22.34 G RMS	0.308 in pk-pk

Channel Measurements:

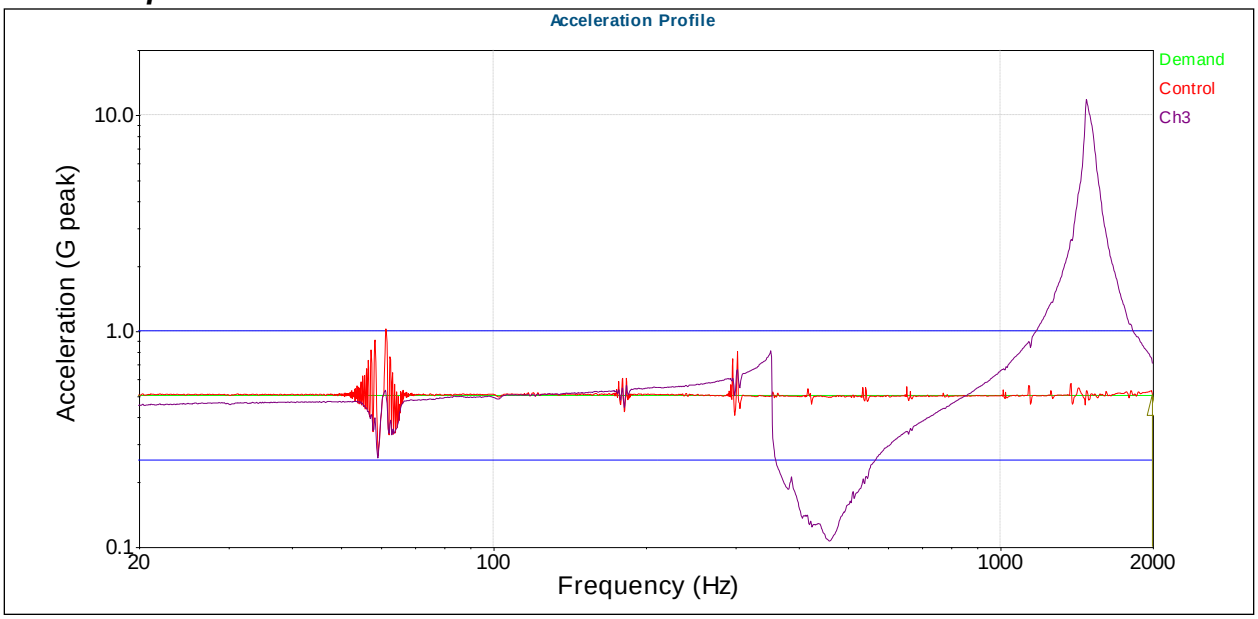
	(Overall)	(InBand)
Ch1	22.39 G RMS	22.44 G RMS
Ch2	22.22 G RMS	22.23 G RMS
Ch3	84.55 G RMS	83.51 G RMS

Environmental Testing Laboratory, Inc.

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

Customer: Radio Amateur Satellite Corp.
Job#: 16602, Post-Sine Sweep, Z Axis Re-Test.

End of Sweep Test



Breakpoint table

Start Freq.	Amplitude	End Freq.	Amplitude
20 Hz	0.5 G	2000 Hz	0.5 G

Test level schedule:

	Duration	Level
1)	1 sweeps	100 %

** Test started Jun 09, 2022 09:01:37, running for 0:02:41
** Current level: 1, running at 100 %, 1 of 1 sweeps complete

Current Measurements:

Demand: 0.5 G at 2000 Hz
Control: 0.5058 G
Control Vel.: 0.01554 in/s
Control Disp.: 2.473e-06 in
Ch1: 0.4634 G
Ch2: 0.5057 G
Ch3: 0.7025 G
Ch4: 0.0003088 G

Channel Measurements:

	Accel	*Velocity*	*Displacement*
Ch1	0.4634 G	0.01424 in/s	2.266e-06 in
Ch2	0.5057 G	0.01424 in/s	2.266e-06 in
Ch3	0.7025 G	0.02158 in/s	3.435e-06 in

11034 Indian Trail
Dallas, TX 75229-3513
(972) 247-9657
Fax (972) 247-9659
info@etldallas.com

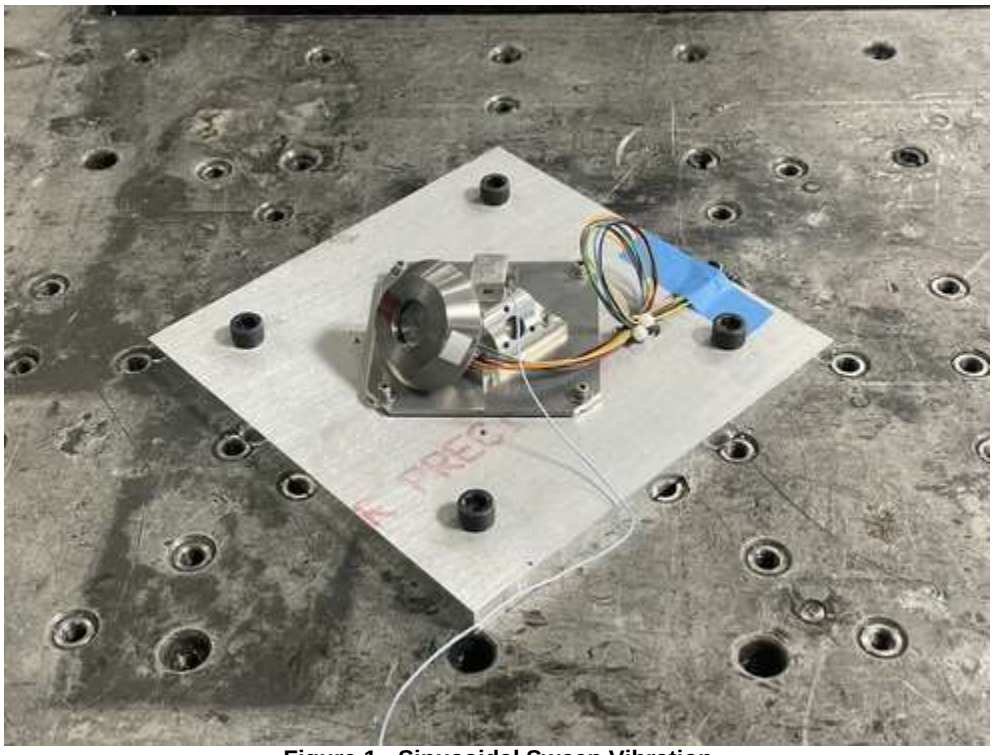


Figure 1 - Sinusoidal Sweep Vibration

Figure 2 - Sinusoidal Sweep Vibration

ETL	**Environmental Testing Laboratory, Inc Calibration Data**	ETL #1401

Environmental Testing Laboratory, Inc. is accredited by ANSI National Accreditation Board (ANAB) to ISO/IEC 17025:2017. Refer to Certificate of Accreditation and Scope of Accreditation Certificate Number: AT-1787. Certificate Valid Through 5/24/2023.

Condition of instrument as received:		**X**	**Within tolerance**	**Instrument:** Vibration Research Controller
			Out of tolerance	**Manufacturer:** Vibration Research Corporation
			Limited Use	**Due Date:** 10/2/2021
			New	**Calibration Date:** 10/1/2021
X	**Internal Calibration**		**External Calibration**	**Cal Freq:** 12 months
Serial #: 9505DD41		**Model #:** VR9500 Revolution		**Next Cal Due:** 10/1/2022
ETL Calibration Procedure #: 2.23-ETL-QS				**Budget:** N/A

Calibrator and Additional Standards

ETL Asset #	Manufacturer	Model	Accuracy	Ch#	Uncertainty	Cert #	Cal Due Date
ETL #1358	Agilent Technologies	34401A	0.0035 V	1	See Certificate	1063-22	3/9/2022

Ambient conditions during cal:	**Barometric Pressure:** 29.56 **"Hg**	**Relative Humidity:** 68 **%**	**Temperature:** 26 **°C**

STD IN*			PRE CAL*		POST CAL*	
MU*	**Channel #1**	**Channel #2**	**Channel #1**	**Channel #2**	**Channel #1**	**Channel #2**

Verification and calibration done internally with Vibration Research Inc. software. See attached Certificate of Calibration # 9505DD4120211001

Measurement Uncertainty(1,2):

MU* = Use for measurement uncertainty calculation, Y = Yes, N = No

Keegan Larimer

Calibrated By: Keegan Larimer

Calibration Date: 10/1/2021

Certificate of Calibration

Certificate No.:9505DD4120211001

Equipment:

Manufacturer: Vibration Research Corporation
Item: VibrationVIEW I/O Box
Serial Number: 9505DD41

Procedures used:

VRC9555AC Rev.C as automated with Vibration Research software VR95-CAL.

Environmental Conditions:

Ambient Temperature: 26 C (23C +/- 5C)
Relative Humidity: 68 % (< 85%)

Received Condition: In Tolerance

Shipped condition: Calibrated

Calibration:

Calibration Date: Oct 1, 2021
Calibration Due: Oct 1, 2022
Calibration Technician: Keegan Larimer

Parameters tested:

See attached calibration table and graphs.

Remarks or Special Requirements:

Our calibration procedures are designed to provide measurement uncertainty of less than or equal to one quarter of the specification of the unit under test, where possible, with a coverage factor of 2. Traceability is to national standards administered by the U.S. NIST.

Comments:

None.

Signature:

Keegan Larimer

List of Test Equipment

Meter Brand / Model	Serial Number	Trace Number	Due Date
HEWLETT-PACKARD 34401A	US36223701	1063-22	3/9/2022

ETL	**Environmental Testing Laboratory, Inc Calibration Data**	ETL #1534

Environmental Testing Laboratory, Inc. is accredited by ANSI National Accreditation Board (ANAB) to ISO/IEC 17025:2017. Refer to Certificate of Accreditation and Scope of Accreditation Certificate Number: AT-1787. Certificate Valid Through 5/24/2023.

Condition of instrument as received:		**X**	**Within tolerance**	**Instrument:** PCB Piezotronics Accelerometer	
			Out of tolerance	**Manufacturer:** PCB Piezotronics	
			Limited Use	**Due Date:** 4/23/2022	
			New	**Calibration Date:** 3/14/2022	
X	**Internal Calibration**		**External Calibration**	**Cal Freq:** 12 months	
Serial #: LW150726		**Model #:** 352A21		**Next Cal Due:** 3/14/2023	
ETL Calibration Procedure #: 2.08-ETL-QS				**Budget:** 0.95-1.05 G/G for 1-4000 Hz	

Calibrator and Additional Standards

ETL Asset #	Manufacturer	Model	Accuracy	Ch#	Uncertainty	Cert #	Cal Due Date
ETL #1674	PCB Piezotronics	301A11	+/-0.5 %	1	3.0 %	CAL20-3698664747.180+1, CAL96-3698684469.760+1	3/15/2022
ETL #1400	Vibration Research Corporation	VR9500 Revolution	0.3 %	1	0.3 %	950663BE20211021	10/21/2022

Ambient conditions during cal:	**Barometric Pressure:** 29.59 **"Hg**	**Relative Humidity:** 47 **%**	**Temperature:** 22 **°C**

STD IN*			PRE CAL*		POST CAL*	
MU*	**Channel #1**	**Channel #2**	**Channel #1**	**Channel #2**	**Channel #1**	**Channel #2**
	Calibration results fall within Budget limits. See Transmissibility Graph on attached Calibration Certificate.					

Measurement Uncertainty(1,2):

MU* = Use for measurement uncertainty calculation, Y = Yes, N = No

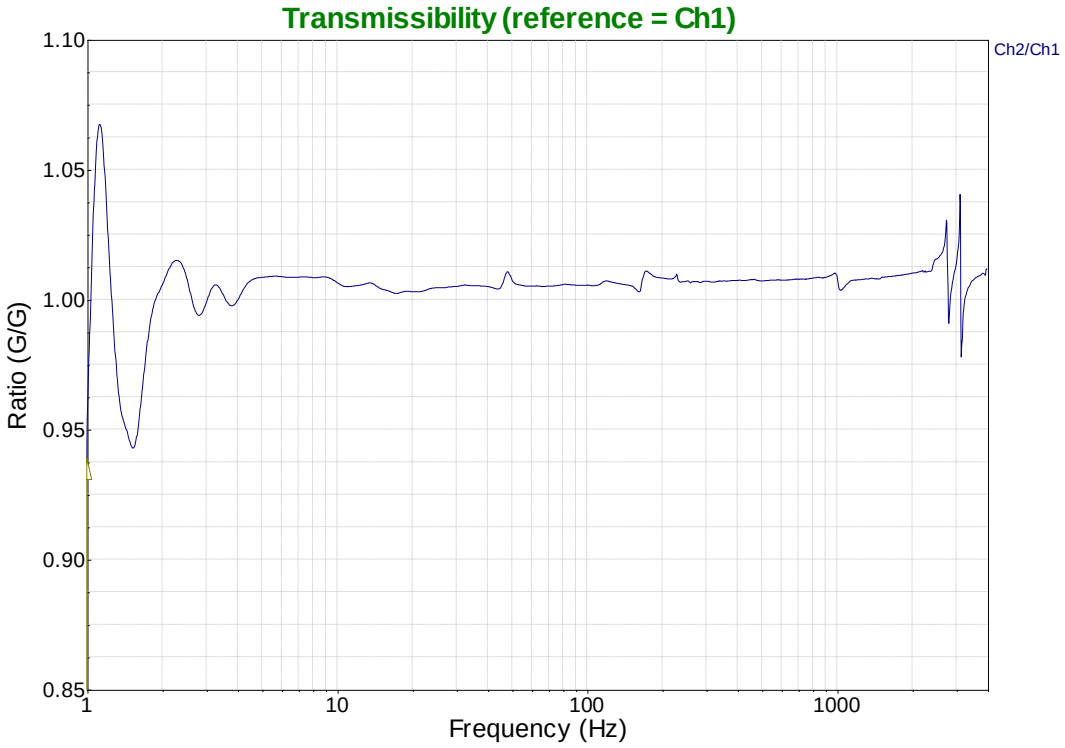
Keegan Larimer

Calibrated By: Keegan Larimer

Calibration Date:3/14/2022

Calibration Certificate

Report Date	5/14/2022
ETL Asset Number	1534
Model	352A21
Serial#	LW150726
New Unit	
Re-Calibration	X
● As Received	In Tolerance
● As Returned	In Tolerance
Ref. Sensitivity	10.18 mV/G
Remarks:	None.



ETL	**Environmental Testing Laboratory, Inc Calibration Data**	ETL #1535

Environmental Testing Laboratory, Inc. is accredited by ANSI National Accreditation Board (ANAB) to ISO/IEC 17025:2017. Refer to Certificate of Accreditation and Scope of Accreditation Certificate Number: AT-1787. Certificate Valid Through 5/24/2023.

Condition of instrument as received:		**X**	**Within tolerance**	**Instrument:** PCB Piezotronics Accelerometer	
			Out of tolerance	**Manufacturer:** PCB Piezotronics	
			Limited Use	**Due Date:** 4/23/2022	
			New	**Calibration Date:** 3/13/2022	
X	**Internal Calibration**		**External Calibration**	**Cal Freq:** 12 months	
Serial #: LW150727		**Model #:** 352A21		**Next Cal Due:** 3/13/2023	
ETL Calibration Procedure #: 2.08-ETL-QS				**Budget:** 0.95-1.05 G/G for 1-4000 Hz	

Calibrator and Additional Standards

ETL Asset #	Manufacturer	Model	Accuracy	Ch#	Uncertainty	Cert #	Cal Due Date
ETL #1674	PCB Piezotronics	301A11	+/-0.5 %	1	3.0 %	CAL20-3698664747.180+1, CAL96-3698684469.760+1	3/15/2022
ETL #1400	Vibration Research Corporation	VR9500 Revolution	0.3 %	1	0.3 %	950663BE20211021	10/21/2022

Ambient conditions during cal:	**Barometric Pressure:** 29.79 **"Hg**	**Relative Humidity:** 17 **%**	**Temperature:** 22 **°C**

STD IN*			PRE CAL*		POST CAL*	
MU*	**Channel #1**	**Channel #2**	**Channel #1**	**Channel #2**	**Channel #1**	**Channel #2**
	Calibration results fall within Budget limits. See Transmissibility Graph on attached Calibration Certificate.					

Measurement Uncertainty(1,2):

MU* = Use for measurement uncertainty calculation, Y = Yes, N = No

Keegan Larimer

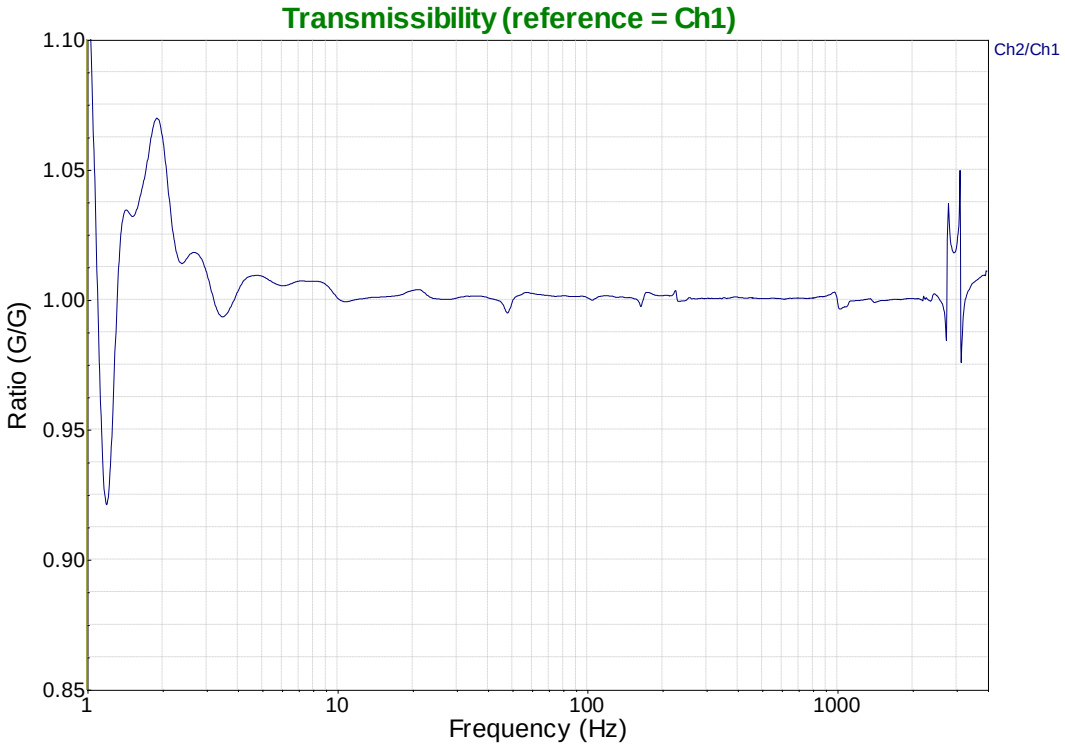
Calibrated By: Keegan Larimer

Calibration Date:3/13/2022

Environmental Testing Laboratory, Inc.

Calibration Certificate

Report Date	3/13/2022
ETL Asset Number	1535
Model	352A21
Serial#	LW150727
New Unit	
Re-Calibration	X
● As Received	In Tolerance
● As Returned	In Tolerance
Ref. Sensitivity	10.18 mV/G
Remarks:	None.



ETL	**Environmental Testing Laboratory, Inc Calibration Data**	ETL #1717

Environmental Testing Laboratory, Inc. is accredited by ANSI National Accreditation Board (ANAB) to ISO/IEC 17025:2017. Refer to Certificate of Accreditation and Scope of Accreditation Certificate Number: AT-1787. Certificate Valid Through 5/24/2023.

Condition of instrument as received:			X	**Within tolerance**	**Instrument:** PCB Piezotronics Accelerometer
				Out of tolerance	**Manufacturer:** PCB Piezotronics
				Limited Use	**Due Date:** 11/4/2021
				New	**Calibration Date:** 11/4/2021
X	**Internal Calibration**		**External Calibration**		**Cal Freq:** 12 months
Serial #: LW351177		**Model #:** 352A21			**Next Cal Due:** 11/4/2022
ETL Calibration Procedure #: 2.08-ETL-QS					**Budget:** 0.95-1.05 G/G for 1-4000 Hz

Calibrator and Additional Standards

ETL Asset #	Manufacturer	Model	Accuracy	Ch#	Uncertainty	Cert #	Cal Due Date
ETL #1674	PCB Piezotronics	301A11	+/-0.5 %	1	3.0 %	CAL20-3698664747.180+1, CAL96-3698684469.760+1	3/15/2022
ETL #1415	Vibration Research Corporation	VR9500 Revolution	0.3%	1	0.2%	950776D120210504	5/4/2022

Ambient conditions during cal:	**Barometric Pressure:** 29.84 **"Hg**	**Relative Humidity:** 38 **%**	**Temperature:** 22 **°C**

STD IN*			PRE CAL*		POST CAL*	
MU*	**Channel #1**	**Channel #2**	**Channel #1**	**Channel #2**	**Channel #1**	**Channel #2**
	Calibration results fall within Budget limits. See Transmissibility Graph on attached Calibration Certificate.					

Measurement Uncertainty(1,2):

MU* = Use for measurement uncertainty calculation, Y = Yes, N = No

Keegan Larimer

Calibrated By: Keegan Larimer

Calibration Date: 11/4/2021

Environmental Testing Laboratory, Inc.

Calibration Certificate

Report Date	11/4/2021
ETL Asset Number	1717
Model	352A21
Serial#	LW351177
New Unit	
Re-Calibration	X
● As Received	In Tolerance
● As Returned	In Tolerance
Ref. Sensitivity	10.15 mV/G
Remarks:	None.