SEISMIC TEST REPORT – 17101TR1.0

MANUFACTURER

LS ELECTRIC CO., LTD

LS Tower, 127, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-Do, 14119, Republic of Korea

Contact: Namki Lee - +82-41-550-8585 - nlee@ls-electric.com

TEST CRITERIA

Testing was performed in accordance with ICC-ES AC156 to the following seismic levels:

Level	S_{DS_1} (g)	$z/h_{\_1}$	S_{DS_2} (g)	$z/h_{\_2}$	$A_{FLX\text{-}H}$ (g)	$A_{RIG\text{-}H}$ (g)	$A_{FLX\text{-}V}$ (g)	$A_{RIG\text{-}V}$ (g)
1	2.00	1	2.50	0	3.20	2.40	1.68	0.68

TEST UNITS

UUT	Description	Mounting	Dimensions (in)			Weight (lb)	Resonant Freq. (Hz)			Max. Level	Test Date
			Depth	Width	Height		F-B	S-S	V		
UUT 1	LSLV0075SP100-2CEND3	Wall	7.1	6.2	29.5	34	N/A	N/A	N/A	1	12/11/2019
UUT 2	LSLV0150H100-4CEFN+DI	Wall	9.2	7.1	24.6	24	N/A	N/A	N/A	1	12/11/2019
UUT 3	LSLV0185H100-2CENN+DI	Wall	9.2	8.7	23.0	30	N/A	N/A	N/A	1	12/11/2019
UUT 4	LSLV0300SP100-4CEFD3	Wall	10.0	9.4	44.6	107	N/A	N/A	N/A	1	12/11/2019
UUT 5	LSLV0300H100-4CEFN+FL	Wall	8.8	8.7	15.1	21	N/A	N/A	N/A	1	12/11/2019
UUT 6	LSLV0370H100-4CEFD	Wall	11.2	10.8	20.5	60	N/A	N/A	N/A	1	12/11/2019
UUT 7	LSLV0450H100-4COFD	Wall	11.2	12.1	20.1	75	N/A	N/A	N/A	1	12/11/2019
UUT 8	LSLV0550SP100-4CEND3	Wall	12.0	12.9	57.5	182	N/A	N/A	N/A	1	12/11/2019
UUT 9	LSLV0750H100-4COND+FL	Wall	12.8	12.1	21.7	92	N/A	N/A	N/A	1	12/11/2019
UUT 10	LSLV0900H100-4CEND	Wall	12.8	12.1	27.0	104	N/A	N/A	N/A	1	12/11/2019
UUT 11	LSLV0900H100-4CEND+DI	Wall	12.2	12.1	38.6	121	N/A	N/A	N/A	1	12/11/2019

TESTING LABORATORY

ENVIRONMENTAL TESTING LABORATORY

11034 Indian Trail, Dallas, TX 75229

Contact: Jeremy Lange - 972-247-9657 - jeremy@etldallas.com

Table: 10ft x 10ft Triaxial

CERTIFICATION COMPANY

MANWILL ENGINEERING LLC

Certifying Engineer: Derek Manwill, SE

California License Number: S6266

Date Signed: 06/23/2023

TESTING SUMMARY

Each referenced UUT was tested in accordance with the requirements of ICC-ES AC156 and was full of operating content during the shake table test. Each UUT maintained structural integrity and remained functional per manufacturer requirement after the shake table test.

Test Units

UUT	Description	Mounting	Dimensions (in)			Weight (lb)	Resonant Freq. (Hz)			Max. Level	Test Date
			Depth	Width	Height		F-B	S-S	V		
UUT 1	LSLV0075SP100-2CEND3	Wall	7.1	6.2	29.5	34	N/A	N/A	N/A	1	12/11/2019
UUT 2	LSLV0150H100-4CEFN+DI	Wall	9.2	7.1	24.6	24	N/A	N/A	N/A	1	12/11/2019
UUT 3	LSLV0185H100-2CENN+DI	Wall	9.2	8.7	23.0	30	N/A	N/A	N/A	1	12/11/2019
UUT 4	LSLV0300SP100-4CEFD3	Wall	10.0	9.4	44.6	107	N/A	N/A	N/A	1	12/11/2019
UUT 5	LSLV0300H100-4CEFN+FL	Wall	8.8	8.7	15.1	21	N/A	N/A	N/A	1	12/11/2019
UUT 6	LSLV0370H100-4CEFD	Wall	11.2	10.8	20.5	60	N/A	N/A	N/A	1	12/11/2019
UUT 7	LSLV0450H100-4COFD	Wall	11.2	12.1	20.1	75	N/A	N/A	N/A	1	12/11/2019
UUT 8	LSLV0550SP100-4CEND3	Wall	12.0	12.9	57.5	182	N/A	N/A	N/A	1	12/11/2019
UUT 9	LSLV0750H100-4COND+FL	Wall	12.8	12.1	21.7	92	N/A	N/A	N/A	1	12/11/2019
UUT 10	LSLV0900H100-4CEND	Wall	12.8	12.1	27.0	104	N/A	N/A	N/A	1	12/11/2019
UUT 11	LSLV0900H100-4CEND+DI	Wall	12.2	12.1	38.6	121	N/A	N/A	N/A	1	12/11/2019

Note: See UUT Summaries for detailed description of UUT mounting. The fixture was isolated and rigid mounted to the table, depending on the test run.

Test Data

The test levels are listed below:

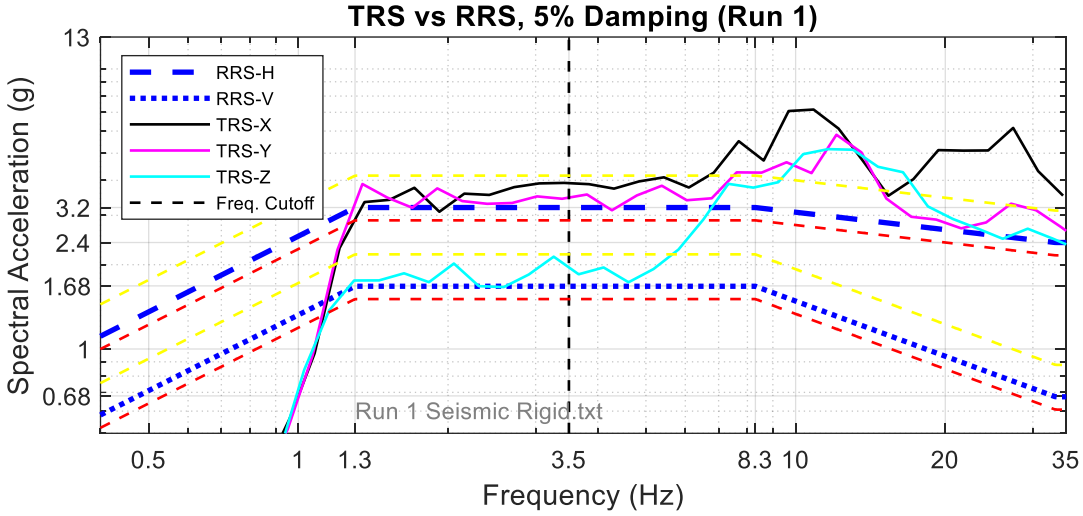
Level	S_{DS_1} (g)	z/h_1	S_{DS_2} (g)	z/h_2	A_{FLX-H} (g)	A_{RIG-H} (g)	A_{FLX-V} (g)	A_{RIG-V} (g)
1	2.00	1	2.50	0	3.20	2.40	1.68	0.68

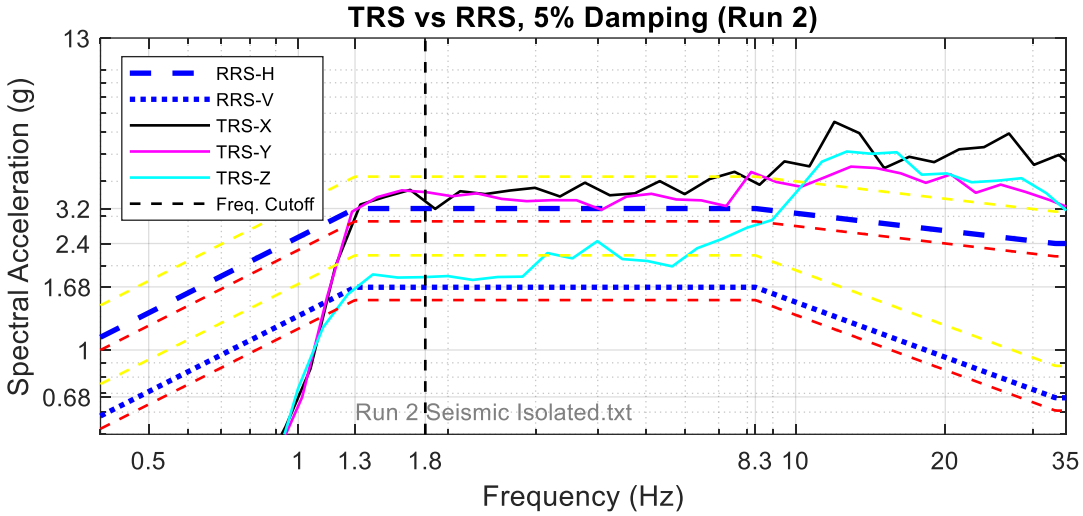
The acceleration time histories met the 90% A_{RIG} requirement from AC156 as shown below:

Test Run	Date	Level	Description	90% A_{RIG} (g)		Peak Table Acceleration (g)		
				Horizontal	Vertical	X	Y	Z
Run 1	12/11/2019	1	UUT 1 to UUT 11 (Rigid)	2.16	0.61	3.00	2.21	1.50
Run 2	12/11/2019	1	UUT 1 to UUT 11 (Isolated)	2.16	0.61	3.16	2.28	1.95

The Test Response Spectra met the Required Response Spectra as allowed by Section 6.5.3 of AC156. Shake table motions in three orthogonal directions were found to be statistically independent. Detailed plots and tabular data can be found in the section for each test run.

Test Response Spectra vs. Required Response Spectra





MANWILL ENGINEERING

LS ELECTRIC

REVISION HISTORY

Revision	Date	Revision Description
0	06/23/2023	Initial issue of report.

TABLE OF CONTENTS

TEST WITNESSES

Jeong-Dae “J.D.” – LS Electric Co., Ltd
Jeremy Lange, Jeff Lewis – Environmental Testing Laboratory
Derek Manwill – Manwill Engineering

SHAKE TABLE INFORMATION

Table: 10ft x 10ft Triaxial; Displacement: 10in; Maximum Velocity: 75in/sec; Frequency Range: 1-100Hz; Actuators: (6) 24kip; Maximum Acceleration: 7g; Maximum Payload: 20kip.

Environmental Testing Laboratory is accredited to ISO 17025 for the ICC-ES AC156 test standard by the ANSI-ASQ National Accreditation Board. The accreditation certificate is attached to the end of the report. The required equipment was in calibration at the time of testing, as shown in the equipment calibration schedule below.

Lab ID	Ch.	Description	Manufacturer	Model	Cal. Date	Cal. Due
1430	1	Accelerometer	PCB Piezotronics	353B34	6/14/2019	6/14/2020
1431	5	Accelerometer	PCB Piezotronics	353B34	6/15/2019	6/15/2020
1432	9	Accelerometer	PCB Piezotronics	353B34	6/22/2019	6/22/2020
1643	2	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1644	6	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1645	10	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1656	3	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1657	7	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1658	11	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1653	4	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1654	8	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1655	12	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1635	13	Accelerometer	PCB Piezotronics	355B03	3/15/2019	3/15/2020
1636	14	Accelerometer	PCB Piezotronics	355B03	3/15/2019	3/15/2020
1637	15	Accelerometer	PCB Piezotronics	355B03	3/15/2019	3/15/2020
1650	16	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1651	17	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1652	18	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1640	19	Accelerometer	PCB Piezotronics	355B03	3/15/2019	3/15/2020
1641	20	Accelerometer	PCB Piezotronics	355B03	3/15/2019	3/15/2020
1642	21	Accelerometer	PCB Piezotronics	355B03	3/15/2019	3/15/2020
1631	22	Accelerometer	PCB Piezotronics	355B03	3/8/2019	3/8/2020
1632	23	Accelerometer	PCB Piezotronics	355B03	3/8/2019	3/8/2020
1634	24	Accelerometer	PCB Piezotronics	355B03	3/15/2019	3/15/2020
1646	25	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1647	26	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1648	27	Accelerometer	PCB Piezotronics	355B03	3/29/2019	3/29/2020
1629	28	Accelerometer	PCB Piezotronics	355B03	2/5/2019	2/5/2020
1630	29	Accelerometer	PCB Piezotronics	355B03	2/5/2019	2/5/2020
1631	30	Accelerometer	PCB Piezotronics	355B03	3/8/2019	3/8/2020
1416	N/A	Vibration Controller	Vibration Research	VR9500 Revolution	5/8/2019	5/8/2020
1417	N/A	Vibration Controller	Vibration Research	VR9500 Revolution	5/8/2019	5/8/2020
1418	N/A	Vibration Controller	Vibration Research	VR9500 Revolution	5/6/2019	5/6/2020
1419	N/A	Vibration Controller	Vibration Research	VR9500 Revolution	5/3/2019	5/3/2020
1420	N/A	Vibration Controller	Vibration Research	VR9500 Revolution	5/3/2019	5/3/2020
1421	N/A	Vibration Controller	Vibration Research	VR9500 Revolution	5/2/2019	5/2/2020
1422	N/A	Vibration Controller	Vibration Research	VR9500 Revolution	5/2/2019	5/2/2020

TEST PROCEDURE

The following test procedure was implemented in accordance with ICC-ES AC156. Detailed photographs and plots can be found in the section for each test run.

Pre-Test Inspection, Weighing, and Measuring

Upon arrival at the lab, each UUT was visually examined for structural damage from transport and lifting. No visible damage was observed. Photographs of the pre-test condition are included in the section for each test run. Each UUT was weighed and measured at the test laboratory. The results can be found in the “UUT Summary” table at the beginning of this report.

Pre-Test Functional Verification

Functional testing was performed by the manufacturer at the test laboratory prior to performing the multi-frequency seismic simulation test. The functional test included powering the drives, ensuring all internal components operated, and running a motor from the drive. Each UUT passed the functional tests.

Mounting

Each UUT was mounted to the test fixture as described in the footnotes of the “UUT Summary” table at the beginning of this report. The fixture was isolated and rigid mounted to the table, depending on the test run, as described in the footnotes of the “UUT Summary” table at the beginning of this report.

Monitoring

Reference control accelerometers were located on the shake table. These accelerometers were used to determine the shake table motions and compliance with the requirements of ICC-ES AC156. Accelerometers were located on each UUT. Photographs of the accelerometer placement are included in the section for each test run.

Resonant Frequency Search

A resonant frequency search was performed prior to performing the multi-frequency seismic simulation test. The search was a 0.1g ± 0.05g sine sweep from 1.3 to 50Hz at two octaves per minute. Transmissibility plots can be found in the section for each test run.

Multi-Frequency Seismic Simulation Test

Each UUT was subjected to a multi-frequency seismic simulation test with the parameters shown in the “Test Data” section at the beginning of this report. The input motion was approximately 30 seconds long with at least 20 seconds of strong motion. The plots of TRS vs. RRS, Acceleration Time History, Coherence, and Cross Correlation can be found in the section for each test run.

Post-Test Inspection

After the multi-frequency seismic simulation test, each UUT was visually examined. No visible damage was observed. Photographs of the post-test condition are included in the section for each test run.

Post-Test Functional Verification

Functional testing was performed by the manufacturer at the test laboratory after performing the multi-frequency seismic simulation test. The post-test functional verification was identical to the pre-test functional verification listed above. Each UUT passed the functional tests.

UUT SUMMARY

UUT Summary – UUT 1

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0075SP100-2CEND3

Dimensions: Depth=7.1-in, Width=6.2-in, Height=29.5-in, Weight=34-lb

Resonant Frequencies: F-B=N/A, S-S=N/A, V=N/A

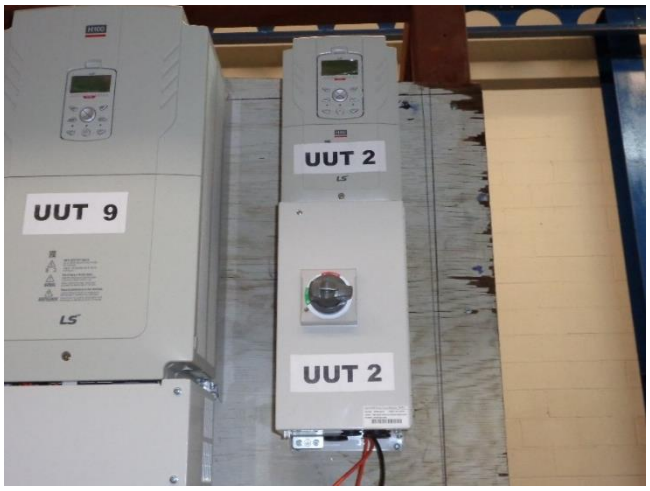
Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (4) #10 wood screws. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: LS Electric - capacitor PCB (10120003821), Metasol - contactor (13370032), Kosed - DC reactors (22910000874), LS Electric - manual motor starter (7051051), Wabash - transformer (73016296006), LS Electric - power PCB (10120004554), LS Electric - OL detector (38060134), Honeywell - thermal overload device (6110000126), Osada - terminal block (10060001237), LS Electric - auxiliary contact (83361634001), LS Electric - interlock unit (83411634001), Fuji - PIM/IGBT (8910000851), LS Electric - main power assembly (10120004554), LS Electric - input PCB (10120003803), LS Electric - I/O CPU (10120004549), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294114), DCC - fan (7760000244), LS Electric - LED bar (63466295001), LS Electric - LCD keypad (11040002604)



UUT Summary – UUT 2

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0150H100-4CEFN+DI

Dimensions: Depth=9.2-in, Width=7.1-in, Height=24.6-in, Weight=24-lb

Resonant Frequencies: F-B=N/A , S-S=N/A , V=N/A

Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (6) #10 wood screws. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: LS Electric - disconnect modules (64160044), LS Electric - capacitor PCB (10120003826), LS Electric - circuit breaker (02070354UL), LS Electric - power PCB (10120004561), Infineon - PIM/IGBT (08910000856), LS Electric - main power assembly (10120004561), LS Electric - input PCB (10120003807), LS Electric - I/O CPU (10120004549), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294117), Nidec - fan (7760000299), LS Electric - LED bar (63466295001), LS Electric - LCD keypad (11040002604)

UUT Summary – UUT 3

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0185H100-2CENN+DI

Dimensions: Depth=9.2-in, Width=8.7-in, Height=23.0-in, Weight=30-lb

Resonant Frequencies: F-B=N/A, S-S=N/A, V=N/A

Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (6) #10 wood screws. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: LS Electric - disconnect modules (64160036), LS Electric - capacitor PCB (10120003827), LS Electric - manual motor starter (7070019), LS Electric - power PCB (10120004557), Fuji - PIM/IGBT (8910000853), LS Electric - main power assembly (10120004557), LS Electric - input PCB (10120003805), LS Electric - I/O CPU (10120004549), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294120), Nidec - fan (7760000172), LS Electric - LED bar (63466295001), LS Electric - LCD keypad (11040002604)

UUT Summary – UUT 4

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0300SP100-4CEFD3

Dimensions: Depth=10.0-in, Width=9.4-in, Height=44.6-in, Weight=107-lb

Resonant Frequencies: F-B=N/A, S-S=N/A, V=N/A

Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (4) #10 wood screws. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: LS Electric - capacitor PCB (10120003831), Metasol - contactor (13620002), Kosed - DC reactors (22910000889), LS Electric - circuit breaker (02070368UL), Wabash - transformer (73016296006), LS Electric - power PCB (10120004564), LS Electric - OL detector (38060132), Honeywell - thermal overload device (6110000126), Osada - terminal block (10060001237), LS Electric - auxiliary contact (83361634001), LS Electric - interlock unit (83411634001), Infineon - PIM/IGBT (08910000858), LS Electric - main power assembly (10120004564), LS Electric - input PCB (10120003808), LS Electric - I/O CPU (10120004549), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294120), Nidec - fan (7760000172), LS Electric - LED bar (63466295001), LS Electric - LCD keypad (11040002604)

UUT Summary – UUT 5

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0300H100-4CEFN+FL

Dimensions: Depth=8.8-in, Width=8.7-in, Height=15.1-in, Weight=21-lb

Resonant Frequencies: F-B=N/A, S-S=N/A, V=N/A

Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (4) #10 wood screws. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: LS Electric - capacitor PCB (10120003831), LS Electric - power PCB (10120004564), Infineon - PIM/IGBT (08910000858), LS Electric - main power assembly (11040002616), LS Electric - input PCB (10120003808), LS Electric - I/O CPU (10120004549), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294120), Nidec - fan (7760000172), LS Electric - LED bar (63466295001), LS Electric - LCD keypad (11040002604)

UUT Summary – UUT 6

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0370H100-4CEFD

Dimensions: Depth=11.2-in, Width=10.8-in, Height=20.5-in, Weight=60-lb

Resonant Frequencies: F-B=N/A, S-S=N/A, V=N/A

Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (4) 1/4-in lag bolts. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: Kosed - DC reactors (22910000751), Huawei - main capacitor (08810002700), LS Electric - EMC filter (9710000540), LS Electric - power PCB (10120004346), Fuji - PIM/IGBT (8910001102), LS Electric - control PCB (10120004581), LS Electric - main PCB (10120004566), LS Electric - snubber PCB (10120004347), Sanrex - diode module (08960001322), LS Electric - I/O CPU (10120004550), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294123), LS Electric - terminal block (62776224001), Nidec - fan (7760000172), Shizuki - snubber capacitor (8810002338), LS Electric - capacitor bank (50826224001), LS Electric - busbar (70226224035, 70226224037, 70226225012), LS Electric - busbar diode (70216225048), LS Electric - LED bar (63466295001), LS Electric - noise filter circuit assembly (77026236100), LS Electric - LCD keypad (11040002604)

UUT Summary – UUT 7

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0450H100-4COFD

Dimensions: Depth=11.2-in, Width=12.1-in, Height=20.1-in, Weight=75-lb

Resonant Frequencies: F-B=N/A, S-S=N/A, V=N/A

Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (4) 1/4-in lag bolts. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: Kosed - DC reactors (22910000752), Huawei - main capacitor (08810002699), LS Electric - EMC filter (9710000541), LS Electric - control PCB (10120004581), LS Electric - main PCB (10120004567), LS Electric - gate drive (10120006332), LS Electric - CT PCB (10120004349), LS Electric - snubber PCB (10120004347), Sanrex - diode module (08960001322), LS Electric - I/O CPU (10120004550), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294126), LS Electric - terminal block (62776224004), Nidec - fan (7760000172), Shizuki - snubber capacitor (8810002338), LS Electric - capacitor bank (50826224002), LS Electric - busbar (70226224038, 70226224039), LS Electric - busbar diode (70216225048), LS Electric - LED bar (63466295001), LS Electric - noise filter circuit assembly (77026236100), LS Electric - LCD keypad (11040002604)

UUT Summary – UUT 8

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0550SP100-4CEND3

Dimensions: Depth=12.0-in, Width=12.9-in, Height=57.5-in, Weight=182-lb

Resonant Frequencies: F-B=N/A, S-S=N/A, V=N/A

Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (4) 5/16-in lag bolts. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: Metasol - contactor (13640002), Kosed - DC reactors (22910000753), Huawei - main capacitor (08810002701), LS Electric - circuit breaker (02070369UL), Wabash - transformer (73016296006), LS Electric - OL detector (38060132), Honeywell - thermal overload device (6110000126), Osada - terminal block (10060002056), LS Electric - auxiliary contact (83361634001), LS Electric - interlock unit (83411634001), Fuji - PIM/IGBT (8910001101), LS Electric - control PCB (10120004581), LS Electric - main PCB (10120004568), LS Electric - gate drive (10120006332), LS Electric - CT PCB (10120004361), LS Electric - snubber PCB (10120004347), Sanrex - diode module (08960001323), LS Electric - I/O CPU (10120004550), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294126), LS Electric - terminal block (62776224002), Nidec - fan (7760000172), Shizuki - snubber capacitor (8810002338), LS Electric - capacitor bank (50826224004), LS Electric - busbar (70226224038, 70226224039), LS Electric - LED bar (63466295001), LS Electric - noise filter circuit assembly (77026236100), LS Electric - LCD keypad (11040002604)

UUT Summary – UUT 9

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0750H100-4COND+FL

Dimensions: Depth=12.8-in, Width=12.1-in, Height=21.7-in, Weight=92-lb

Resonant Frequencies: F-B=N/A, S-S=N/A, V=N/A

Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (4) 5/16-in lag bolts. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: Kosed - DC reactors (22910000754), Huawei - main capacitor (08810002700), Fuji - PIM/IGBT (8910001101), LS Electric - control PCB (10120004581), LS Electric - main PCB (10120004569), LS Electric - gate drive (10120006332), LS Electric - snubber PCB (10120004353), LS Electric - fan SMPS (10120004352), Sanrex - diode module (08960001321), LS Electric - I/O CPU (10120004550), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294129), LS Electric - terminal block (62776224003), NMB - fan (7760000272), Shizuki - snubber capacitor (8810002338), LS Electric - capacitor bank (50826224003), LS Electric - busbar (70226224040), LS Electric - LED bar (63466295001), LS Electric - noise filter circuit assembly (77026236100), LS Electric - LCD keypad (11040002604)

UUT Summary – UUT 10

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0900H100-4CEND

Dimensions: Depth=12.8-in, Width=12.1-in, Height=27.0-in, Weight=104-lb

Resonant Frequencies: F-B=N/A, S-S=N/A, V=N/A

Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (4) 5/16-in lag bolts. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: Kosed - DC reactors (22910000755), Huawei - main capacitor (08810002699), Fuji - PIM/IGBT (8910001100), LS Electric - control PCB (10120004581), LS Electric - main PCB (10120004580), LS Electric - gate drive (10120006333), LS Electric - snubber PCB (10120004353), LS Electric - fan SMPS (10120004352), Sanrex - diode module (08960001321), LS Electric - I/O CPU (10120004550), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294129), LS Electric - terminal block (62776224005), NMB - fan (7760000272), Shizuki - snubber capacitor (8810002338), LS Electric - capacitor bank (50826224005), LS Electric - busbar (70226224040), LS Electric - LED bar (63466295001), LS Electric - noise filter circuit assembly (77026236100), LS Electric - LCD keypad (11040002604)

UUT Summary – UUT 11

Manufacturer: LS Electric Co., Ltd, **Model**: LSLV0900H100-4CEND+DI

Dimensions: Depth=12.2-in, Width=12.1-in, Height=38.6-in, Weight=121-lb

Resonant Frequencies: F-B=N/A, S-S=N/A, V=N/A

Importance Factor, I_P=1.5: Unit was full of operating content during the shake table test. Unit maintained structural integrity and remained functional per manufacturer requirement after shake table test.

Mounting: Wall mounted using (6) 5/16-in lag bolts. For Rigid run, the test fixture was rigid mounted to the table. For Isolated run, the test fixture was mounted to table using (4) Mason SSLFHC spring isolators.

Construction: Carbon steel and plastic construction.

Testing Notes: None.

Subcomponents: LS Electric - disconnect modules (64160052), Kosed - DC reactors (22910000755), Huawei - main capacitor (08810002699), LS Electric - circuit breaker (02090228UL), Fuji - PIM/IGBT (8910001100), LS Electric - control PCB (10120004581), LS Electric - main PCB (10120004580), LS Electric - gate drive (10120006333), LS Electric - snubber PCB (10120004353), LS Electric - fan SMPS (10120004352), Sanrex - diode module (08960001321), LS Electric - I/O CPU (10120004550), LS Electric - I/O TB (10120004551), LS Electric - cover power (64626294129), LS Electric - terminal block (62776224005), NMB - fan (7760000272), Shizuki - snubber capacitor (8810002338), LS Electric - capacitor bank (50826224005), LS Electric - busbar (70226224040), LS Electric - LED bar (63466295001), LS Electric - noise filter circuit assembly (77026236100), LS Electric - LCD keypad (11040002604)

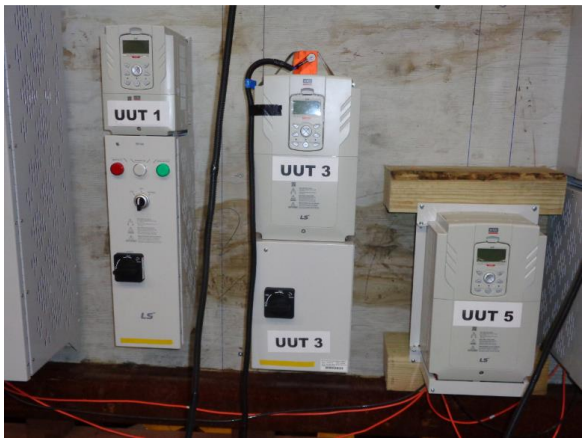
RUN 1 – Rigid

The rigid run was performed to Level 1 as shown in the “Test Data” section at the beginning of this report. This section provides detailed photographs and plots from the testing.

Test Pictures

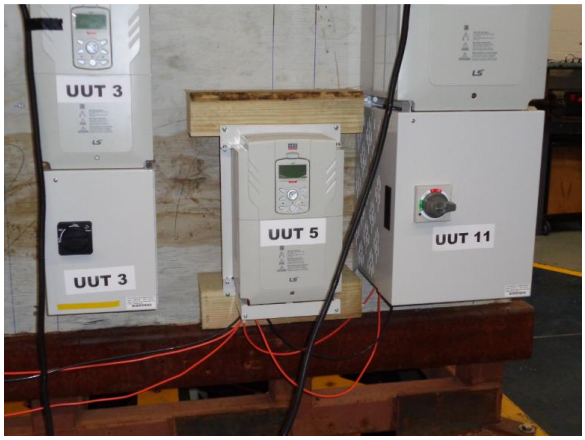
Pre-test UUT 1

Pre-test UUT 2



Pre-test UUT 3

Pre-test UUT 4



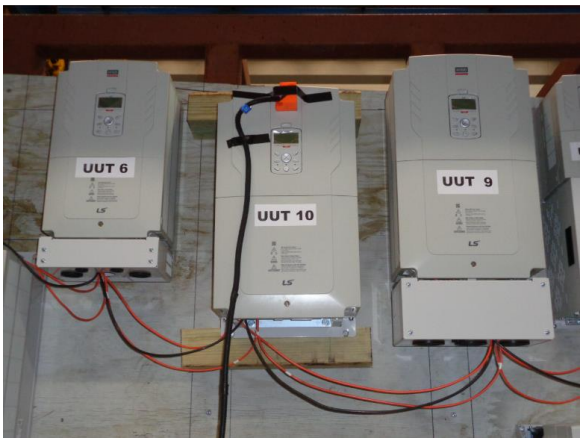
Pre-test UUT 5

Pre-test UUT 6

Pre-test UUT 7

Pre-test UUT 8

Pre-test UUT 9



Pre-test UUT 10

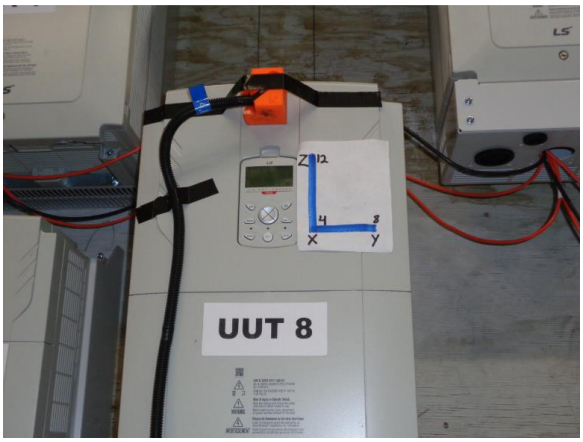
Pre-test UUT 11


Pre-test


Pre-test fixture anchorage

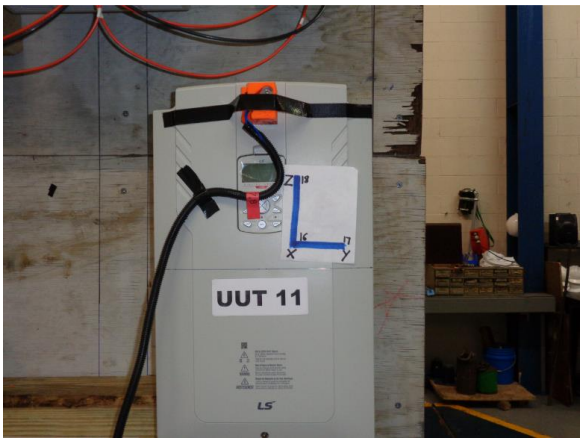

Pre-test fixture

Accelerometer UUT 3
X/FB=Ch3, Y/SS=Ch7, Z/V=Ch11



Accelerometer UUT 8
X/FB=Ch4, Y/SS=Ch8, Z/V=Ch12

Accelerometer UUT 10
X/FB=Ch13, Y/SS=Ch14, Z/V=Ch15



Accelerometer UUT 11
X/FB=Ch16, Y/SS=Ch17, Z/V=Ch18

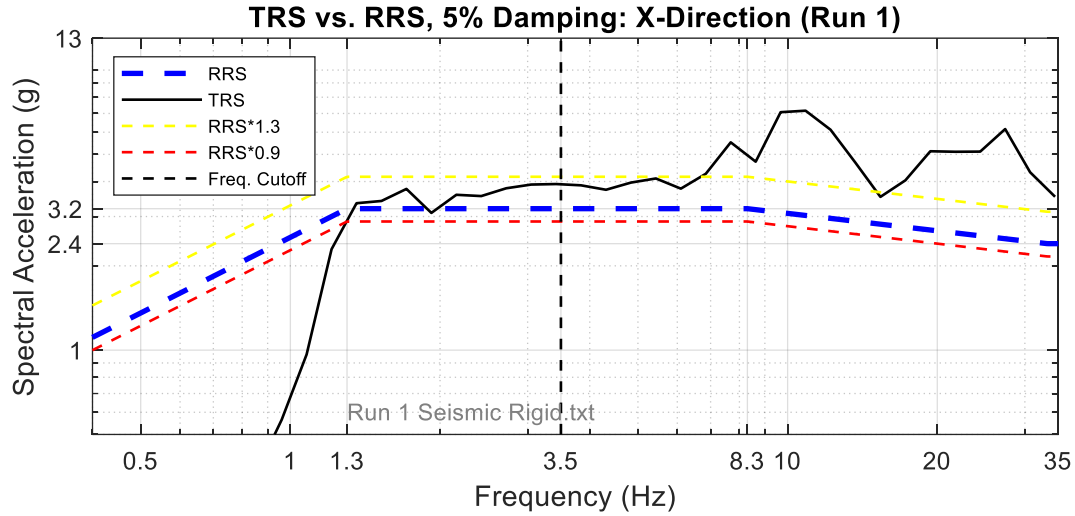
Post-test

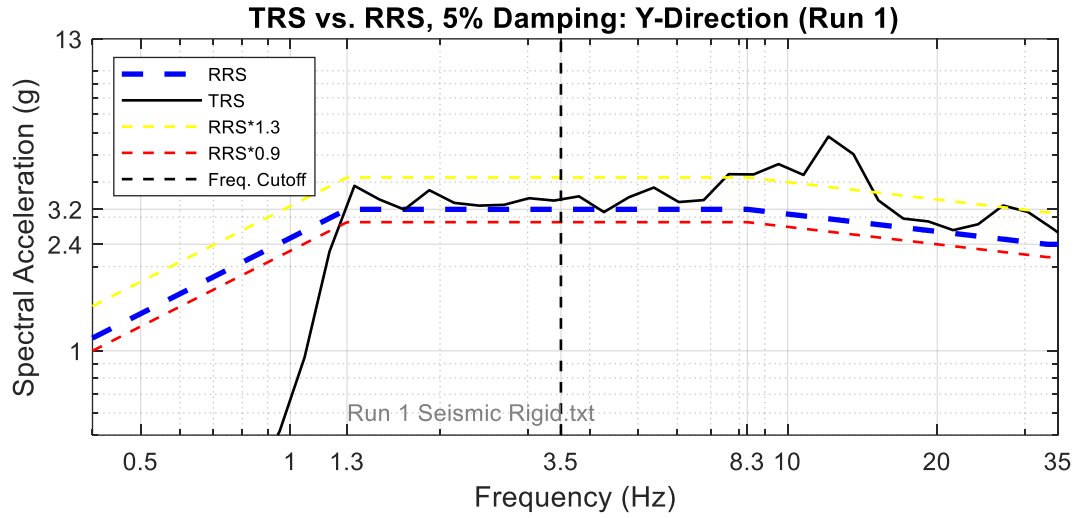
Post-test

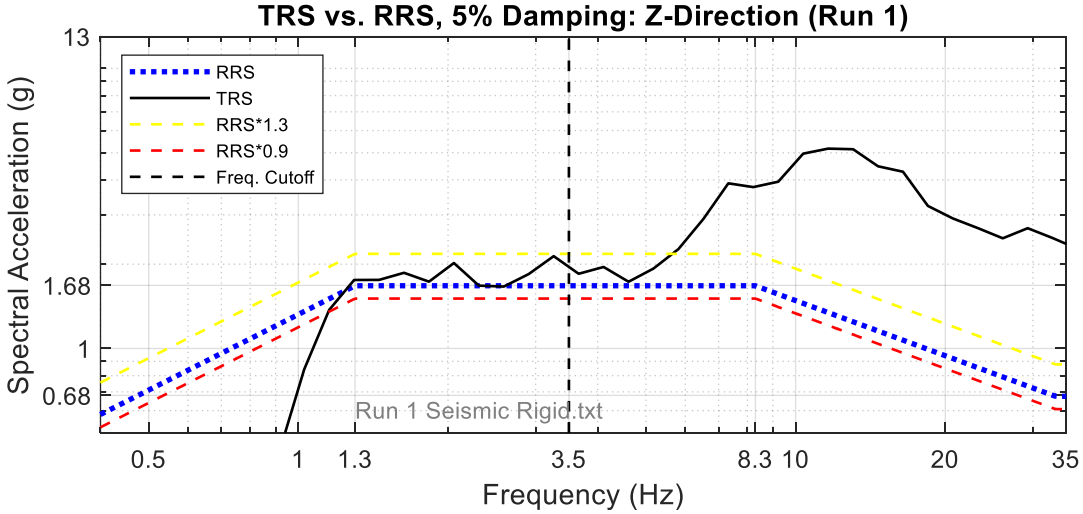
Post-test

Post-test

Test Response Spectra vs. Required Response Spectra Plots







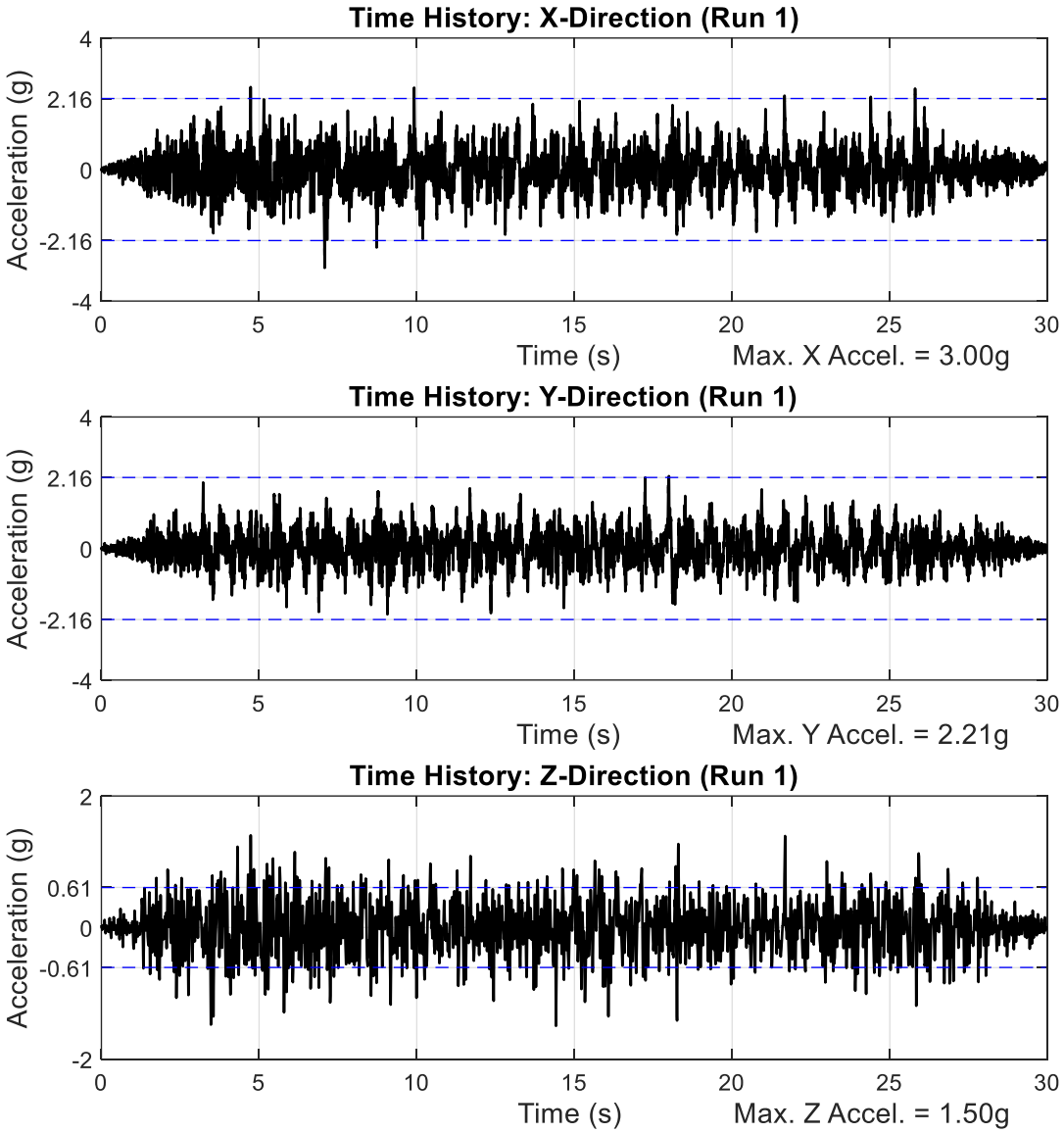
Test Response Spectra vs. Required Response Spectra Data

The tabular data used to create the previous TRS vs. RRS plots is as follows:

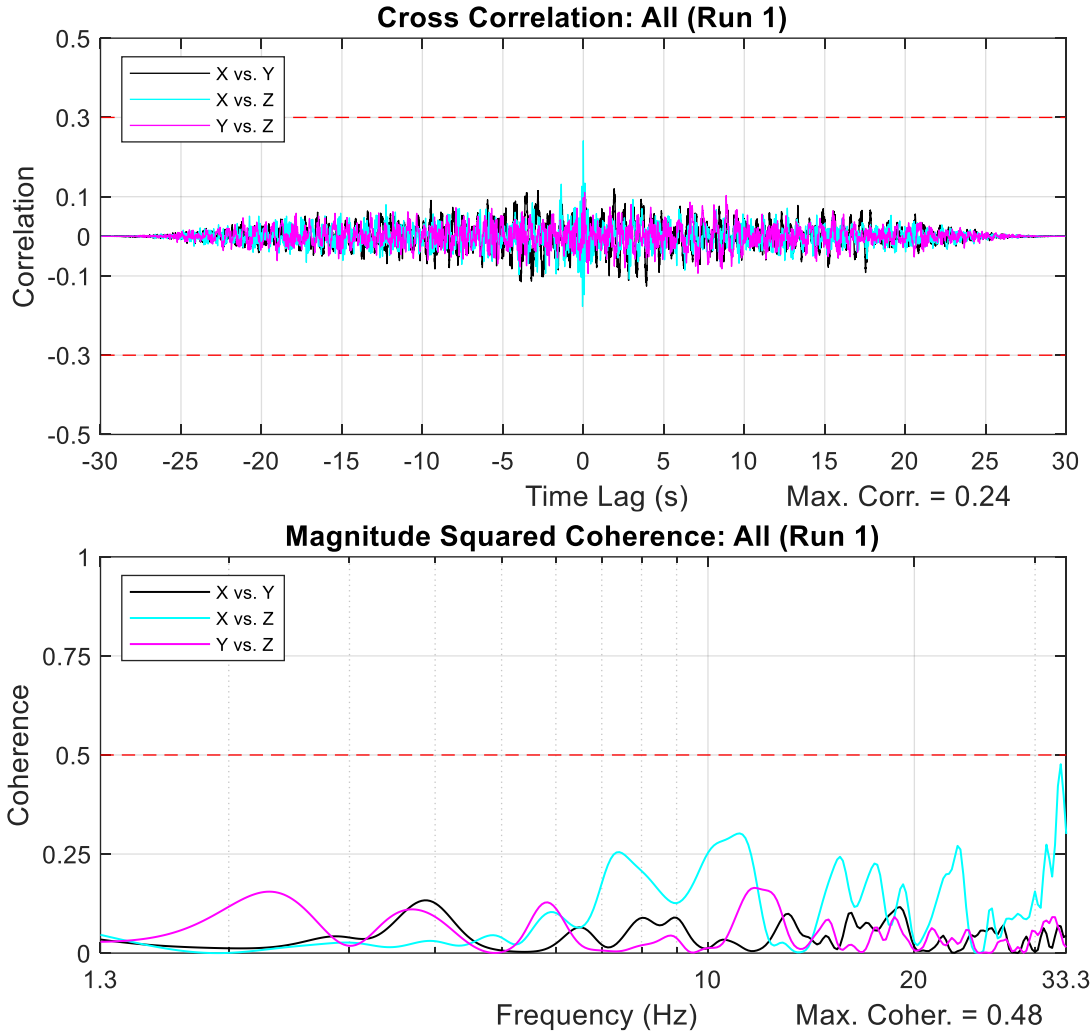
X Direction			Y Direction			Z Direction		
Freq. (Hz)	RRS (g)	TRS (g)	Freq. (Hz)	RRS (g)	TRS (g)	Freq. (Hz)	RRS (g)	TRS (g)
1.21	3.00	2.29	1.20	2.98	2.26	1.29	1.67	1.76
1.36	3.20	3.35	1.35	3.20	3.88	1.45	1.68	1.76
1.52	3.20	3.41	1.51	3.20	3.47	1.63	1.68	1.86
1.71	3.20	3.76	1.70	3.20	3.19	1.83	1.68	1.73
1.92	3.20	3.09	1.90	3.20	3.75	2.06	1.68	2.02
2.16	3.20	3.59	2.14	3.20	3.37	2.31	1.68	1.68
2.42	3.20	3.55	2.40	3.20	3.30	2.59	1.68	1.66
2.72	3.20	3.78	2.69	3.20	3.32	2.91	1.68	1.84
3.05	3.20	3.90	3.02	3.20	3.51	3.26	1.68	2.14
3.42	3.20	3.92	3.39	3.20	3.44	3.66	1.68	1.85
3.84	3.20	3.88	3.81	3.20	3.56	4.11	1.68	1.95
4.31	3.20	3.74	4.27	3.20	3.13	4.61	1.68	1.73
4.84	3.20	3.97	4.79	3.20	3.53	5.18	1.68	1.93
5.43	3.20	4.10	5.38	3.20	3.83	5.81	1.68	2.26
6.10	3.20	3.77	6.04	3.20	3.40	6.52	1.68	2.90
6.85	3.20	4.26	6.78	3.20	3.45	7.32	1.68	3.89
7.68	3.20	5.52	7.61	3.20	4.27	8.22	1.68	3.77
8.63	3.17	4.71	8.54	3.18	4.26	9.23	1.56	3.94
9.68	3.10	7.07	9.59	3.11	4.64	10.36	1.45	4.96
10.87	3.03	7.16	10.76	3.03	4.25	11.63	1.34	5.17
12.20	2.95	6.12	12.08	2.96	5.82	13.05	1.25	5.15
13.69	2.88	4.67	13.56	2.89	5.04	14.65	1.16	4.47
15.37	2.82	3.53	15.22	2.82	3.45	16.44	1.07	4.28
17.25	2.75	4.04	17.09	2.76	2.97	18.45	0.99	3.23
19.36	2.69	5.13	19.18	2.69	2.90	20.71	0.92	2.91
21.74	2.62	5.11	21.53	2.63	2.70	23.25	0.85	2.69
24.40	2.56	5.12	24.16	2.56	2.83	26.10	0.79	2.47
27.38	2.50	6.16	27.12	2.50	3.30	29.29	0.73	2.69
30.74	2.44	4.32	30.44	2.44	3.13	32.88	0.68	2.48
34.50	2.40	3.53	34.17	2.40	2.73	36.91	0.68	2.27

As is shown in the "Resonant Frequency Search Plots" section below, no resonance response phenomena exist below 5Hz. Therefore, per ICC-ES AC156 Section 6.5.3.1.1, the TRS is only required to envelop the RRS down to 3.5Hz. Any TRS points that fall below the RRS (above the cutoff frequency) are highlighted above. The TRS meets all requirements from ICC-ES AC156 Section 6.5.3.

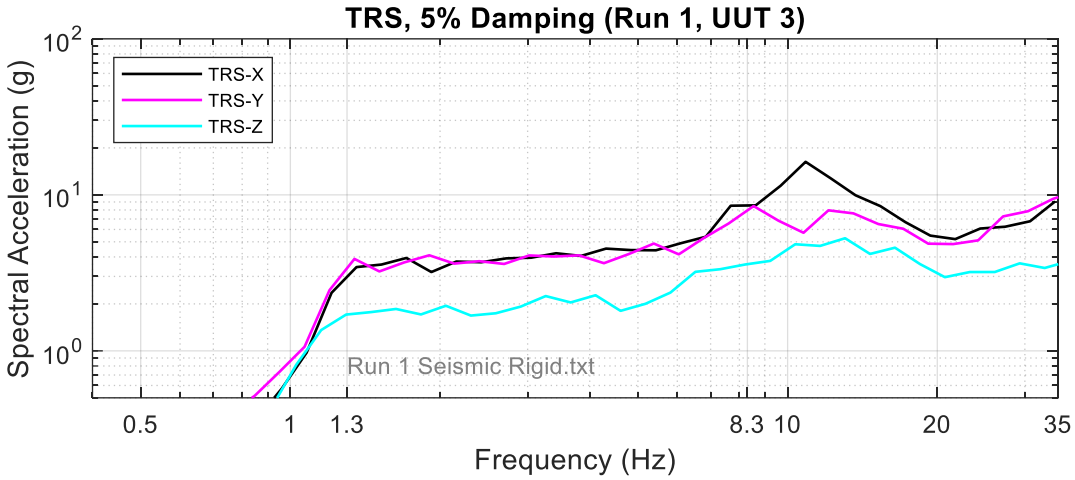
Acceleration Time History Plots

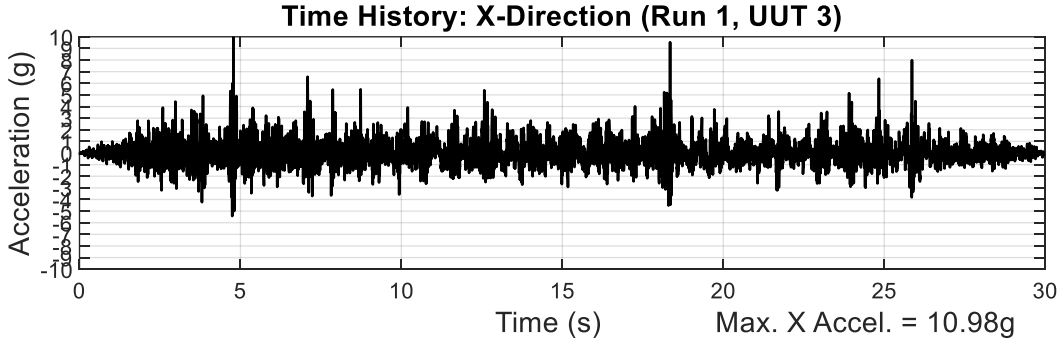


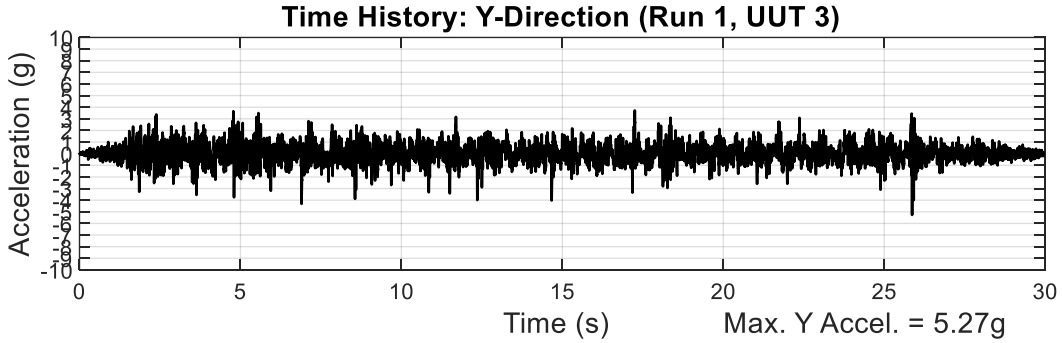
Statistical Independence of Table Motion Plots

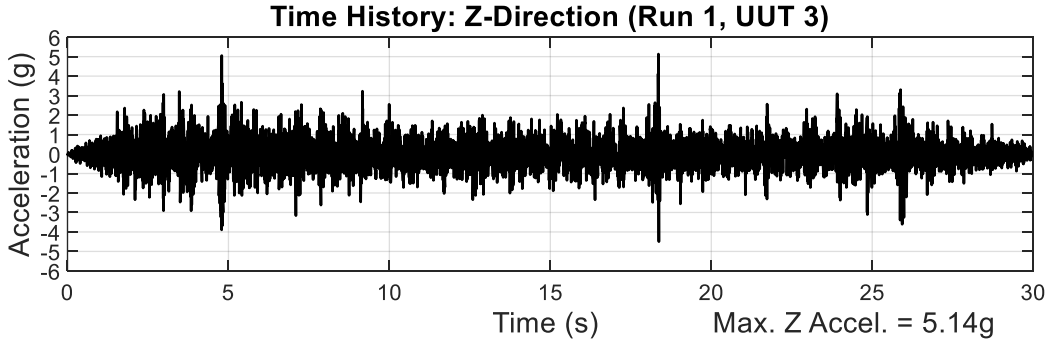


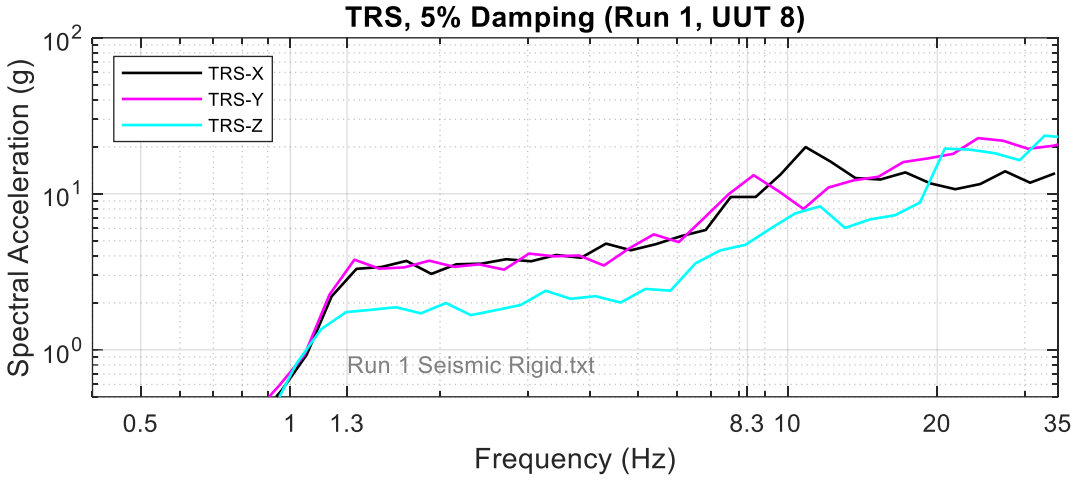
Unit Accelerometer Output

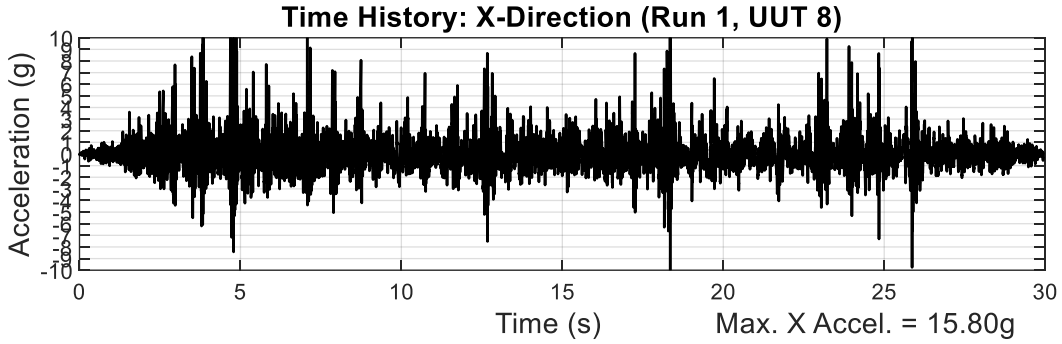


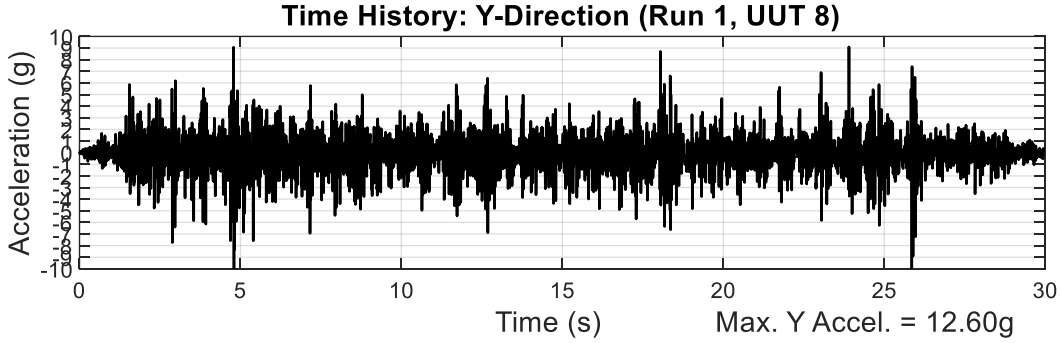


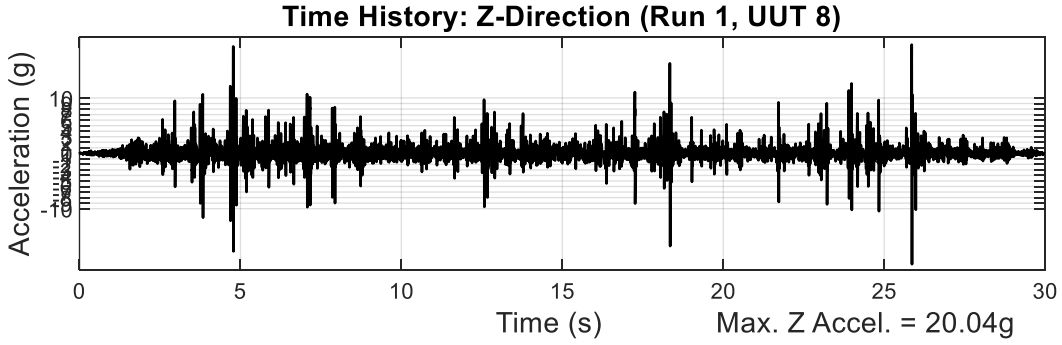


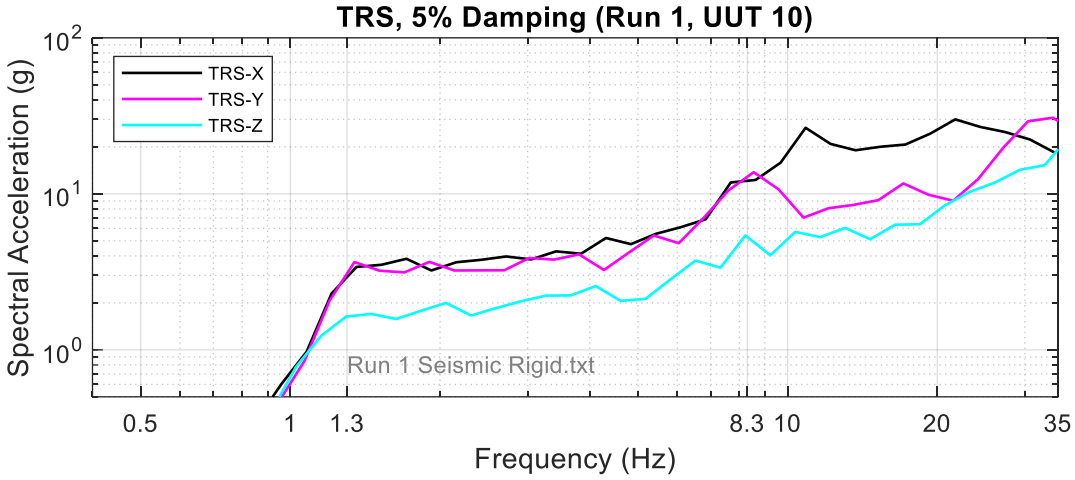


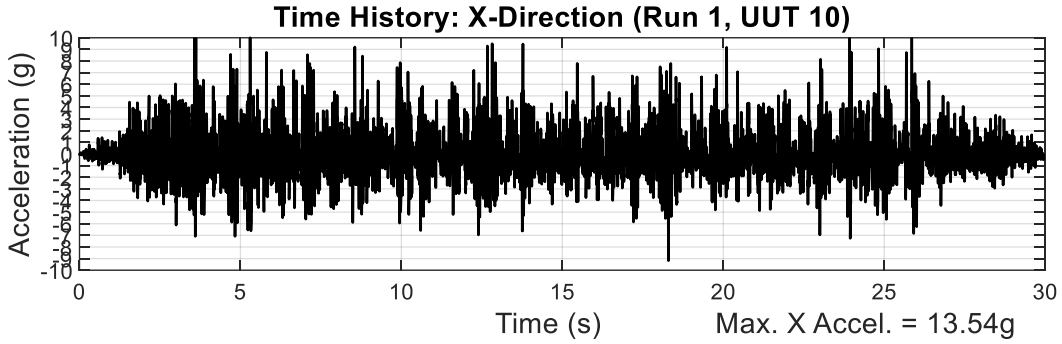

TRS, 5% Damping (Run 1, UUT 8)
TRS-X
TRS-Y
TRS-Z
Spectral Acceleration (g)
Run 1 Seismic Rigid.txt
Frequency (Hz)

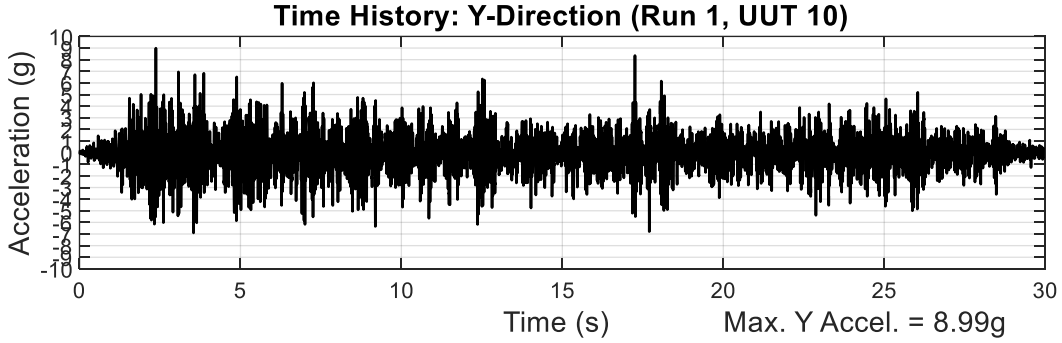

Time History: X-Direction (Run 1, UUT 8)
Acceleration (g)
Time (s)
Max. X Accel. = 15.80g

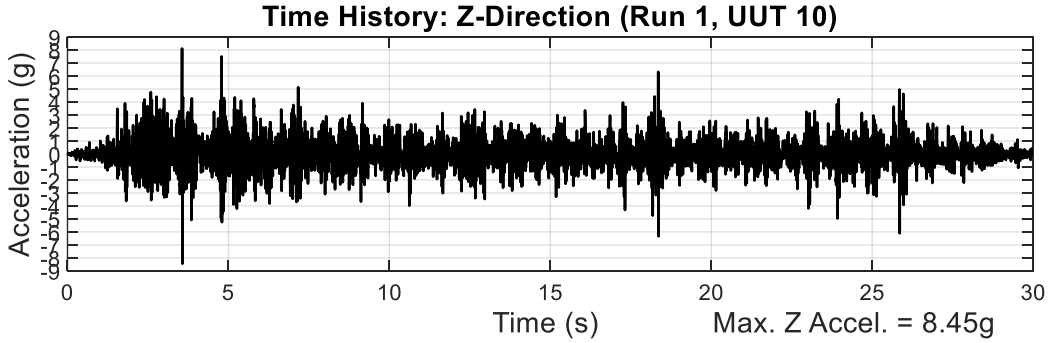

Time History: Y-Direction (Run 1, UUT 8)
Acceleration (g)
Time (s)
Max. Y Accel. = 12.60g

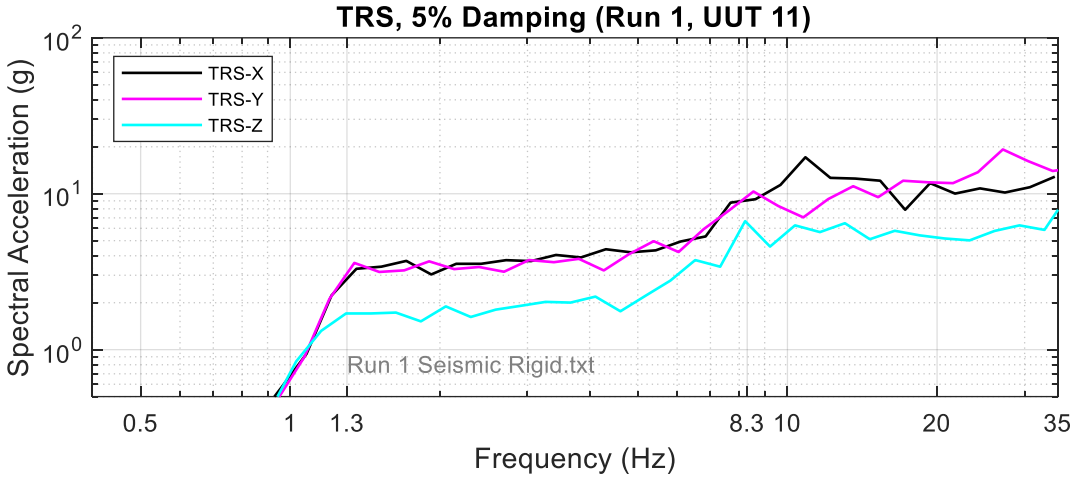

Time History: Z-Direction (Run 1, UUT 8)
Acceleration (g)
Time (s)
Max. Z Accel. = 20.04g

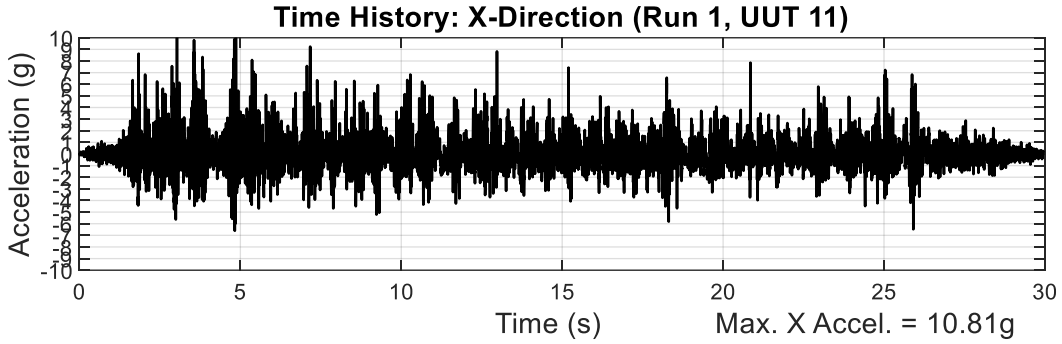

TRS, 5% Damping (Run 1, UUT 10)
Spectral Acceleration (g)
TRS-X
TRS-Y
TRS-Z
Run 1 Seismic Rigid.txt
Frequency (Hz)

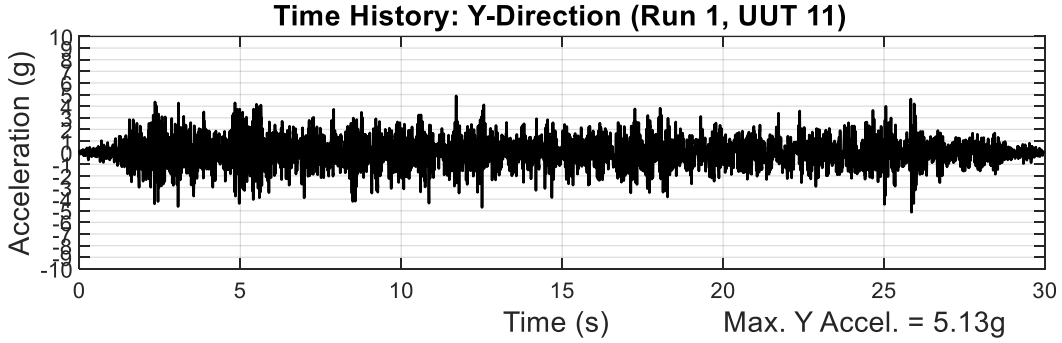

Time History: X-Direction (Run 1, UUT 10)
Acceleration (g)
Time (s)
Max. X Accel. = 13.54g

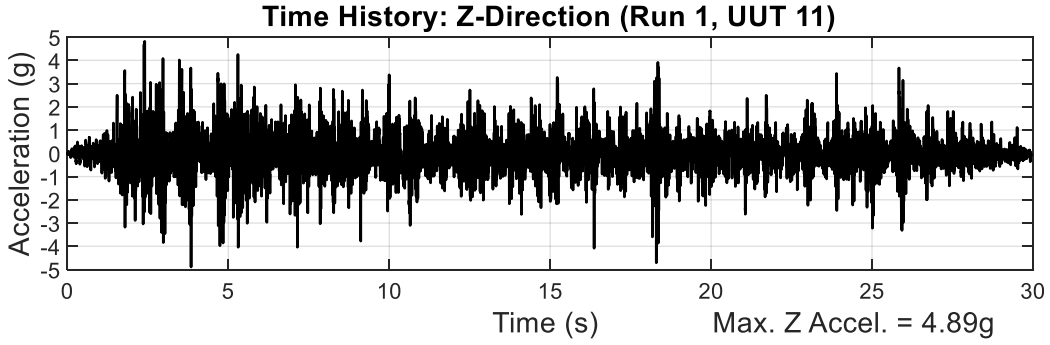

Time History: Y-Direction (Run 1, UUT 10)
Acceleration (g)
Time (s)
Max. Y Accel. = 8.99g


Time History: Z-Direction (Run 1, UUT 10)
Acceleration (g)
Time (s)
Max. Z Accel. = 8.45g

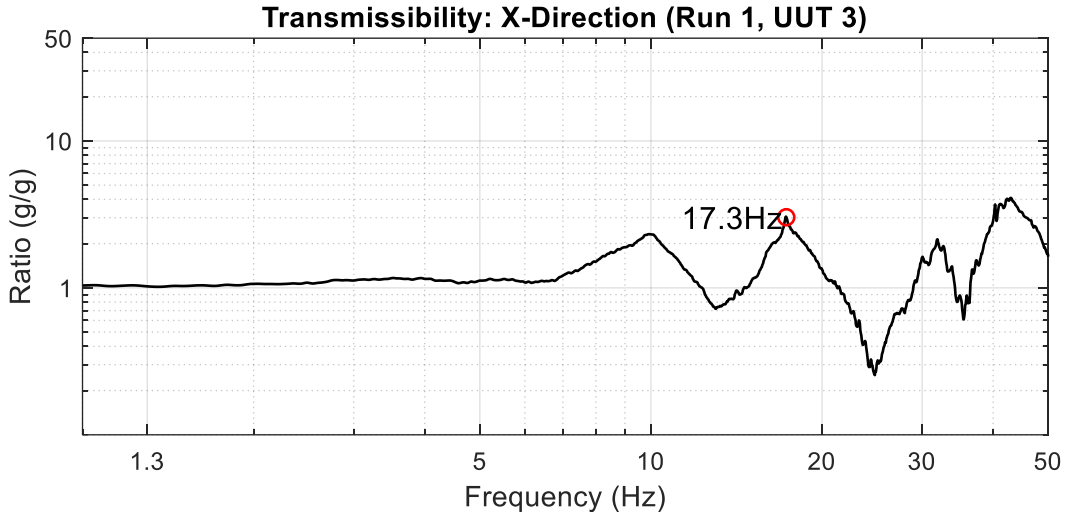

TRS, 5% Damping (Run 1, UUT 11)
Spectral Acceleration (g)
TRS-X
TRS-Y
TRS-Z
Run 1 Seismic Rigid.txt
Frequency (Hz)

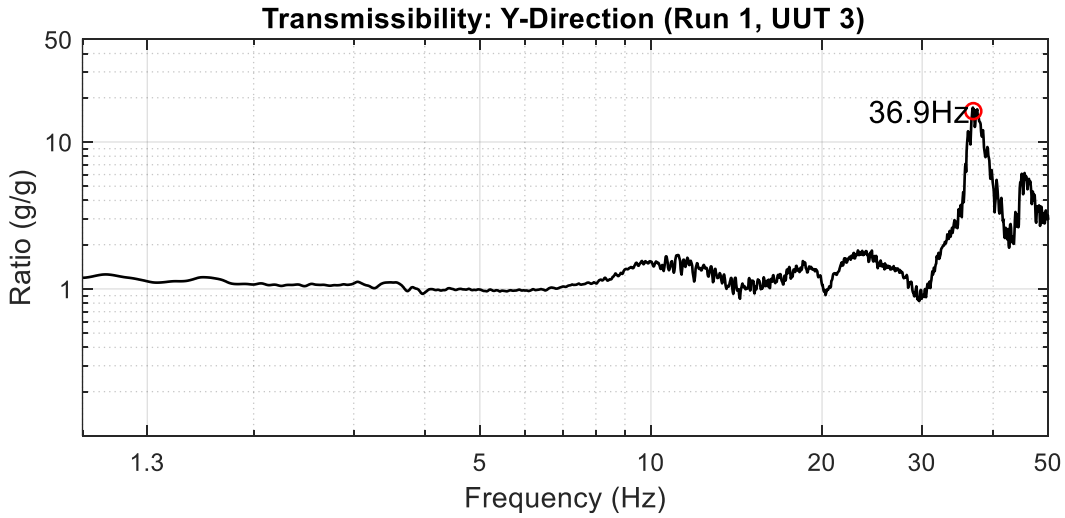

Time History: X-Direction (Run 1, UUT 11)
Acceleration (g)
Time (s)
Max. X Accel. = 10.81g

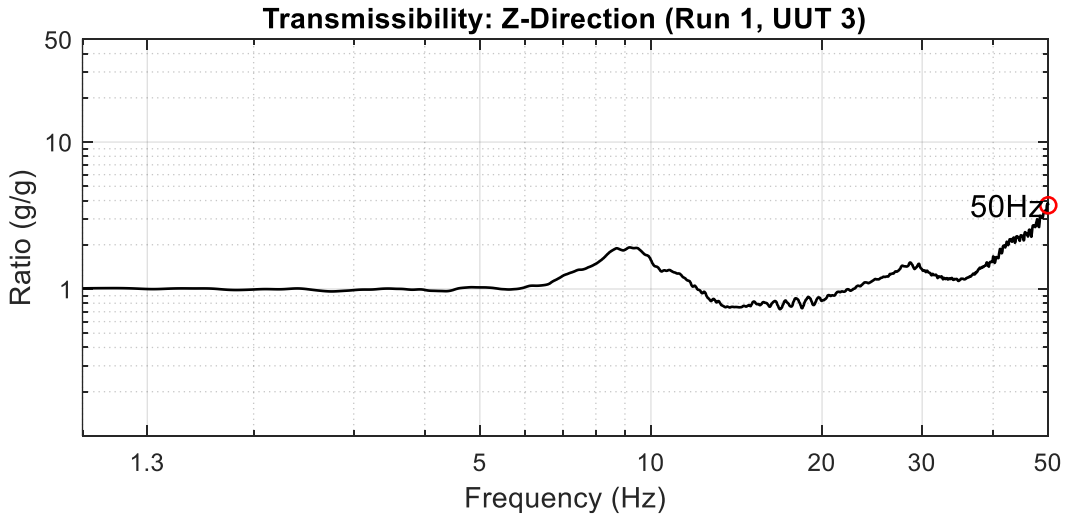

Time History: Y-Direction (Run 1, UUT 11)
Acceleration (g)
Time (s)
Max. Y Accel. = 5.13g

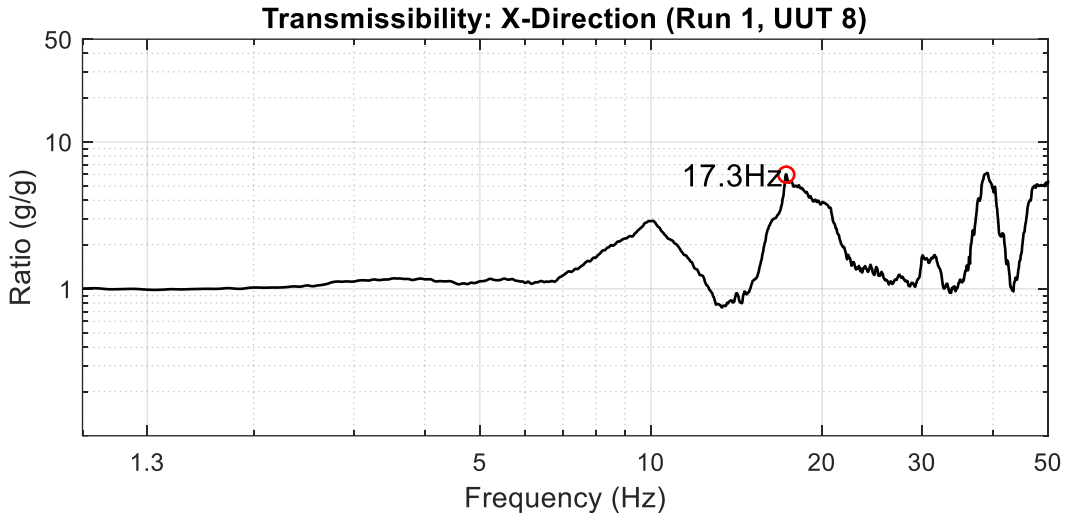

Time History: Z-Direction (Run 1, UUT 11)
Acceleration (g)
Time (s)
Max. Z Accel. = 4.89g

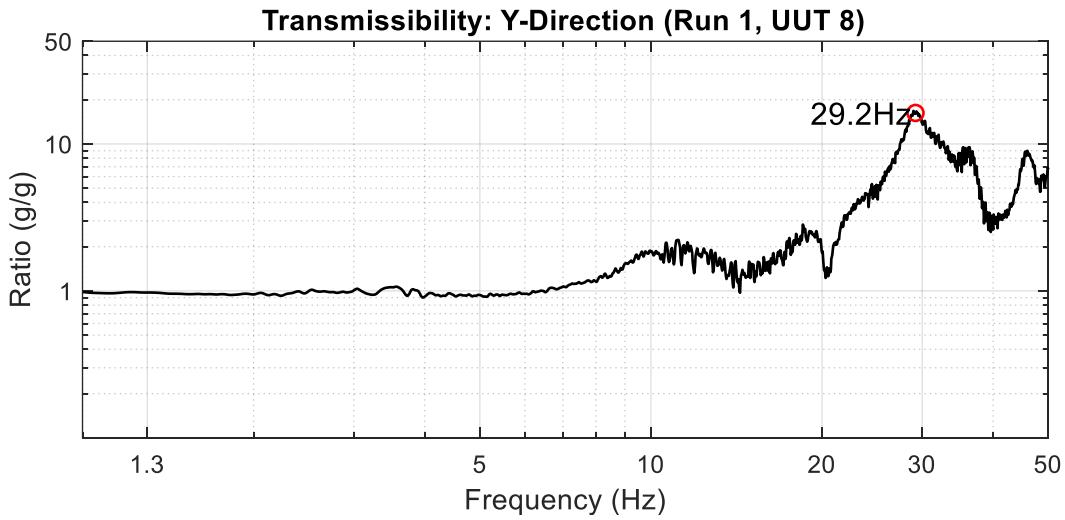
Resonant Frequency Search Plots

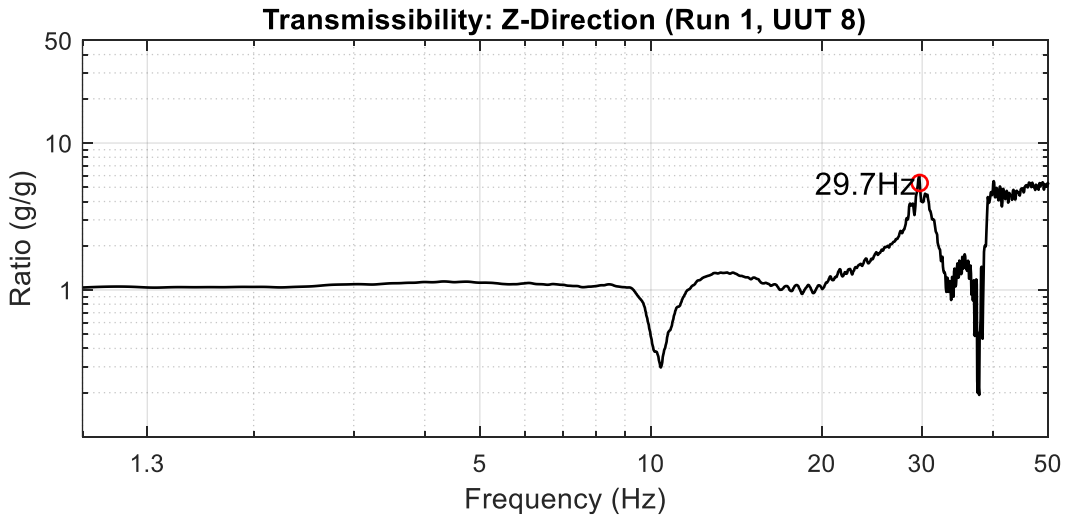


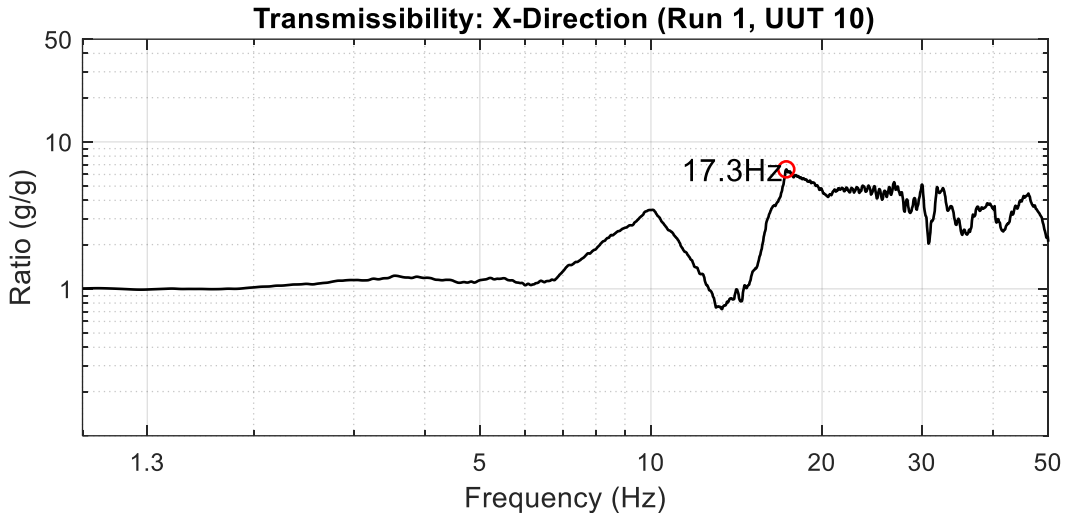


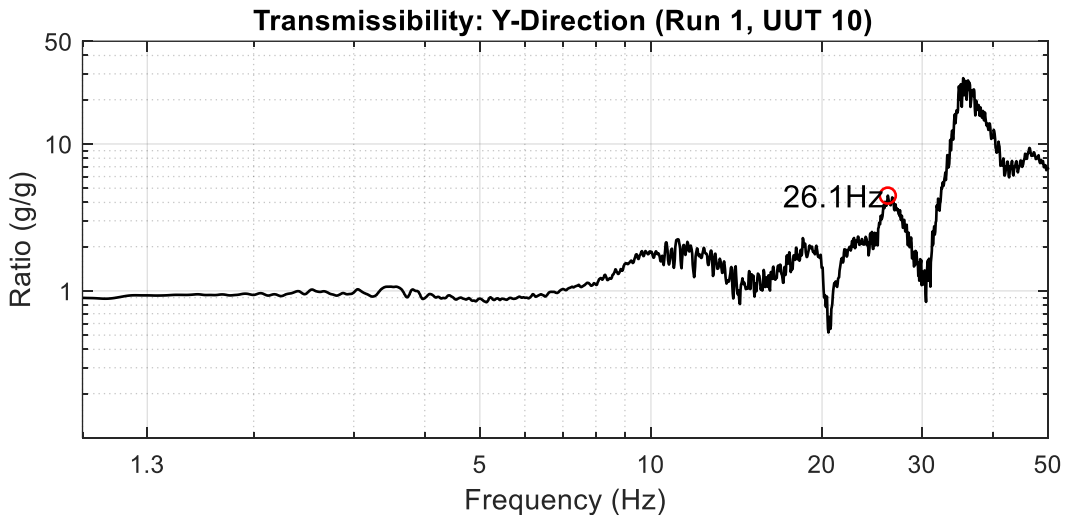


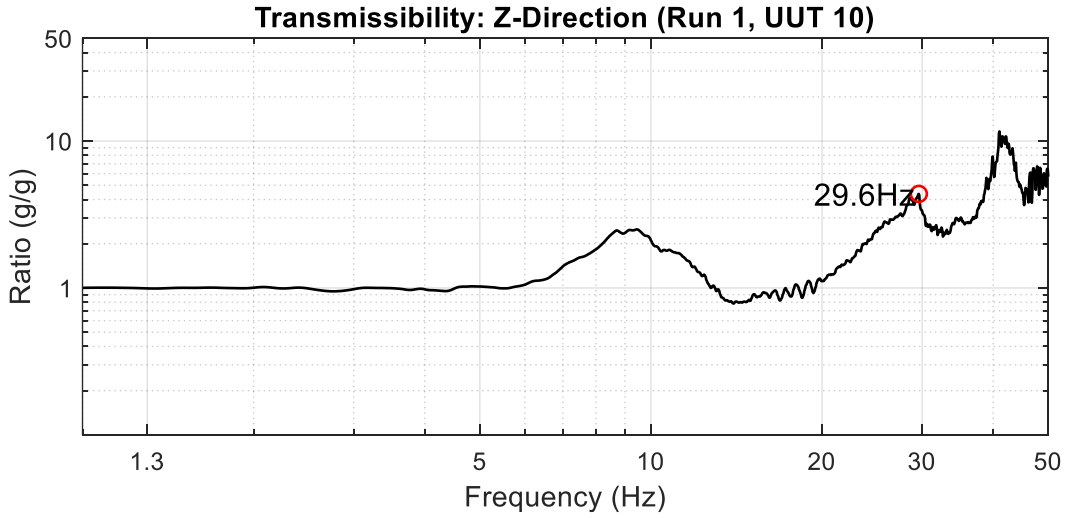

Transmissibility: X-Direction (Run 1, UUT 8)
50
10
1
Ratio (g/g)
17.3Hz
1.3
5
10
20
30
50
Frequency (Hz)

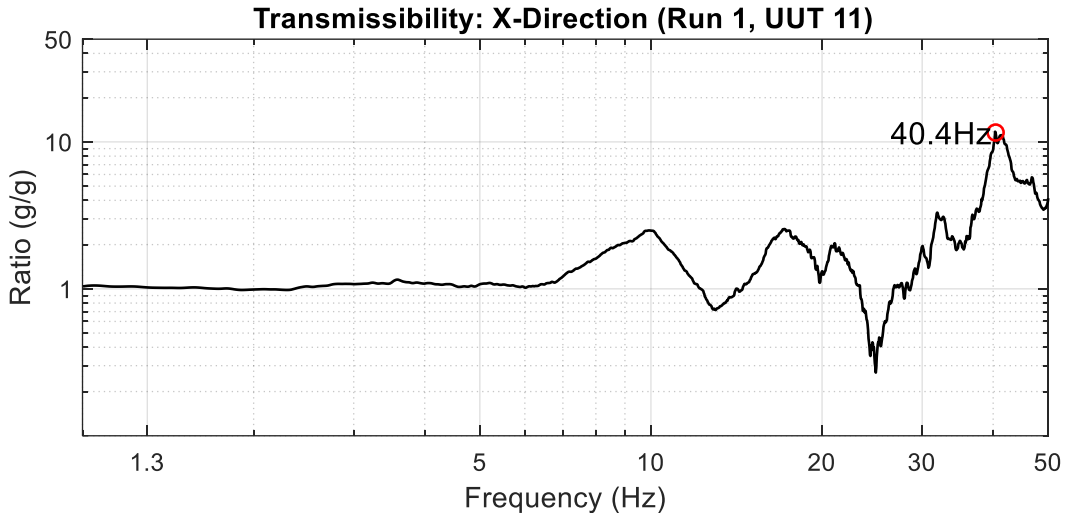

Transmissibility: Y-Direction (Run 1, UUT 8)
50
10
1
Ratio (g/g)
29.2Hz
1.3
5
10
20
30
50
Frequency (Hz)

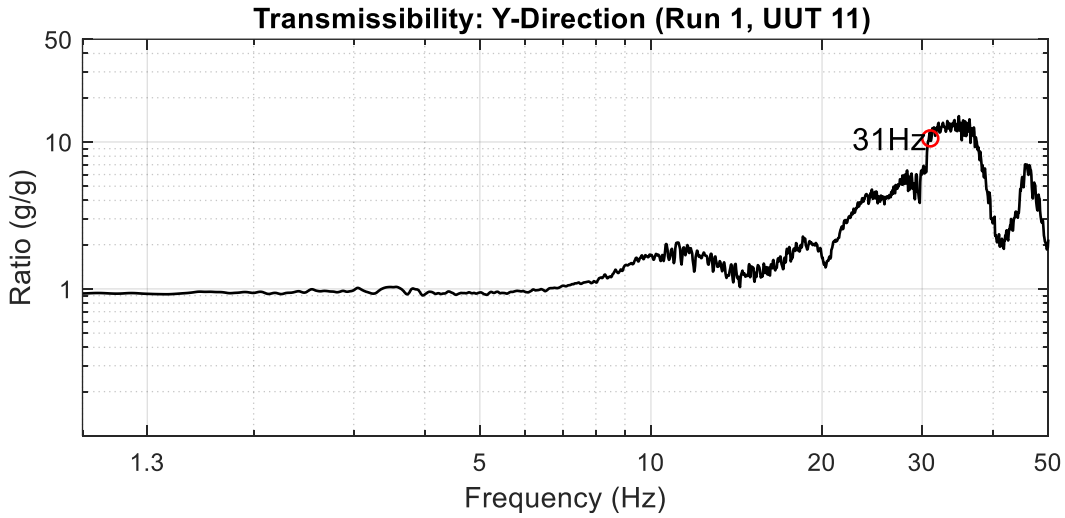

Transmissibility: Z-Direction (Run 1, UUT 8)
50
10
1
Ratio (g/g)
29.7Hz
1.3
5
10
20
30
50
Frequency (Hz)

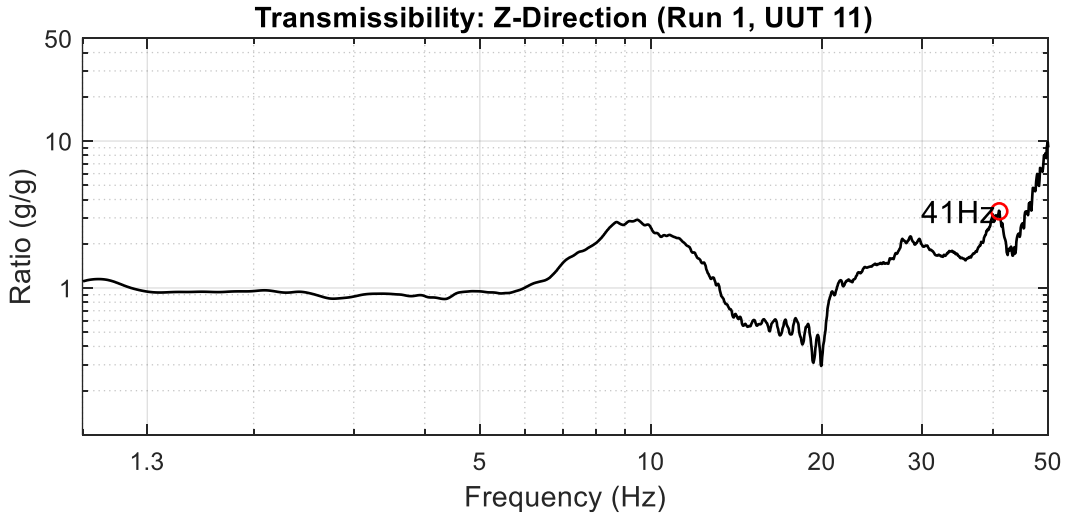

Transmissibility: X-Direction (Run 1, UUT 10)
50
10
1
Ratio (g/g)
17.3Hz
1.3
5
10
20
30
50
Frequency (Hz)


Transmissibility: Y-Direction (Run 1, UUT 10)
50
10
1
Ratio (g/g)
26.1Hz
1.3
5
10
20
30
50
Frequency (Hz)


Transmissibility: Z-Direction (Run 1, UUT 10)
50
10
1
Ratio (g/g)
29.6Hz
1.3
5
10
20
30
50
Frequency (Hz)


Transmissibility: X-Direction (Run 1, UUT 11)
Ratio (g/g)
50
10
1
40.4Hz
1.3
5
10
20
30
50
Frequency (Hz)


Transmissibility: Y-Direction (Run 1, UUT 11)
Ratio (g/g)
50
10
1
31Hz
1.3
5
10
20
30
50
Frequency (Hz)


Transmissibility: Z-Direction (Run 1, UUT 11)
Ratio (g/g)
50
10
1
41Hz
1.3
5
10
20
30
50
Frequency (Hz)

RUN 2 – Isolated

The isolated run was performed to Level 1 as shown in the “Test Data” section at the beginning of this report. This section provides detailed photographs and plots from the testing.

Test Pictures

Pre-test

Pre-test


Pre-test fixture


Pre-test isolator mounting


Post-test


Post-test

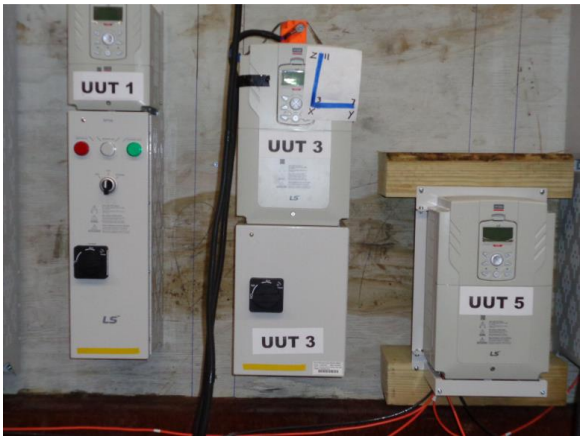

Post-test


Post-test


Post-test

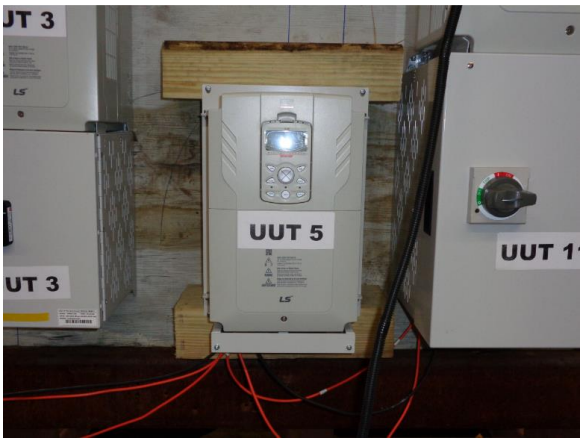
Post-test UUT 1

Post-test UUT 2



Post-test UUT 3

Post-test UUT 4



Post-test UUT 5

Post-test UUT 6

Post-test UUT 7

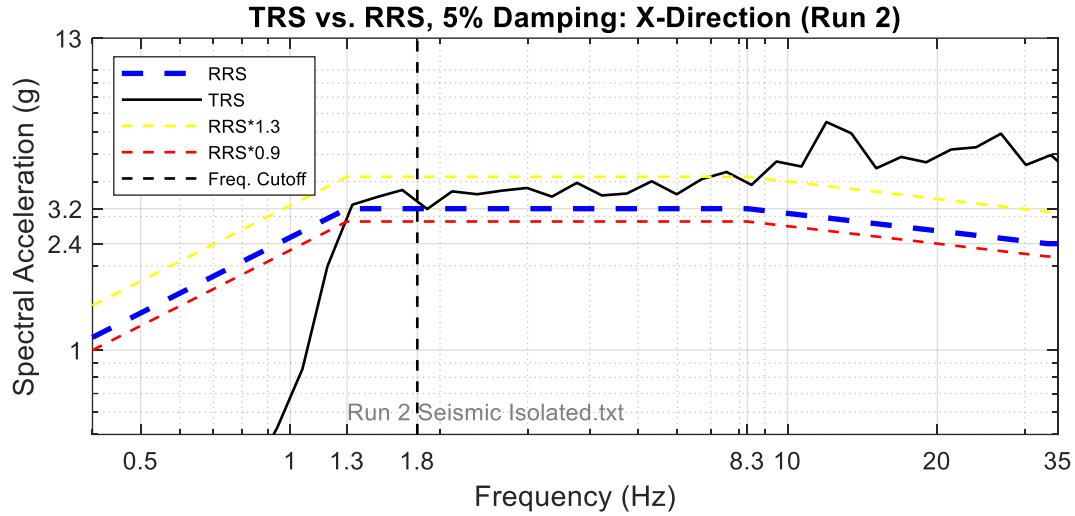
Post-test UUT 8

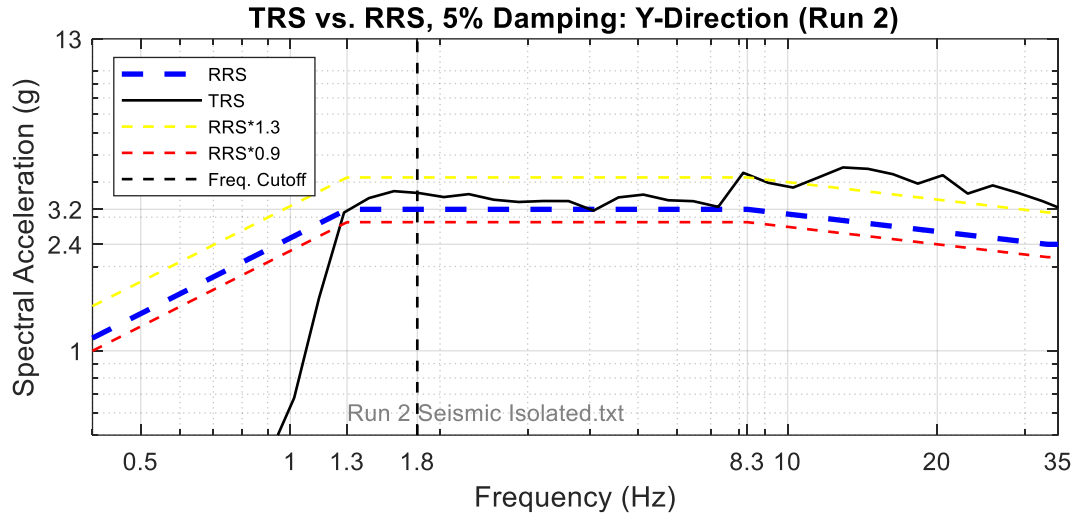
Post-test UUT 9

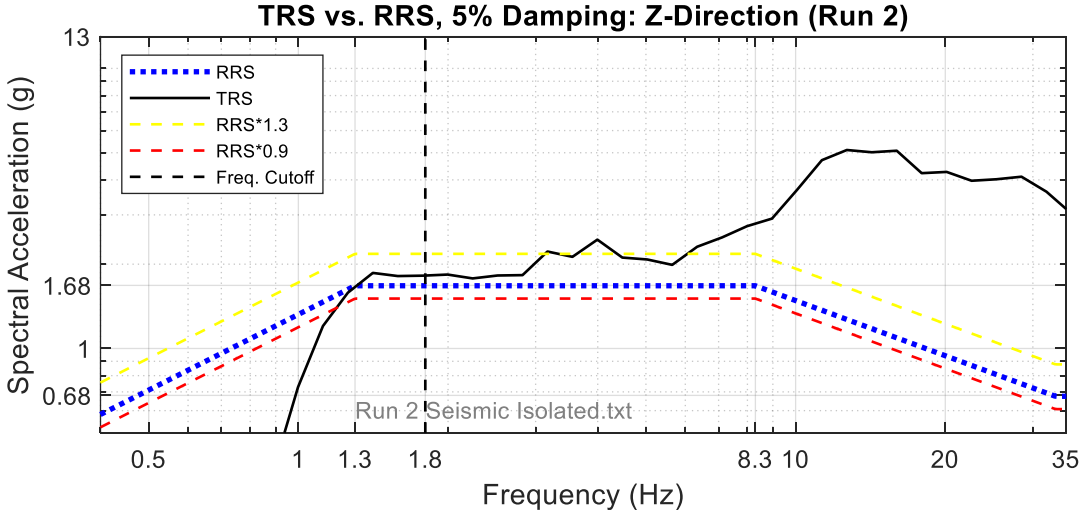
Post-test UUT 10

Post-test UUT 11

Test Response Spectra vs. Required Response Spectra Plots







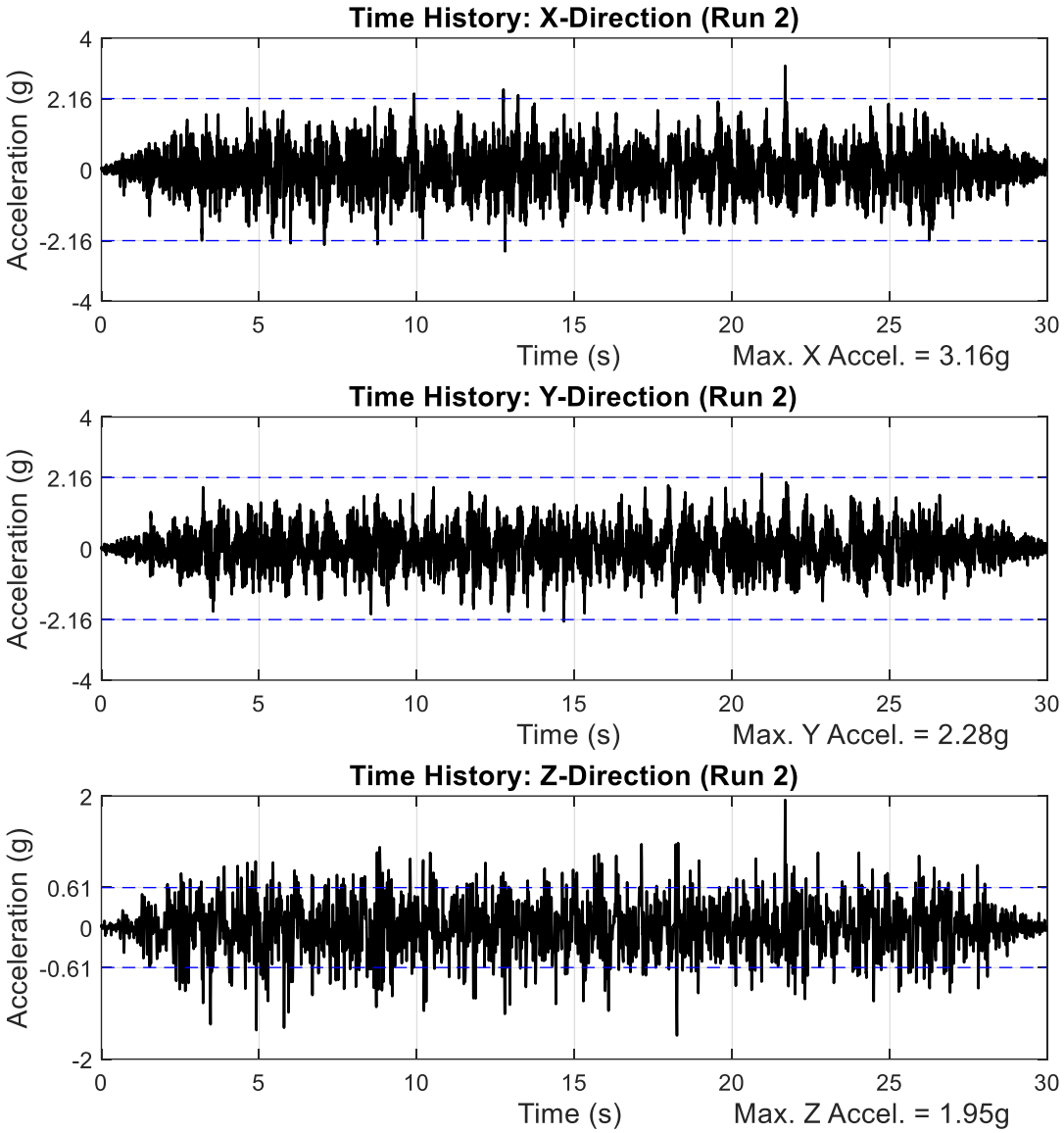
Test Response Spectra vs. Required Response Spectra Data

The tabular data used to create the previous TRS vs. RRS plots is as follows:

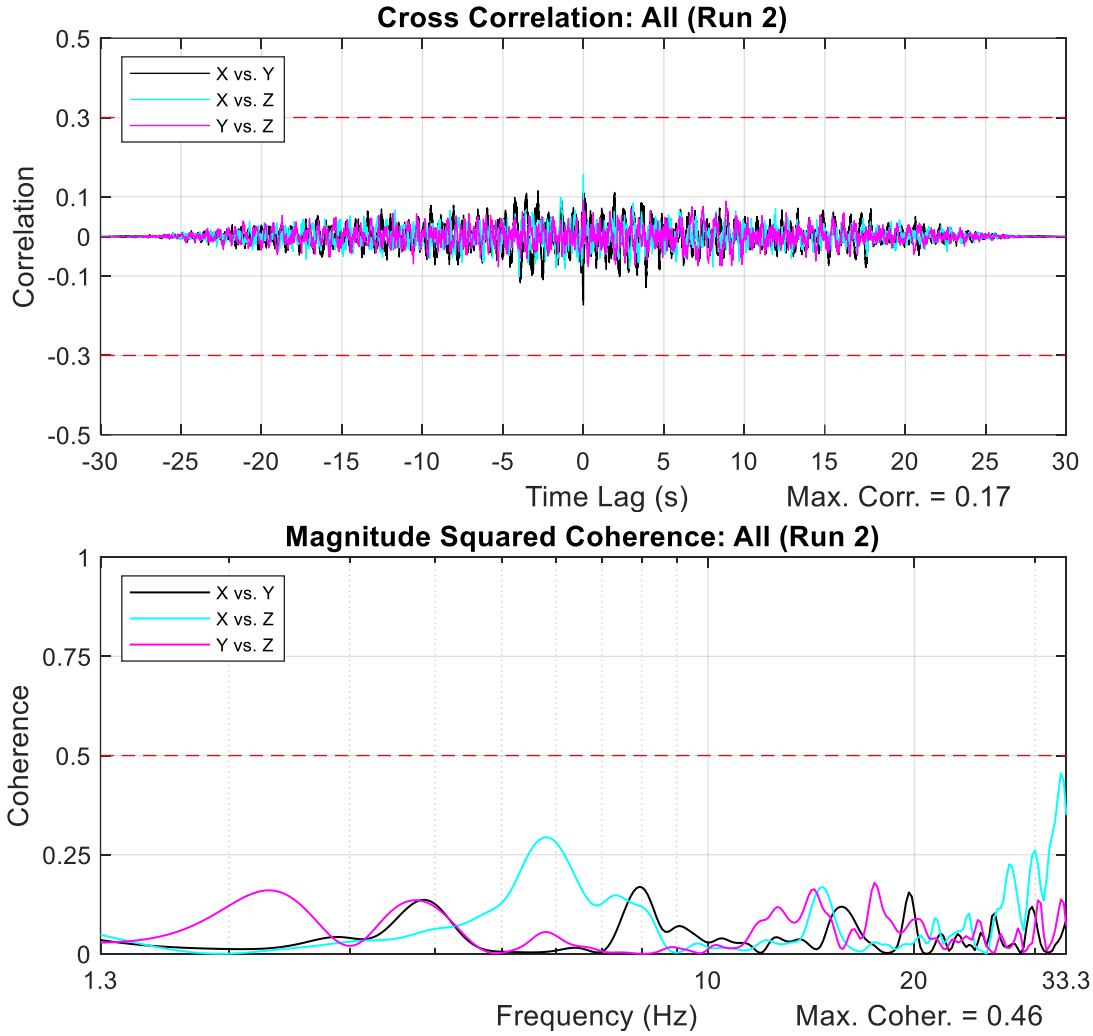
X Direction			Y Direction			Z Direction		
Freq. (Hz)	RRS (g)	TRS (g)	Freq. (Hz)	RRS (g)	TRS (g)	Freq. (Hz)	RRS (g)	TRS (g)
1.19	2.95	1.99	1.28	3.16	3.12	1.26	1.63	1.58
1.33	3.20	3.31	1.44	3.20	3.51	1.41	1.68	1.86
1.50	3.20	3.52	1.62	3.20	3.72	1.58	1.68	1.81
1.68	3.20	3.73	1.81	3.20	3.66	1.78	1.68	1.82
1.88	3.20	3.19	2.04	3.20	3.54	2.00	1.68	1.84
2.12	3.20	3.69	2.28	3.20	3.63	2.24	1.68	1.78
2.37	3.20	3.60	2.56	3.20	3.46	2.52	1.68	1.82
2.67	3.20	3.71	2.88	3.20	3.40	2.82	1.68	1.83
2.99	3.20	3.79	3.23	3.20	3.43	3.17	1.68	2.22
3.36	3.20	3.53	3.63	3.20	3.43	3.56	1.68	2.12
3.77	3.20	3.96	4.07	3.20	3.17	3.99	1.68	2.45
4.23	3.20	3.57	4.57	3.20	3.53	4.48	1.68	2.11
4.75	3.20	3.62	5.13	3.20	3.61	5.03	1.68	2.08
5.33	3.20	4.01	5.76	3.20	3.45	5.65	1.68	1.99
5.98	3.20	3.60	6.46	3.20	3.42	6.34	1.68	2.31
6.72	3.20	4.08	7.25	3.20	3.26	7.11	1.68	2.49
7.54	3.20	4.33	8.14	3.20	4.32	7.99	1.68	2.73
8.46	3.19	3.89	9.14	3.14	3.98	8.96	1.59	2.91
9.50	3.11	4.72	10.26	3.06	3.83	10.06	1.48	3.68
10.66	3.04	4.53	11.51	2.99	4.15	11.29	1.37	4.70
11.97	2.97	6.53	12.92	2.92	4.52	12.68	1.27	5.11
13.43	2.90	5.95	14.51	2.85	4.46	14.23	1.18	5.02
15.08	2.83	4.46	16.28	2.78	4.27	15.97	1.09	5.08
16.92	2.76	4.90	18.28	2.72	3.95	17.93	1.01	4.23
18.99	2.70	4.68	20.52	2.65	4.24	20.12	0.94	4.27
21.32	2.63	5.21	23.03	2.59	3.64	22.59	0.87	3.97
23.93	2.57	5.30	25.85	2.53	3.90	25.35	0.81	4.02
26.86	2.51	5.93	29.01	2.47	3.67	28.46	0.75	4.11
30.15	2.45	4.58	32.57	2.41	3.42	31.94	0.69	3.63
33.84	2.40	4.97	36.55	2.40	3.15	35.86	0.68	3.03

As is shown in the "Resonant Frequency Search Plots" section below, no resonance response phenomena exist below 2.4Hz. Therefore, per ICC-ES AC156 Section 6.5.3.1.1, the TRS is only required to envelop the RRS down to 1.8Hz. Any TRS points that fall below the RRS (above the cutoff frequency) are highlighted above. The TRS meets all requirements from ICC-ES AC156 Section 6.5.3.

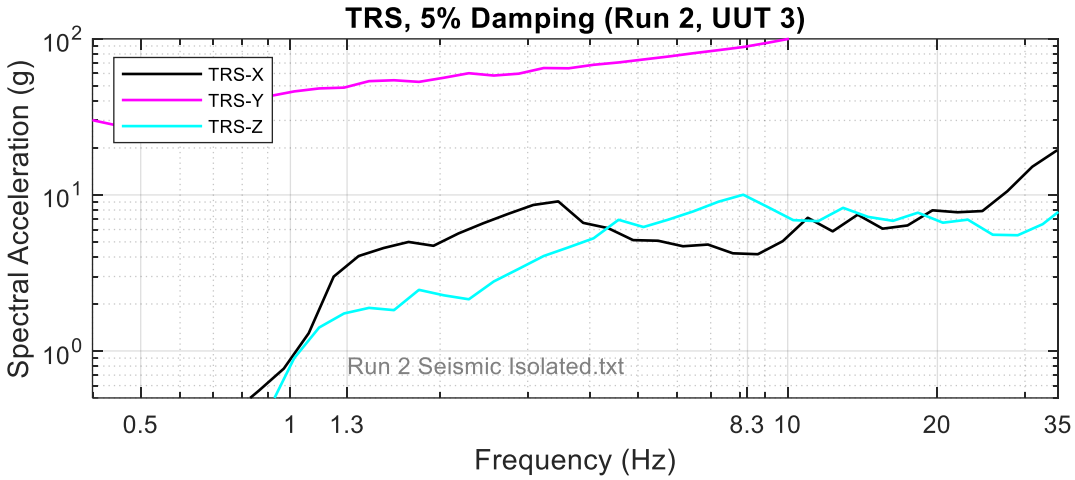
Acceleration Time History Plots

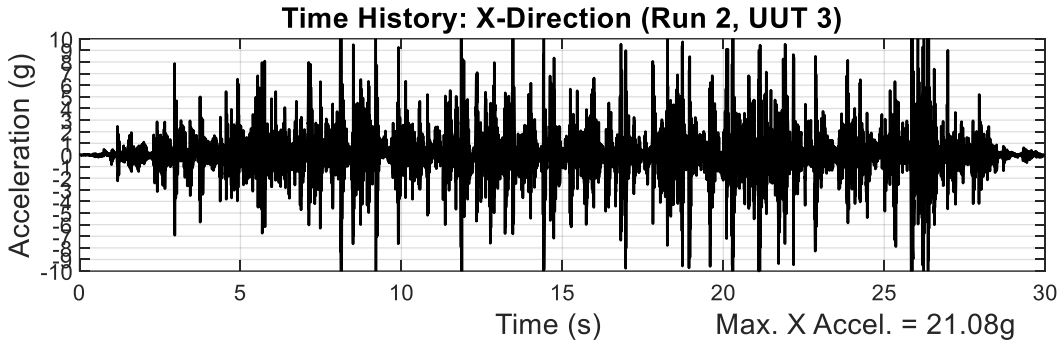


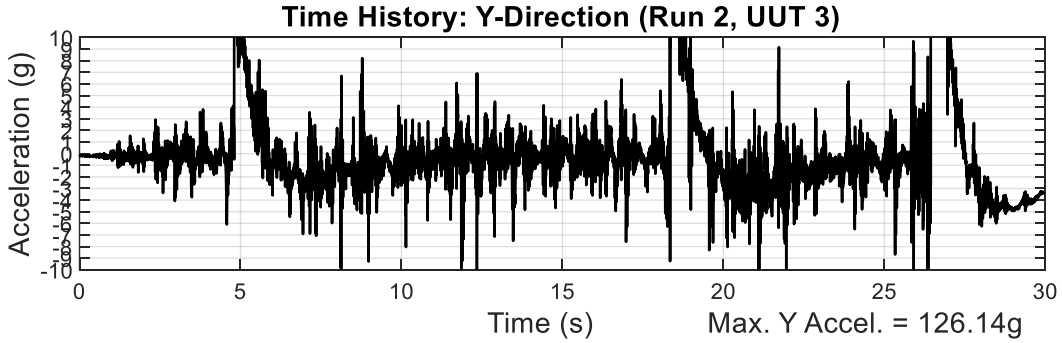
Statistical Independence of Table Motion Plots

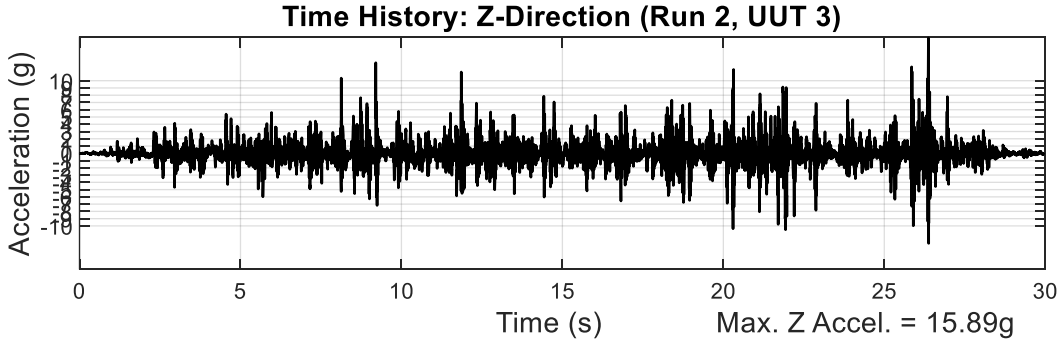


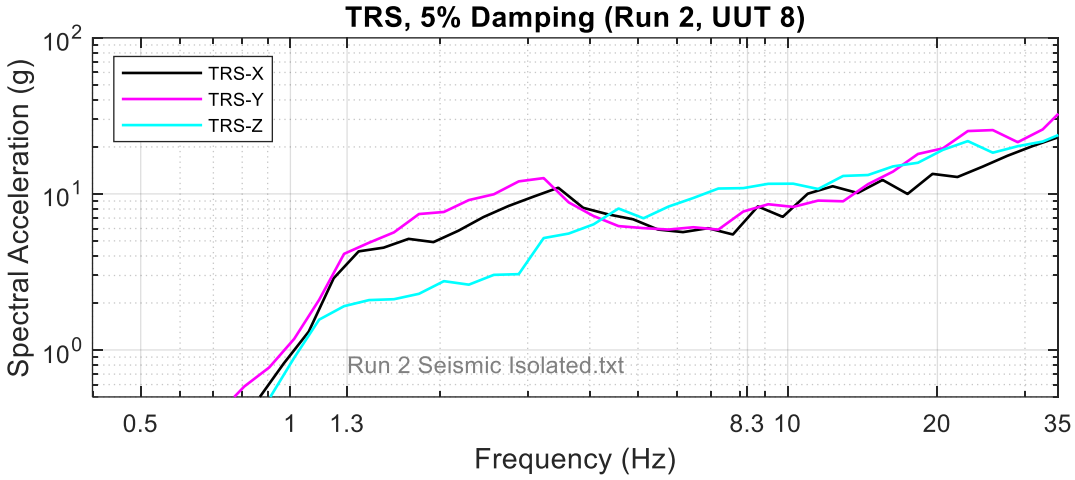
Unit Accelerometer Output

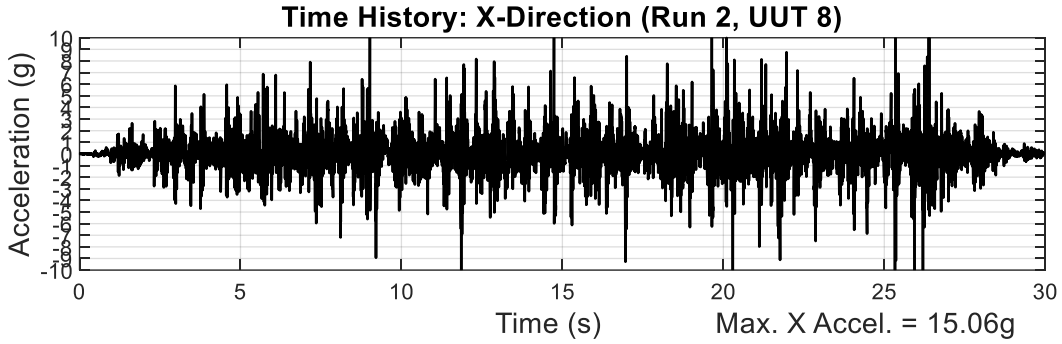


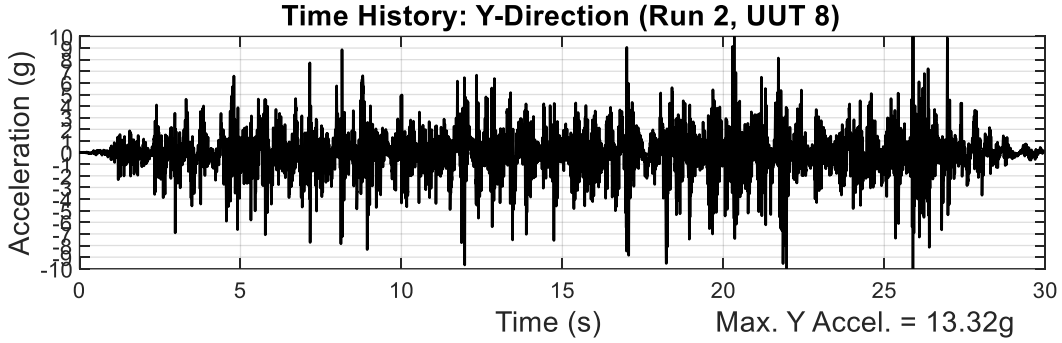


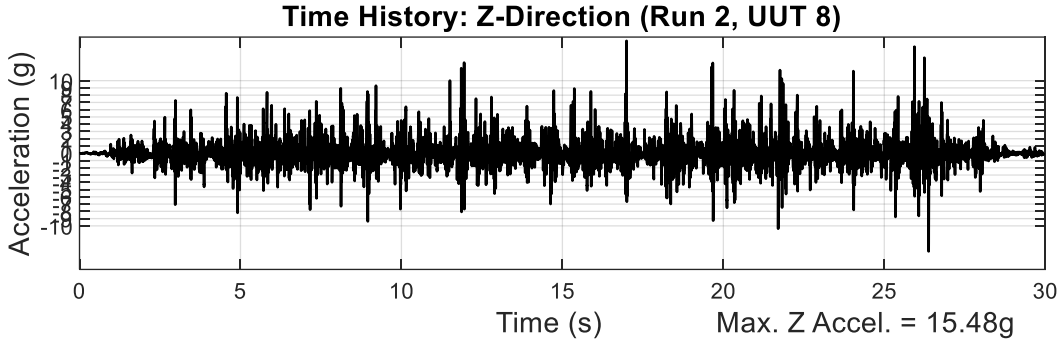


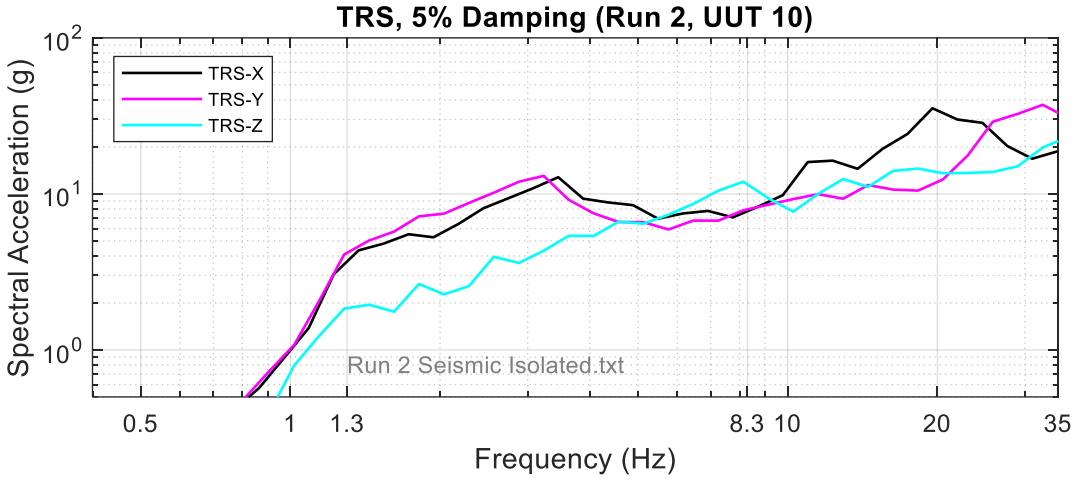


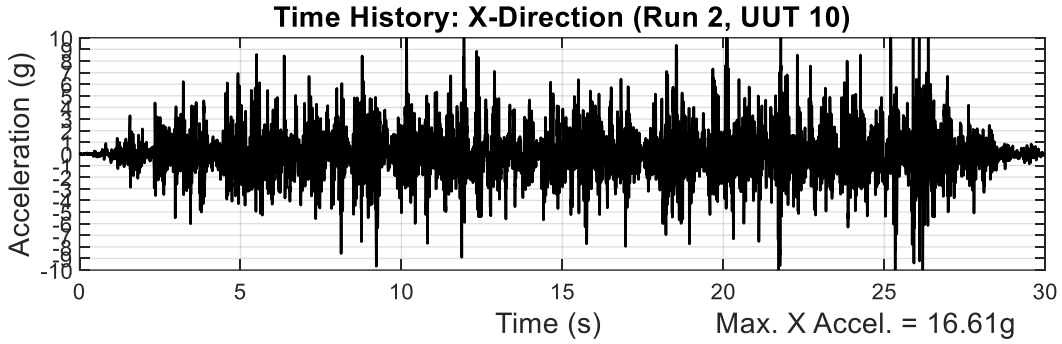

TRS, 5% Damping (Run 2, UUT 8)
Spectral Acceleration (g)
TRS-X
TRS-Y
TRS-Z
Run 2 Seismic Isolated.txt
Frequency (Hz)

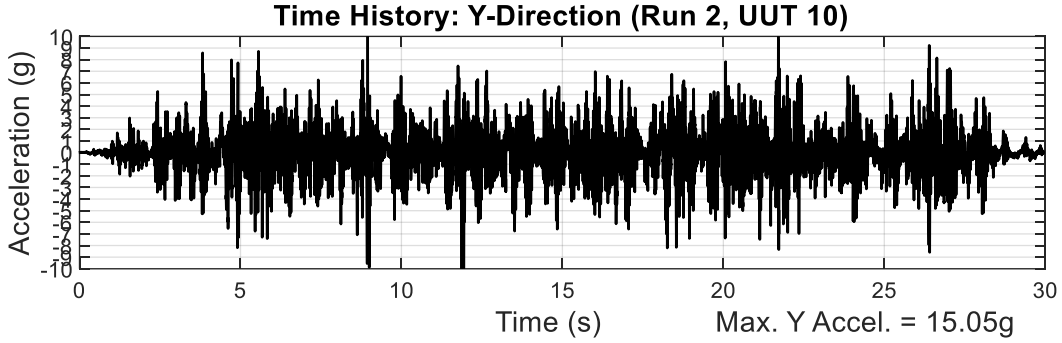

Time History: X-Direction (Run 2, UUT 8)
Acceleration (g)
Time (s)
Max. X Accel. = 15.06g

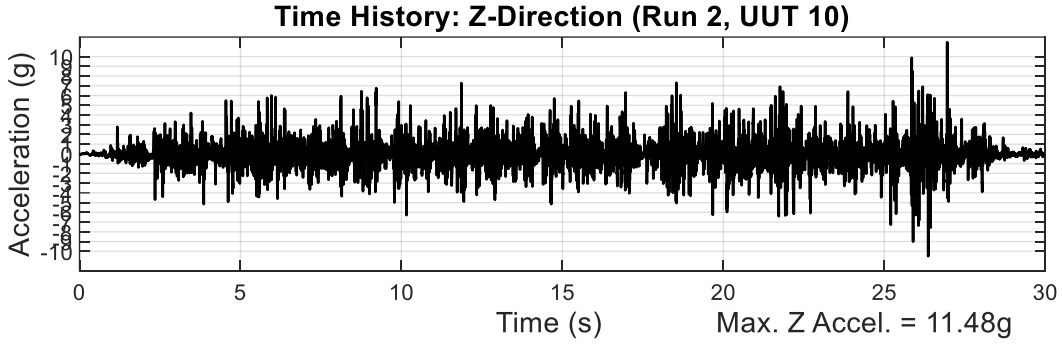

Time History: Y-Direction (Run 2, UUT 8)
Acceleration (g)
Time (s)
Max. Y Accel. = 13.32g

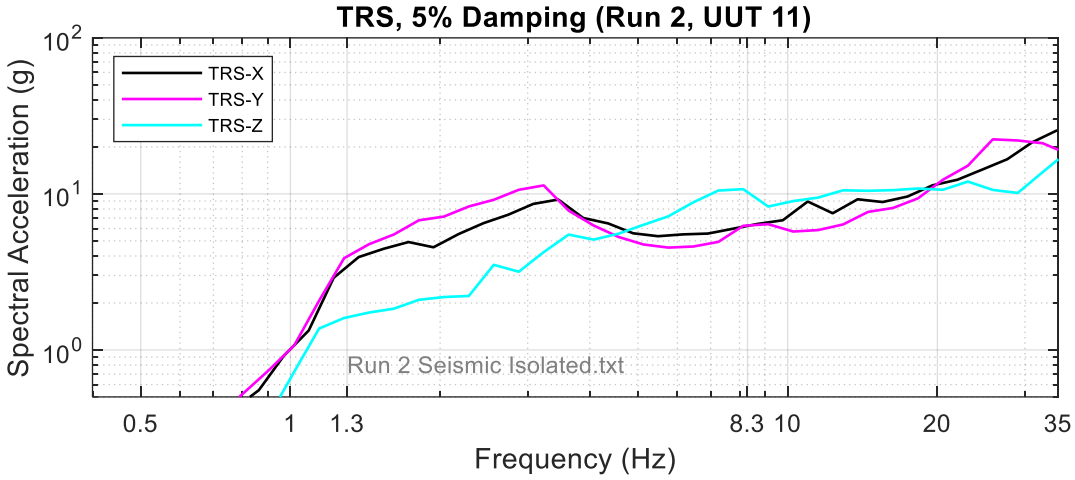

Time History: Z-Direction (Run 2, UUT 8)
Acceleration (g)
Time (s)
Max. Z Accel. = 15.48g

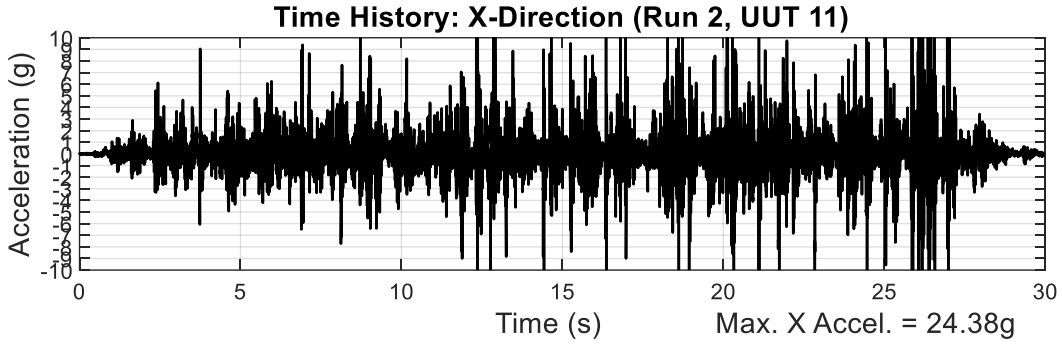

TRS, 5% Damping (Run 2, UUT 10)
TRS-X
TRS-Y
TRS-Z
Spectral Acceleration (g)
Run 2 Seismic Isolated.txt
Frequency (Hz)

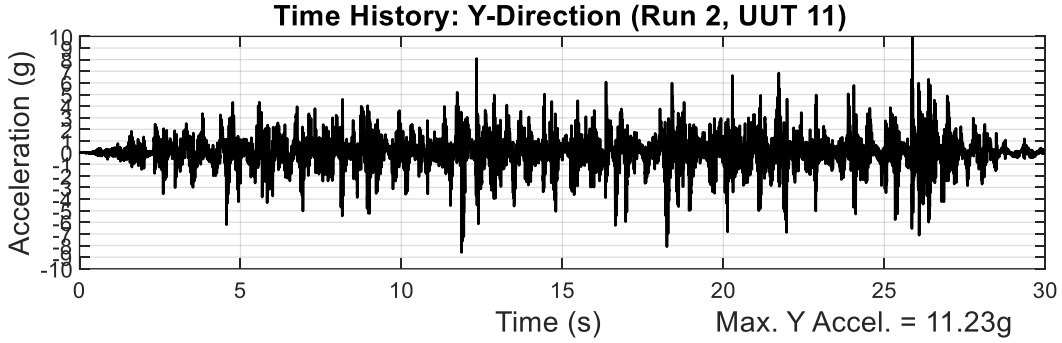

Time History: X-Direction (Run 2, UUT 10)
Acceleration (g)
Time (s)
Max. X Accel. = 16.61g

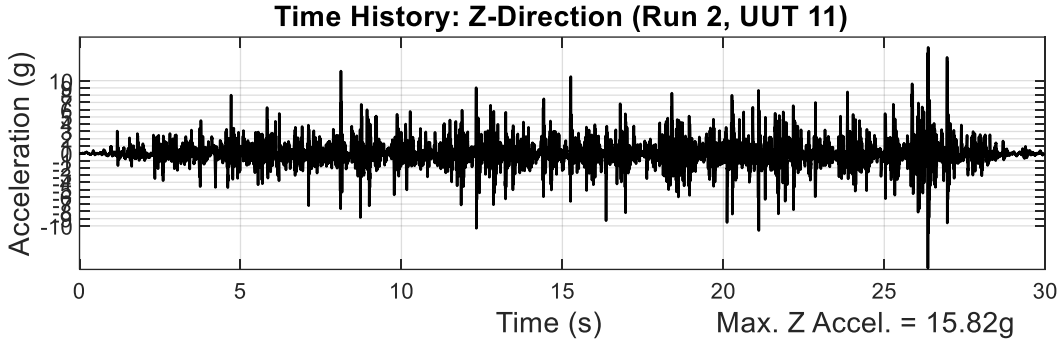

Time History: Y-Direction (Run 2, UUT 10)
Acceleration (g)
Time (s)
Max. Y Accel. = 15.05g


Time History: Z-Direction (Run 2, UUT 10)
Acceleration (g)
Time (s)
Max. Z Accel. = 11.48g

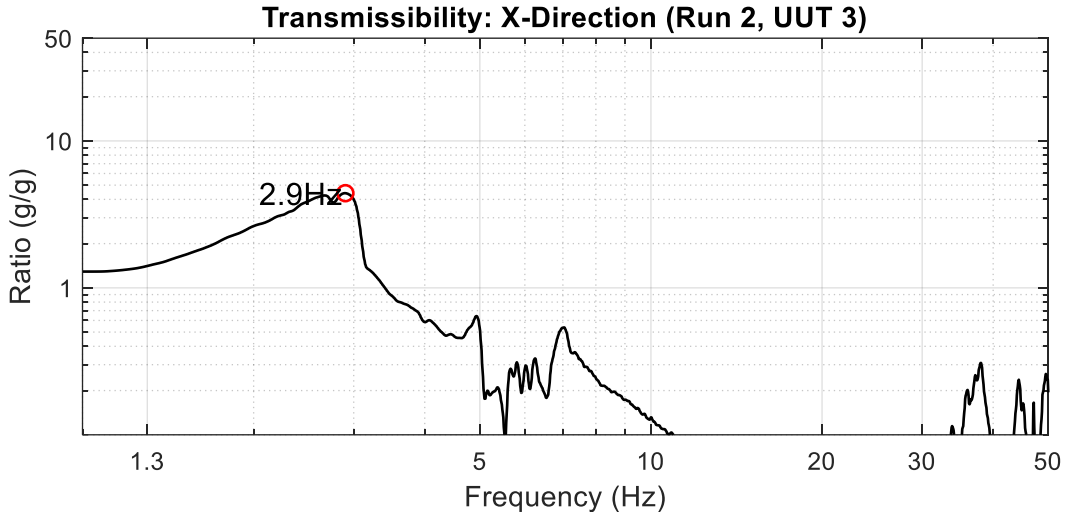

TRS, 5% Damping (Run 2, UUT 11)
Spectral Acceleration (g)
TRS-X
TRS-Y
TRS-Z
Run 2 Seismic Isolated.txt
Frequency (Hz)

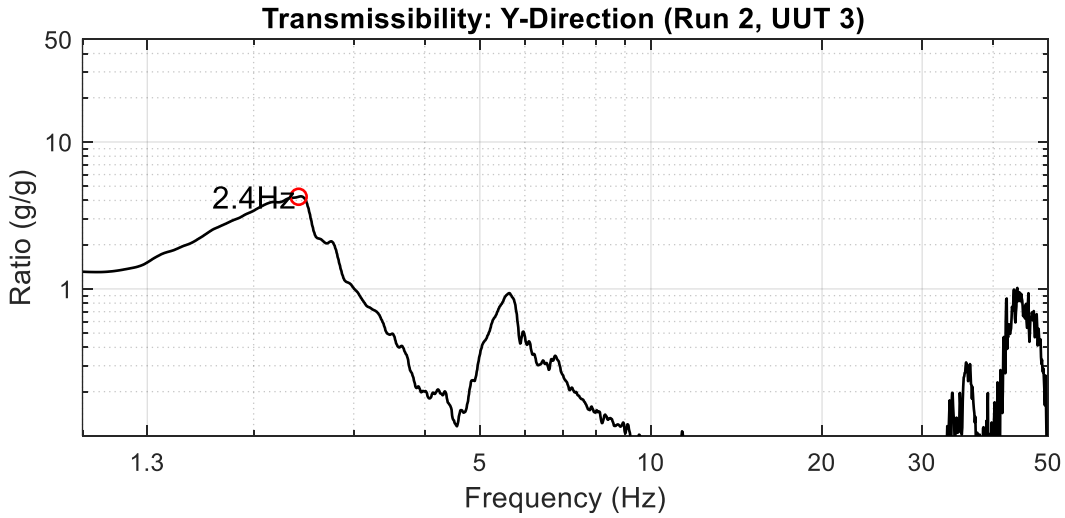

Time History: X-Direction (Run 2, UUT 11)
Acceleration (g)
Time (s)
Max. X Accel. = 24.38g

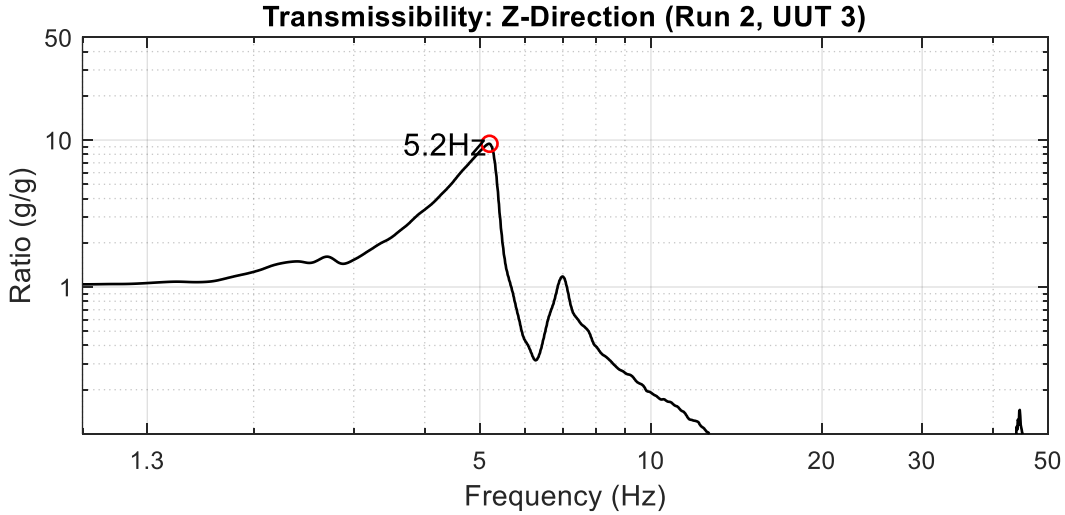

Time History: Y-Direction (Run 2, UUT 11)
Acceleration (g)
Time (s)
Max. Y Accel. = 11.23g

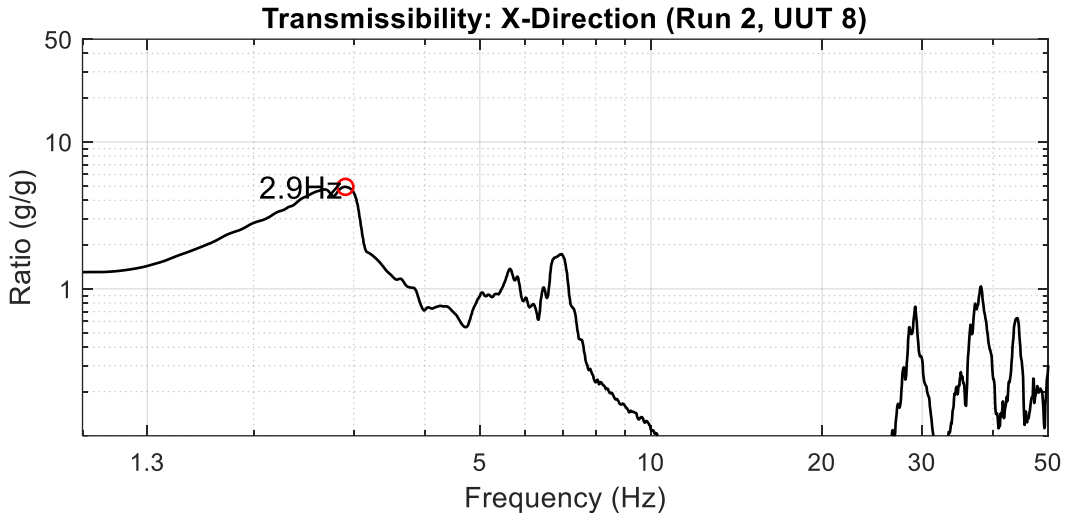

Time History: Z-Direction (Run 2, UUT 11)
Acceleration (g)
Time (s)
Max. Z Accel. = 15.82g

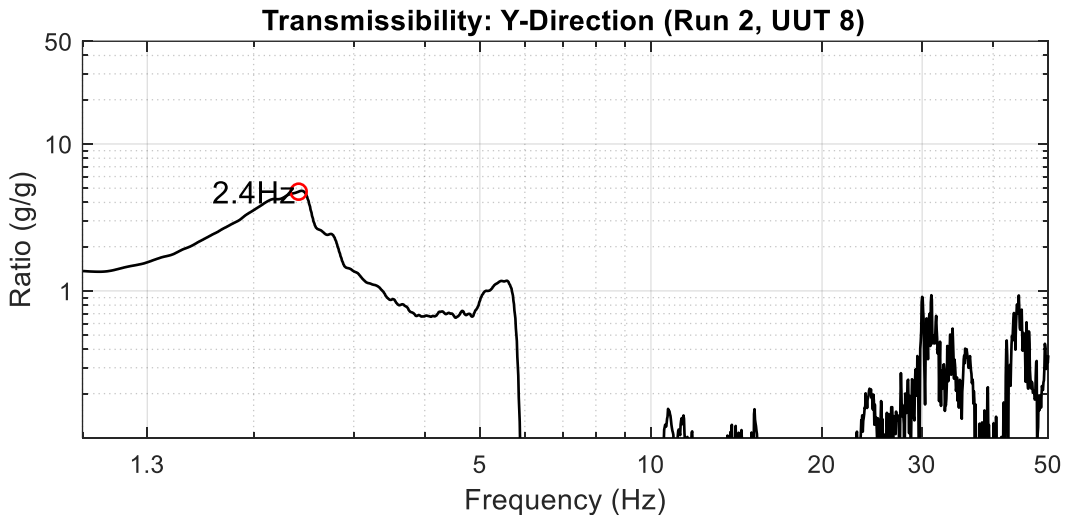
Resonant Frequency Search Plots

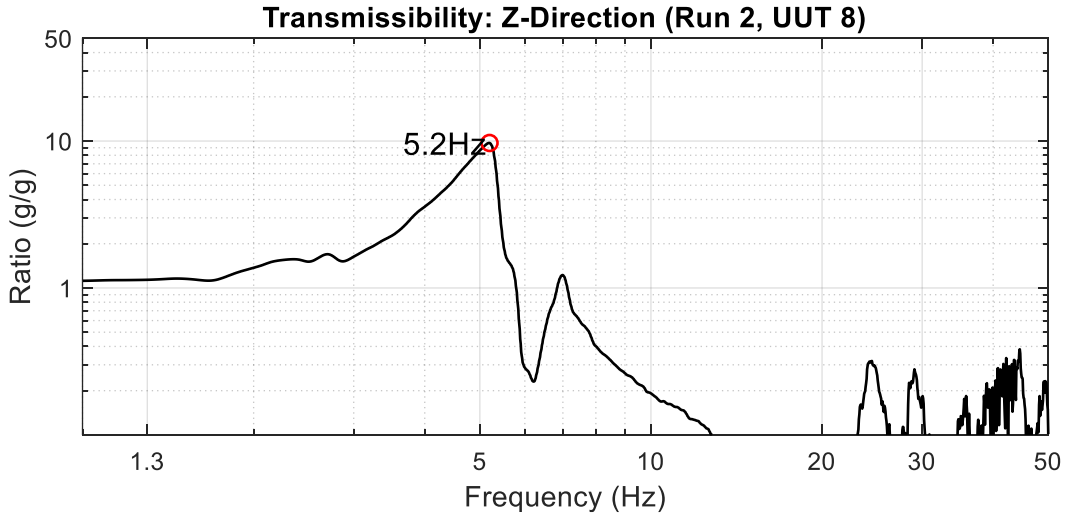


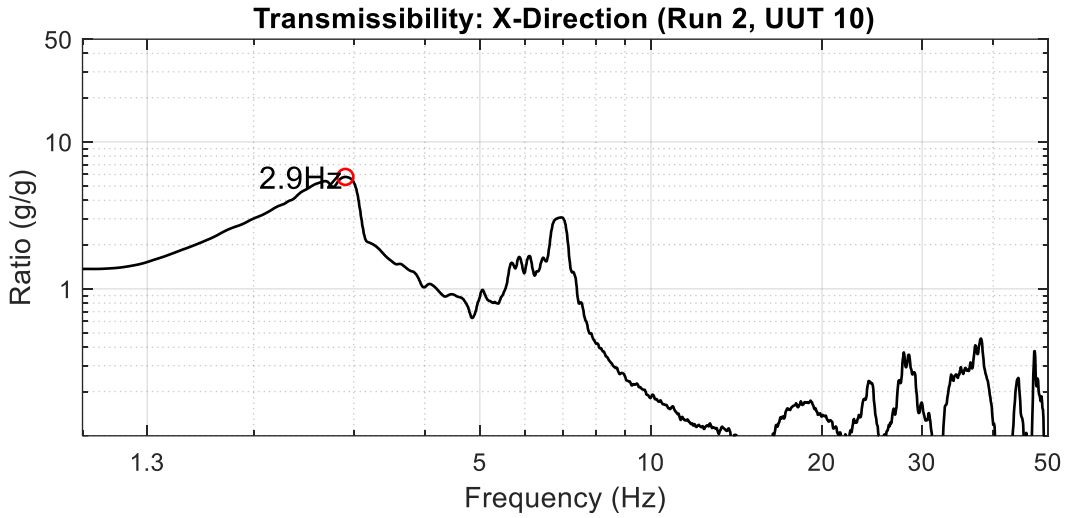


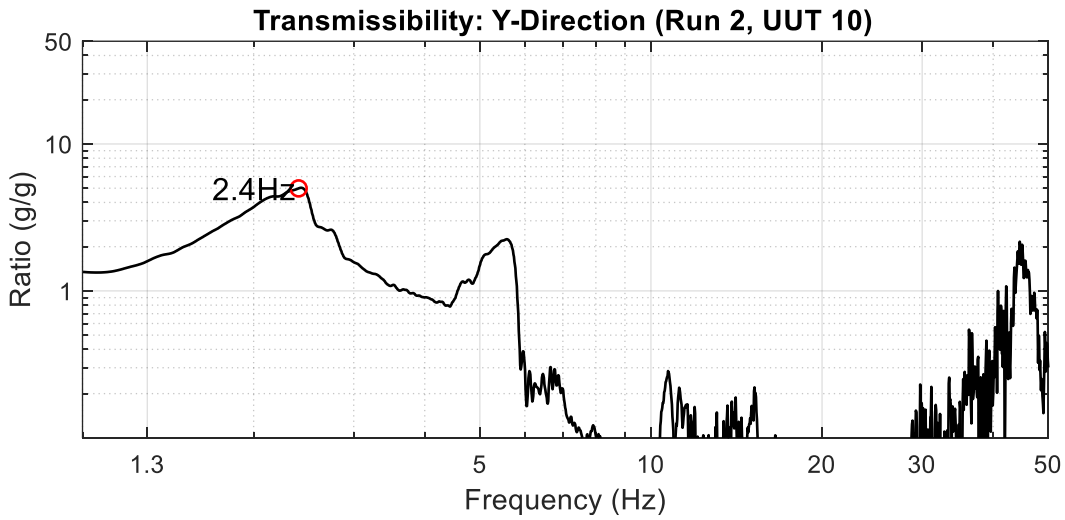


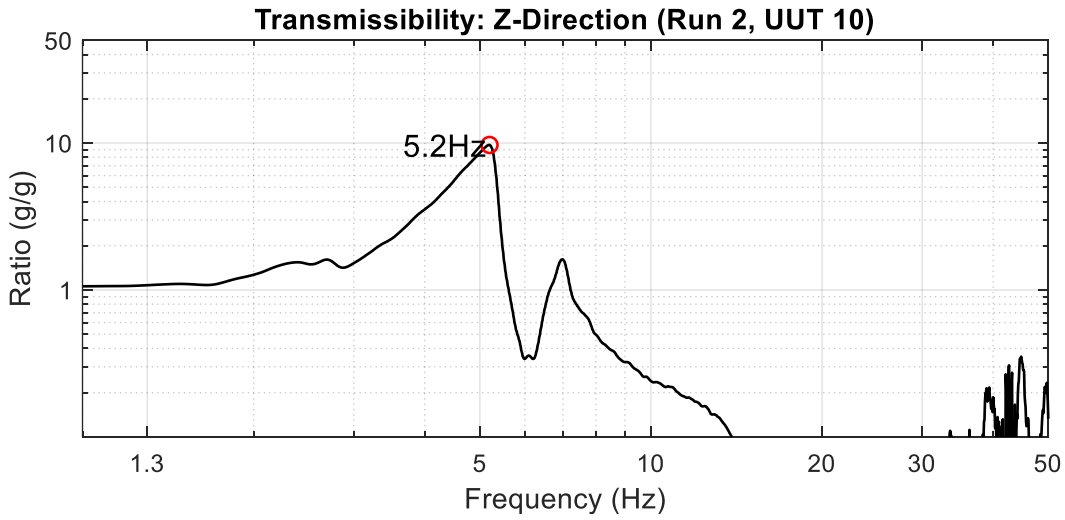

Transmissibility: X-Direction (Run 2, UUT 8)
Ratio (g/g)
50
10
1
2.9Hz
1.3
5
10
20
30
50
Frequency (Hz)

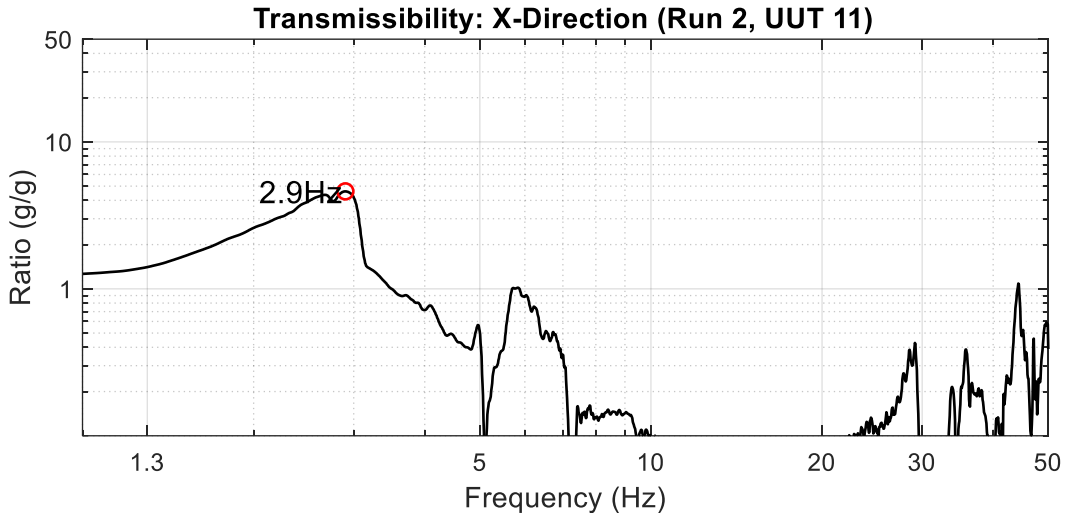

Transmissibility: Y-Direction (Run 2, UUT 8)
Ratio (g/g)
50
10
1
2.4Hz
1.3
5
10
20
30
50
Frequency (Hz)

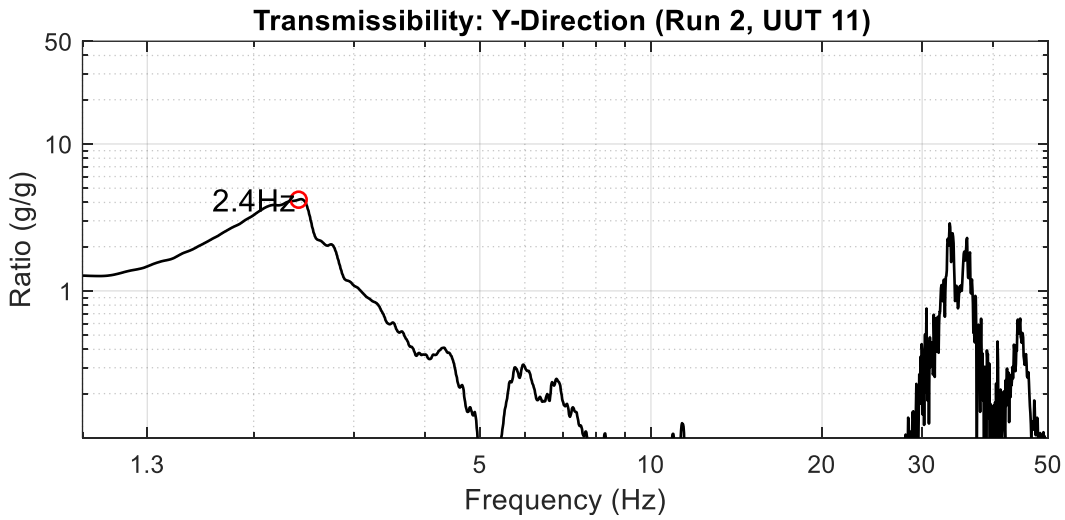

Transmissibility: Z-Direction (Run 2, UUT 8)
Ratio (g/g)
50
10
1
5.2Hz
1.3
5
10
20
30
50
Frequency (Hz)

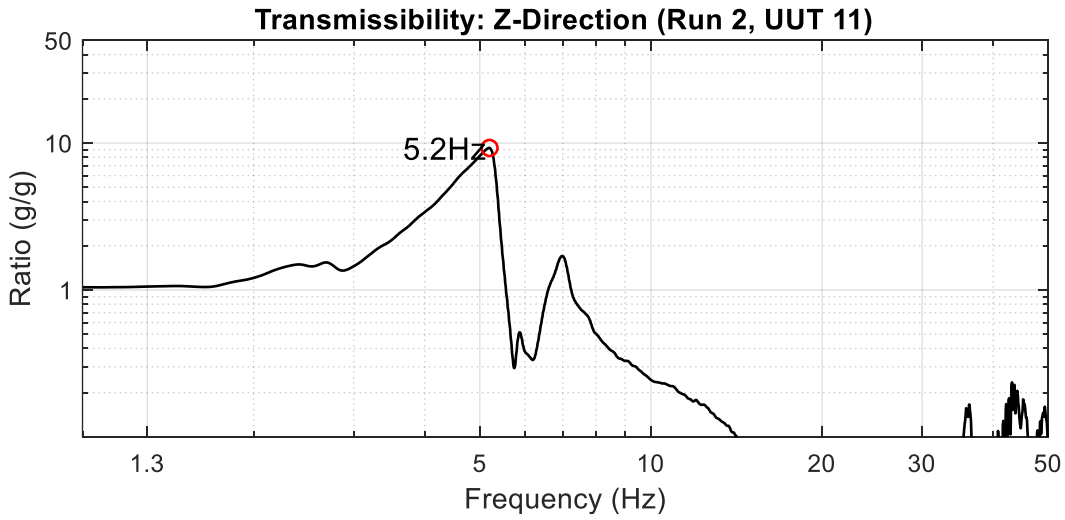

Transmissibility: X-Direction (Run 2, UUT 10)
50
10
1
Ratio (g/g)
2.9Hz
1.3
5
10
20
30
50
Frequency (Hz)


Transmissibility: Y-Direction (Run 2, UUT 10)
50
10
1
Ratio (g/g)
2.4Hz
1.3
5
10
20
30
50
Frequency (Hz)


Transmissibility: Z-Direction (Run 2, UUT 10)
50
10
1
Ratio (g/g)
5.2Hz
1.3
5
10
20
30
50
Frequency (Hz)


Transmissibility: X-Direction (Run 2, UUT 11)
Ratio (g/g)
50
10
1
2.9Hz
1.3
5
10
20
30
50
Frequency (Hz)


Transmissibility: Y-Direction (Run 2, UUT 11)
Ratio (g/g)
50
10
1
2.4Hz
1.3
5
10
20
30
50
Frequency (Hz)


Transmissibility: Z-Direction (Run 2, UUT 11)
Ratio (g/g)
50
10
1
5.2Hz
1.3
5
10
20
30
50
Frequency (Hz)

APPENDIX – LABORATORY ACCREDITATION

CERTIFICATE OF ACCREDITATION

ANSI National Accreditation Board

11617 Coldwater Road, Fort Wayne, IN 46845 USA

This is to certify that

Environmental Testing Laboratory
11034 Indian Trail
Dallas, TX 75229

has been assessed by ANAB and meets the requirements of international standard

ISO/IEC 17025:2017

while demonstrating technical competence in the field of

TESTING

Refer to the accompanying Scope of Accreditation for information regarding the types of activities to which this accreditation applies

AT-1787
Certificate Number

ANAB Approval

Certificate Valid Through: 05/24/2021
Version No. 005 Issued: 04/24/2019

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

Environmental Testing Laboratory

11034 Indian Trail
Dallas, Texas 75229
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Jeremy@etldallas.com www.etldallas.com

TESTING

Valid to: **May 24, 2021** Certificate Number: **AT-1787**

Mechanical

Specific Tests and/or Properties Measured	Specification, Standard, Method, or Test Technique	Items, Materials or Product Tested	Key Equipment or Technology
Temperature, Temperature Shock	ASTM Specifications GR-63-CORE Specifications GR-487-CORE Specifications IEC Specifications ISO Specifications ISTA Specifications MIL-Standards Specifications RTCA/DO-160 Specifications Customer Supplied Procedure	Interior Components Exterior Components	HP Data Acquisition Various Size Chambers
Altitude, Decompression, Overpressure	ASTM Specifications IEC Specifications MIL-Standard Specifications RTCA/DO-160 Telcordia GR-63-CORE Telcordia GR-487-CORE UL 50E Customer Supplied Procedure	Interior Components Exterior Components	HP Data Acquisition Various Size Chambers
Humidity	ASTM Specifications GR-63-CORE Specifications GR-487-CORE Specifications IEC Specifications ISO Specifications ISTA Specifications MIL-Standard Specifications RTCA/DO-160 Specifications Customer Supplied Procedure	Interior Components Exterior Components Cabinets	HP Data Acquisition Various Size Chambers

Mechanical

Specific Tests and/or Properties Measured	Specification, Standard, Method, or Test Technique	Items, Materials or Product Tested	Key Equipment or Technology
Earthquake Resistance, Seismic	GR-487-CORE Specifications GR-63-CORE Specifications ICC ES AC156 Seismic Specifications, IEEE Standard Specifications Customer Supplied Procedure	Interior Components Rack, Enclosures	32 Channel Controller ANCO Shake Table
Solar Testing	MIL-Standard Specifications RTCA /DO-160 Specifications ASTM G154 Customer Supplied Procedure	Plastics, Metals, Exterior Components	HP Data Acquisition Various Size Chambers
Rain	DIN 40 050 Specifications IEC 60529 Specifications ISO 20653 Specifications MIL- Standard Specifications NEMA 250 Specifications RTCA/DO-160 Specifications Telcordia GR-487-CORE Telcordia GR-63-CORE UL 50E Customer Supplied Procedure	External Components, Racks, Outdoor Products	Various Nozzles Calibrated Flow Meters
Immersion	IEC 60529 MIL-STD Specifications RTCA/DO-160 Specifications Customer Supplied Procedure	External Components	Pressure Vessel Calibrated Flow Meter or Water Column
Sand and Dust	GR-487-CORE Specifications GR-63-CORE Specifications IEC 60529 MIL-Standard Specifications NEMA 250 Specifications RTCA/DO-160 Specifications Customer Supplied Procedure	Metals, Plastics, Rubbers, External Components	Sand & Dust Chambers HP Data Acquisition Anemometer
Explosive Atmosphere	MIL-Standard Specifications RTCA/DO-160 Specifications Customer Supplied Procedure	Internal Components, Electronics	Explosive Atmosphere Chamber N-Hexane or 100 LL HP Data Acquisition
Acceleration	MIL-Standard Specifications RTCA/DO-160 Specifications Customer Supplied Procedure	Aircraft Hardware, Military Hardware	10 foot Centrifuge 200lbs at 200g
Icing Test	MIL-Standard Specifications IEEE C37.30.1-200X D1 Customer Supplied Procedure	External Components	Water Chiller for 33°F Water Various Size Chambers HP Data Acquisition

Mechanical

Specific Tests and/or Properties Measured	Specification, Standard, Method, or Test Technique	Items, Materials or Product Tested	Key Equipment or Technology
Drop Test (Packaged and Un-Packaged)	ASTM Specifications GR-487-CORE Specifications GR-63-CORE Specifications IEC Specifications ISTA Specifications Customer Supplied Procedure	Pallet Packaged, Container Packaged	L.A.B. Drop Tester Multiple Quick Releases
Mechanical Load Test	ASTM Specifications GR-487-CORE Specifications GR-63-CORE Specifications IEC Specifications ISTA Specifications Customer Supplied Procedure	Metal, Alloys, Fasteners, Doors	10 ton press Load Cells (5k, 10k, 100k) lb
Contamination by Fluids	MIL-Standard Specifications RTCA /DO-160 Specifications Customer Supplied Procedure	Rubbers, Plastics, Exterior Components	Various Fluids
Fungus Exposure	MIL STD 810G Sec 508.6 RTCA/DO-160 Specifications Customer Supplied Procedure	Interior Components Exterior Components	HP Data Acquisition Various Size Chambers
Mechanical Shock	ASTM Specifications GR-487-CORE Specifications GR-63-CORE Specifications IEC Specifications ISO Specifications ISTA Specifications MIL-Standards Specifications RTCA/DO-160 Specifications Customer Supplied Procedure	Interior Components Exterior Components	Unholtz Dickie Shakers Vibration Research Controllers Dactron Controllers
Vibration (Sine, Random, SRS, Shock)	ASTM Specifications ETS 300 0019-1-2 Specifications GR-487-CORE Specifications GR-63-CORE Specifications IEC Specifications IEEE Specifications ISTA Specifications MIL-Standard Specifications RTCA/DO-160 Specifications Customer Supplied Procedure	Interior Components Exterior Components	Unholtz Dickie Shakers L.A.B. Transportation Simulator Vibration Research Controllers Dactron Controllers
Salt Fog/Spray	ASTM B 117 MIL-STD Specifications RTCA/DO-160 Specifications	Metals, Alloys	Salt Fog Chamber Customer Set-ups

Mechanical

Specific Tests and/or Properties Measured	Specification, Standard, Method, or Test Technique	Items, Materials or Product Tested	Key Equipment or Technology
Body Structure Load Test	AMD 001 NFPA 1917, Section 9.1 SAE J3057	Ambulance	Hydraulic Fixture Loads up to 60 000 lb
Body Door Retention Load Test	AMD 002 NFPA 1917, Section 9.2	Ambulance	Load Cell Loads up to 3 500 lb
Tank Retention Load Test	AMD 003 NFPA 1917, Section 9.3	Ambulance	Load Cell Loads up to 3 500 lb
Litter Retention Load Test	AMD 004 NFPA 1917, Section 9.4 SAE J3102	Ambulance	Custom Fixture with load cell, loads up to 3 500 lb
12 volt DC Electrical System Test	AMD 005 NFPA 1917, Section 9.5	Ambulance	Calibrated Multi-Meter
Sound Level Test	AMD 006 NFPA 1917, Section 9.6	Ambulance	Sound Meter
Carbon Monoxide Level Test	AMD 007 NFPA 1917, Section 9.7	Ambulance	CO Monitor 0.5 ppm Accuracy
Grab Rail Load Test	AMD 008 NFPA 1917, Section 9.8	Ambulance	Load Cell Loads up to 1 000 lb
125 Volt AC Electrical System Test	AMD 009 NFPA 1917, Section 9.9	Ambulance	Calibrated Multi-Meter
Water Spray	AMD 010 NFPA 1917, Section 9.10	Ambulance	Water Spray Apparatus per AMD
Equipment Temperature Test	AMD 011 NFPA 1917, Section 9.11	Ambulance	HP Data Acquisition System -30 °F to 140 °F
Interior Climate Control Test	AMD 012 NFPA 1917, Section 9.12	Ambulance	HP Data Acquisition System -30 °F to 140 °F
Weight Distribution / Center of Gravity	AMD 013 NFPA 1917, Section 9.13	Ambulance	4 Vehicle Wheel Scales Up to 10 000 per scale Accurate to 5 lb
Engine Cooling Test	AMD 014 NFPA 1917, Section 9.14	Ambulance	HP Data Acquisition System -30 °F to 140 °F
Main Oxygen System Test	AMD 015 NFPA 1917, Section 9.15	Ambulance	Calibrated Pressure Gauge Gas Flow Meter
Patient Lighting Test	AMD 016 NFPA 1917, Section 9.16	Ambulance	Calibrated Light Meter
Road Test	AMD 017 NFPA 1917, Section 9.17	Ambulance	Test per AMD
Step / Bumper Load Test	AMD 018 NFPA 1917, Section 9.18	Ambulance	Hand-Truck and Scale
Storage Measuring	AMD 019 NFPA 1917, Section 9.19	Ambulance	Calibrated tape measure

Mechanical

Specific Tests and/or Properties Measured	Specification, Standard, Method, or Test Technique	Items, Materials or Product Tested	Key Equipment or Technology
Floor Distribution Load Test	AMD 020 NFPA 1917, Section 9.20	Ambulance	Hand-Truck Deflection Indicator per AMD
Aspirator System Test	AMD 021 NFPA 1917, Section 9.21	Ambulance	Gas Flow Meter Vacuum Gauge
Cold Engine Start Test	AMD 022 NFPA 1917, Section 9.22	Ambulance	HP Data Acquisition System -30 °F to 140 °F
Perimeter Illumination Test	AMD 024 NFPA 1917, Section 9.24	Ambulance	Calibrated Light Meter
Occupant Head Clearance	AMD 025 NFPA 1917, Section 9.25	Ambulance	Test Fixture per AMD
Line Voltage Test	AMD 027 NFPA 1917, Section 8	Ambulance	Volt Meter Amp Meter
Interior Storage Compartment Integrity	SAE J3058	Ambulance	Lead Weights Calibrated Weighing Terminal
Occupant Restraint – Front, Rear, and Side Impact	SAE J2917 SAE J2956 SAE J3044 FMVSS 571.210	Ambulance	Load Cell Loads up to 25,000 lbf
Seat Belt Assemblies Testing	FMVSS 571.209 Customer Supplied Procedure	Occupant Restraint Assemblies	Load Cell

Note:

1. This scope is formatted as part of a single document including Certificate of Accreditation No. AT-1787.
2. General identified Standards and Specifications in the above scope that do not have specific document numbers (i.e., ASTM, IEC, ISO, ISTA, MIL STD, and IEEE specifications) are identified of having several documents that provide specifications for a particular test.

Vice President

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