LAB N° 1897 L

SEISMIC AND TRANSPORTATION TESTS

ELECTRICAL PANEL YESPAN ELEKTRIK

QUALIFICATION REPORT

RAT-MTL-ELE24-062-R00

Customer: YESPAN Elektrik San. ve Tic. Ltd. Şti

casari stefano
01.10.2024
10:59:59
GMT+01:00
Advanced digital signature

Seriate, 25/09/2024

Function	Name and Surname	Signature
Laboratory Technician	Salvatore Nobile	
Manager of the Mechanical Testing Sector	Stefano Casari	

REVISION TRACKS

Date	Version	Description of changes	Reference
25/09/2024	00	First issue	-

The results contained in this Test Report is found exclusively to the items being tested.
The results were good for the sample as received.
P&P LMC S.r.l. has adopted the ISO 9001:2015 certified Quality Management System, CSQ Certificate n. 9175.ILMC - IQNet Certificate n. IT - 20582.

[#] Data provided by the Customer.
[*] Activity not accredited by ACCREDIA.

SUMMARY

1. GENERAL DATA

1.1. Customer

YESPAN Elektrik San. ve Tic. Ltd. Şti
Umurlu Mh. Aydın OSB 2. Cd.No:41
09630 Efeler, Aydın
Türkiye

1.2. Unit under test (UUT/EUT)

ID Sample	Quantity# (ID unit)	Sampling#	Description unit under test	Sample receipt date	Components of the unit#
E Series	1 (20240973)	Customer	Electric panel Mass (EUT): 749 kg Dimensions# (EUT): W: 1400mm H: 2200+100mm D: 1000mm	05/08/2024	-

1.3. Manufacturer

YESPAN Elektrik San. ve Tic. Ltd. Şti #
Umurlu Mh. Aydın OSB 2. Cd.No:41
09630 Efeler, Aydın
Türkiye

1.4. Reference documents

1.4.1. Contract documents

a. Offer of P&P LMC S.r.l. no. OFF-MTL-ELE24-045-R01 dated 27/05/2024.

b. Purchase order by acceptance of OFF-MTL-ELE24-045-R01 dated 27/05/2024.

1.4.2. Technical documents

doc. 1.	GR-63-CORE Issue no. 05, date 2017	*Telcordia Technologies Generic Requirements - NEBS TM Requirements: Physical Protection*
doc. 2.	IEC 60068-2-6:2007	*Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)*
doc. 3.	IEC 60068-2-47:2005	*Environmental testing - Part 2-47: Tests - Mounting of specimens for vibration, impact and similar dynamic tests*
doc. 4.	IEC 60068-2-57:2013	*Environmental testing – Part 2-57: Tests – Test Ff: Vibration – Time-history and sine-beat method*
doc. 5.	IEC 60068-3-3:2019	*Environmental testing - Part 3-3: Supporting documentation and guidance - Seismic test methods for equipment*

doc. 6.	ASTM D4169-23	*Standard Practice for Performing Testing of Shipping Containers and Systems*
doc. 7.	ASTM D4728-17	*Standard Test Method for Random Vibration Testing of Shipping Containers*
doc. 8.	ASTM D999-08 (2015)	*Standard Test Methods for Vibration Testing of Shipping Containers*
doc. 9.	Sismik test Panosu	*Technical drawing of EUT of Yespan Elektrik "Sismik Test Panosu"*
doc. 10.	ISO 2041:2018	*Mechanical vibration, shock and condition monitoring – Vocabulary*

In the present report the reference documents will be identified by "doc.".

1.5. Purpose of the tests

The purpose of transportation test was to determine that the sample complied with the requirements reported in § 7.2, doc. 6, Product and packaging undamaged "Criterion 3" (Both criteria 1 and 2).

The purpose of the vibration tests was to determine that the sample complied with the requirements reported in § 4.4, doc. 5 for "Criterion 0".

1.6. Testing laboratory

P&P LMC S.r.l.
via Pastrengo, 9
24068 Seriate (BG)
Italy
VAT 02787860168

1.7. Tests date

Beginning date: August 7th 2024
Ending date: August 9th 2024

1.8. Responsibilities

Function	Name and surname	Company
Project manager (pro. PRO-MTL-ELE24-029)	Stefano Casari	P&P LMC S.r.l.
Laboratory technician	Salvatore Nobile	P&P LMC S.r.l.
Customer technical interface	Aydin Ata	A Belgelendirme - Aydın ATA
Customer administrative interface	Aydin Ata	A Belgelendirme - Aydın ATA

1.9. Witness during the tests

Function	Name and surname	Company	Date
Laboratory technician	Salvatore Nobile	P&P LMC S.r.l.	07/08/2024 ÷ 08/08/2024
Laboratory technician	Marco Cardullo	P&P LMC S.r.l.	09/08/2024

2. TESTING PROCEDURES

2.1. General remarks

Vibration tests were performed with a monoaxial electrodynamic vibration shaker. Along the vertical direction they were conducted on the vibration shaker in vertical position. For the horizontal directions the vibration shaker was rotated 90° and connected to a horizontal hydraulic slip-table. The directions of excitation and the coordinate reference system are shown in Figure .

2.2. Mounting technique

For transportation test the packaged EUT was placed onto the expander 1500x1500 mm of the vibration shaker in its normal transportation conditions (on metallic rigid surface) and orientation allowing it to bounce and to move freely (ref. Photo 1). Wooden beams were fixed to the expander by means of steel stirrups and rods in order to prevent the EUT to fall off the shaking table.

For the seismic test, the base of the unit was connected to the expander 1500x1500 mm of the vibration shaker with n. 20 M14 bolts, with tightening at a torque of 80 Nm (ref. Photo 10), to reproduce the assembly operating conditions established by the Customer.
The head expander (1500x1500 mm) was fixed on top of the shaker in Z direction or on top of slip table in X and Y directions with n. 16 M14 bolts with a tightening torque of 80 Nm.

2.3. Control and measuring positions

For transportation and vibration test motion control the mono-axial accelerometer (CP1) was placed on the expander in the direction of motion.
The chosen control strategy was to consider the average of the signals recorded by the control accelerometers (CP), shown in the legend of the test graphs with the AvgCtrl nomenclature.
For the vibration test the tri-axial accelerometers (MP1, MP2) were placed on the unit for the measurement positions.
The accelerometers were fixed by screwing them to a base at 1,5 Nm, then glued with methacrylate and on PET Liner adhesive tape treated with a special anti-adhesive for silicones.
The accelerometer MP3 was used as check point.
The MP accelerometers were used to recognise the resonance frequencies using the peaks of amplification factor (Q) and the corresponding angle phase.
The deflection at the top of the framework EUT's relative to its base (§ 5.4.1.2, doc. 1) was calculated in the direction of motion by double integration of the MP2 and MP3 acceleration time-histories and then by subtraction of their displacement time-histories.
The following table summarizes the control and measurement positions (CP and MP), identifying the transducers and their location during the tests.

Point ID	Description	Accelerometers			
		Type	s/n	Direction	N. output
CP1	Control point in the same direction of the motion used for Y direction (vibration test) and positioned on the expander.	Mono-axial	25210410 + LW210159	+Y	01
CP1	Control point in the same direction of the motion. Placed onto the expander for vertical testing and on the edge of the expander for horizontal testing.	Mono-axial	25210410 + 48422	+Z, +X	01
MP1	Measurement point placed on the side of the unit	Tri-axial	25210410 + 9829	-Z	04
				+X	05
				-Y	06
MP2	Measurement point placed on the opposite side of MP1, on the top of the unit.	Tri-axial	25210410 + 9830	-Z	07
				-Y	08
				-X	09
MP3	Measurement point used as check point positioned on the top of expander near the fixing points of expander-UUT	Tri-axial	25210410 + 11804	+X	10
				+Y	11
				+Z	12

A digital camera with 1280 x 720 Pixel resolution and 30 fps (0,033 s < 0,1 s) was used to record the video, clearly recording the front view of the frame and the movement of the top of the EUT relative to its base (required by § 5.4.1.2, doc. 1).

2.4. Tests Description

The order of execution in the three directions was agreed with the Customer and was: Z, X, Y. The sequences of tests are as follows:

ID	Description	References	Carried out by
a)	Initial visual inspection for deformations or mechanical alterations.	-	P&P LMC S.r.l.
b)	*Random Truck Low Level Vibration Test	doc. 6	P&P LMC S.r.l.
c)	*Random Truck Medium Level Vibration Test	doc. 6	P&P LMC S.r.l.
d)	*Random Truck High Level Vibration Test	doc. 6	P&P LMC S.r.l.
e)	Visual inspection for deformation and package damaging.	-	P&P LMC S.r.l.
f)	Repeat steps from b) to e) two times.	-	P&P LMC S.r.l.
g)	Initial vibration response investigation test in the Z direction and analysis the resonance frequencies found based on the amplification factor.	§ 8.2, doc. 2 § 9.2, doc. 5	P&P LMC S.r.l.
h)	Perform the earthquake test in the Z direction.	§§ 4.4, 5.4, doc. 1 § 4.4, doc. 4	P&P LMC S.r.l.
i)	Final vibration response investigation test in the Z direction. Comparison of the initial and final resonance frequencies.	§ 8.2, §§ 11, A.9, doc. 2 § 9.2, doc. 5	P&P LMC S.r.l.
j)	Final visual inspection for deformations or mechanical alterations.	-	P&P LMC S.r.l.
k)	Repeated steps g) to j) for X direction and then Y direction	-	P&P LMC S.r.l.

2.4.1. Vibration response investigation

The unit was subjected to sinusoidal sweep with the dynamic characteristics shown in the following table, along the Y, X and Z directions. The purpose of these tests was to find the resonance frequencies of the unit.

RESONANCE FREQUENCY SEARCH (ref. § 8.2, doc. 2; § 5.4.1.5, doc. 1 and § 9.2,doc. 5)			
Conditions		Operational during testing (400 V power supply)	
Frequency range [Hz]	**Level (peak)**	**Sweep rate**	**Number of sweeps**
1,00 [1] ÷ 50,0 Hz	± 0,10 g	1 oct/min	2 (down and up)
Duration			
09 min 17 s			
Filters			
High pass filter 0,5 Hz and Low pass filter 102400 Hz. "Harmonic estimator" to evaluate the amplitude (Q) of resonance frequency.			
Tolerances			
± 15 % on the control signal at the reference point (ref. § 4.1.4.1,doc. 2). ± 25 % @ ≤ 500 Hz on the control signal at the check point (MP3) (ref. § 4.1.4.2, doc. 2). ± 10 % @ 0,5 ÷ 5,0 Hz; ± 0,5 Hz @ 5 Hz ÷ 100 Hz on the critical frequencies measuring (ref. § 4.1.5.3, doc. 2). 50 % @ ≤ 500 Hz of specified amplitude at the check points (MP3) in any axis perpendicular to the excitation direction (ref. § 4.1.2.1, doc. 2). ± 10 % of the sweep rate (ref. § 4.1.6, doc. 2).			
Amplification factor (Q)			
Where there is a peak of Q with a phase change of 90°			
Criterion of conformity			
Comparison of the initial and final resonant frequencies as per §§ 11, A.9, doc. 2 without acceptance or refusal.			

The signals of the measurement accelerometers have been processed to obtain the absolute response functions[2] of the control channel and the frequency transfer functions of the measurement channels on the unit.

[1] Or the minimum achievable frequency due the vibration shaker limits.

[2] The absolute response function is the phasor of the response signal, a complex number whose amplitude is the amplitude of the first harmonic of the oscillation and whose angle is the phase. The Frequency Response transfer Function (FRF) is the frequency-dependent relationship between the motion response phasor and the excitation motion phasor; this is a complex function and is graphically given by curves showing the relationship between the amplitude of the first harmonic of the response signal and the amplitude of the first harmonic of the excitation signal and the relative phase shift or phase angle with respect to frequency.

2.4.2. Earthquake test method

The acceleration time history is a prescribed waveform "VERTEQII" (ref. figure 5-1 and §§ 5.4.1, 5.4.1.2,doc. 1) that allows to obtain the Required Response Spectrum (RRS) as reported in § 5.4 and figure 5-18 of doc. 1. The Test Response Spectrum (TRS) obtained from the vibration shaker acceleration (measured by CP1) shall dominate the RRS across the entire expected frequency range.
The TRS envelopes the RRS with tolerance according to § 4.4.4, doc. 4 and for every direction a comparison is given in the diagrams of the RRS with the TRS at the same damping value.
The parameters of the Required Response Spectrum (RRS) are shown below.

EARTHQUAKE TEST METHOD (ref. §§ 4.4, 5.4, doc. 1 and § 4.4, doc. 4)	
Conditions	Operational during testing (400 V power supply)
Severity level	Zone 4
RRS	
Frequency [Hz]	**Floor acceleration [g]**
0,30	0,20
0,60	2,00
2,00	5,00
5,00	5,00
15,00	1,60
50,00	1,60
Viscous damping ratio (ξ)	2 % → Q factor = 25 → 1/6 octave bands (ref. § 5.4.1.2, doc. 1)
Zero Period Acceleration (ZPA)	1,60 g → directions Y, X and Z
Duration	30 s
Sample rate	400 Hz → ≥ 200 Hz (ref. § 5.4.1.2, doc. 1)
Filters	
High Pass filter 0,5 Hz; Low pass filter 102400 Hz. BP 2,80÷100,00 Hz applied to VERTEQII time-history (§ 2.4.2.1).	
Tolerances	
± 25 % of the specified peak value in the time history at check point (MP3) in any axis perpendicular to the excitation direction (ref. § 4.4.2, doc. 4). ≤ +30 % @ 1 ÷ 7 Hz of RRS (ref. § 5.4.1.5, doc. 1). 0 ÷ +50 % of RRS; > 50 % is permitted @ > $1/3 \cdot f_2$ (ref. § 4.4.4, doc. 4). If a small portion of the individual points lies outside the tolerance zone the test must still be acceptable (ref. §§ 4.4.4, A.1.2, doc. 4).	
Conformity criterion	
Qualification criteria (according to § 4.4, doc. 5): Criterion 0: Equipment subjected to seismic testing which experienced no malfunction either during or after the test.	

2.4.2.1. Method deviation

Due the vibration shaker technical characteristics the requirement of displacement as per § 5.4.1.2, doc. 1, "The usable peak-to-peak stroke of the shaker shall be a minimum of 250 mm (10 in)", is reduced to the maximum stroke peak-to-peak 50,8 mm. Then, the acceleration time history waveform of VERTEQII (§ 5.4.1, doc. 1) was cut by applying a bandpass, starting from the minimum frequency at 2,80 Hz.

2.4.3. Schedule E - Vehicle Vibration: Truck profile

The unit was tested with the RMS and frequency values shown in the following table, along the Z direction, under conditions and duration prescribed by the Customer.

*SCHEDULE E - VEHICLE VIBRATION: TRUCK PROFILE (ref. §§ 12.3, 12.4, Table 2, doc. 6)						
Classification	Vehicle vibration - Truck profile					
Conditions	Not operational during testing. Unit in final transportation packaging.[#] Rigid metal support surface.[#]					
Frequency range	1,00 ÷ 200,00 Hz					
Level						
Direction	**High Level**		**Medium Level**		**Low Level**	
	Frequency [Hz]	**PSD [g²/Hz]**	**Frequency [Hz]**	**PSD [g²/Hz]**	**Frequency [Hz]**	**PSD [g²/Hz]**
Z (vertical)	1.00	0.00072[3]	1.00	0.00072	1.00	0.0004
	3.00	0.030	3.00	0.018	3.00	0.010
	4.00	0.030	4.00	0.018	4.00	0.010
	6.00	0.0012	6.00	0.00072	6.00	0.00040
	12.00	0.0012	12.00	0.00072	12.00	0.00040
	16.00	0.0060	16.00	0.0036	16.00	0.0020
	25.00	0.0060	25.00	0.0036	25.00	0.0020
	30.00	0.0012	30.00	0.00072	30.00	0.00040
	40.00	0.0060	40.00	0.0036	40.00	0.0020
	80.00	0.0060	80.00	0.0036	80.00	0.0020
	100.00	0.00060	100.00	0.00036	100.00	0.00020
	200.00	0.000030	200.00	0.000018	200.00	0.000010
	0.70 g R.M.S.		0.54 g R.M.S.		0.40 g R.M.S.	
Crest factor						
3 (Ref. § 8.4.4 doc. 7)						
DOF						
240 (≥ 60 Ref. § 8.4.2 doc. 7)						
Duration						
60 min (40 min at Low level; 15 min at Medium level; 5 min at High level, ref. 12.4.2.1, doc. 1)						
Filters						
High pass filter 0,5 Hz and Low Pass filter 102400 Hz						
Tolerances						
± 3 dB @ 0,00 ÷ 200,00 Hz tolerance band (ref. § 8.4.1, doc. 7) ± 6 dB over a cumulative bandwidth of 10,00 Hz (ref. § 8.4.1, doc. 7) ± 15 % of the R.M.S. acceleration (ref. § 8.4.1, doc. 7)						
Conformity criterion						
Criterion 3 - Product and packaging undamaged (Both criteria 1 and 2) (ref. § 7.2, doc. 6)						

[3] Modified due to stroke limits of the vibration shaker and keeping unchanged the r.m.s. (see test results for changes applied).

3. MEASURING, EXCITATION AND DATE PROCESSING EQUIPMENT

3.1. Equipment

Description	Manufacturer	Model	s/n	Internal ID	Calibration certificate	Calibration date
Mono-axial electrodynamic vibratio shaker Maximum sinusoidal dynamic force: 100 kN Coil mass: 100 kg Frequency range: 0÷2000 Hz Max. displacement (peak-peak): 50,8 mm Max. accel.: 100 g	Elin	MZV 210 W 20	713255	MTL01SH02	-	-
Slip table Magnesium table moved with n. 4 hydrostatic bearings	Elin	MZL 1-070T 30	184314, 184315 184317, 184318 184319, 184320	MTL01TV01	-	-
Digital camera Optical zoom 8x; F3,3 (W) - 6,3 (T); f = da 4,5 a 36 mm; ISO 80-3200; Video 1.280 × 720/30fps	Sony Corp.	DSC-W830	7543315	MTL05NA03		

3.2. Measure equipment

Description	Manufacturer	Model	s/n	Internal ID	Calibration certificate	Calibration date
Acquisition system channel 1 + acc. mono-axial (CP1)	Siemens + PCB Piezotronics, Inc	SCM2E05V + 393B03	25210410 + LW210159	CH1 (MTL06SC00+ MTL27AC01)	S090/24	22/03/2024
Acquisition system channel 1 + acc. mono-axial (CP1)	Siemens + PCB Piezotronics, Inc	SCM2E05V + 393B04	25210410 + 48422	CH1 (MTL06SC00 + MTL39AC01)	S132/24	28/03/2024
Acquisition system channels 4, 5, 6 + acc. tri-axial (MP1)	Siemens + Dytran Instruments Inc	SCM2E05V + 3023A6	25210410 + 9829	CH4 (MTL06SC00 + MTL21AC01)	S096/24	23/03/2024
				CH5 (MTL06SC00 + MTL21AC01)	S097/24	23/03/2024
				CH6 (MTL06SC00 + MTL21AC01)	S098/24	23/03/2024

Description	Manufacturer	Model	s/n	Internal ID	Calibration certificate	Calibration date
Acquisition system channels 7, 8, 9 + acc. tri-axial (MP2)	Siemens + Dytran Instruments Inc	SCM2E05V + 3023A6	25210410 + 9830	CH7 (MTL06SC00 + MTL22AC01)	S099/24	25/03/2024
				CH8 (MTL06SC00 + MTL22AC01)	S100/24	25/03/2024
				CH9 (MTL06SC00 + MTL22AC01)	S101/24	25/03/2024
Acquisition system channels 10, 11, 12 + acc. tri-axial (MP3)	Siemens + Dytran Instruments Inc	SCM2E05V + 3023A6	25210410 + 11804	CH10 (MTL06SC00 + MTL23AC01)	S102/24	25/03/2024
				CH11 (MTL06SC00 + MTL23AC01)	S103/24	25/03/2024
				CH12 (MTL06SC00 + MTL23AC01)	S104/24	25/03/2024
Mini data logger to environmental temperature measurement. Accuracy: ±0,5 °C Resolution: 0,1 °C	Testo	174T	58908750	MTL02EV00	02_2024	26/02/2024
Dynamometer 6.000 kg, e_{max} = 2 kg	-	MCWLT6	61835	MTL01FR09	0551/23	18/04/2023
Torque bar, 1÷5 Nm	USAG	811N 5	Y120147	MTL07CS00	LAT 166 24-G0317	01/07/2024
Torque wrench 20 ÷ 100 Nm; Resolution 0,25 Nm; Error ± 4%	USAG	810N 100	V120422	MTL05CS00	LAT 166 24-G0315	28/06/2024

The main features of the accelerometers are as follows:

Manufacturer	PCB Piezotronics, Inc	PCB Piezotronics, Inc	Dytran Instruments, Inc
Model	393B04	353B03	3023A6
Nominal sensibility	1000 mV/g	10 mV/g	5 mV/g
Transverse sensibility (max)	< 5%	< 5%	< 5%
Frequency range	1 ÷ 1700 Hz	1 ÷ 7000 Hz	1,5 ÷ 5000 Hz (axis 1 e 2) 1,5 ÷ 10000 Hz (axis 3)
Maximum acceleration	+/- 5 g	+/- 500 g	+/- 1000 g
Resolution	0,01 g	0,01 g	0,010g
Weight	0,50 N	0,105 N	0,04 N

The instrumentation is subjected to a calibration program in accordance with internal procedures.

3.3. Data acquisition and processing equipment

Description	Manufacturer	Model	s/n	Internal ID	Calibration certificate	Calibration date
SCADAS Mobile 5 slots (with n. 2 SCM-V8-E 8 ch, n. 1 SCM-UPS Power supply and n. 1 LMS SCADAS Mobile 8 ch NVH input Module Ethercat)	Siemens (Simcenter)	SCM2E05V	25210410	MTL06SC00	1478-23	22/12/2023
Control and acquisition software	Siemens (Simcenter)	Software Sim.Center TestLab ver. 2021.1	-	-	-	-

During the tests, the shaker was controlled by a SCADAS system consisting of a 24-channel acquisition unit and a Personal Computer with Sim.Center Test.Lab software. This control system generates the required motion profile with a closed loop control chain, fed back using the signal from the accelerometer chosen for the control.
The analog signals from the accelerometers are conditioned by the same SCADA unit and once digitized, are transmitted to the computer responsible for their collection within the test Database and the necessary processing and calculation phases.
The block diagram of the excitation, acquisition and processing system is shown in Figure .

3.4. Uncertainty of the measure

The extended uncertainty U is estimated by the laboratory with a confidence level of 95% and coverage factor k equal to 2.

Uncertainty of measurement chain:

- Uncertainty acceleration [g] U: ± 30 % @ < 1,00 Hz; ± 20 %@ 1,00÷ < 3,00 Hz; ± 5 %@ 3,00 ÷ 2.000,00 Hz. Only for acc. 393B04: ± 8 % @ 315,00 ÷ 1.000,00 Hz.
- Uncertainty frequency [Hz]: U: ± 0,3 %

4. TEST RESULTS

4.1.1. Vibration response investigation

The following table shows the characteristic parameters (frequency, amplification factor and the relationship between final and initial frequency) of the detected resonance frequencies in the measuring positions.
To detect resonance frequencies by Frequency Response Function (FRF), the peak value of amplitude and corresponding phase has been considered.
The MP accelerometers were used to recognise the resonance frequencies using the amplification factor (Q).

Z DIRECTION							
Point ID	**Direction**	**Sweep Direction**	**Beginning**		**Ending**		**fE/fB**
			Freq. [Hz]	**Q [adim]**	**Freq. [Hz]**	**Q [adim]**	**[%]**
MP2	-Z	Up	36.11	3.32	36.11	3.42	0.0%

X DIRECTION							
Point ID	**Direction**	**Sweep Direction**	**Beginning**		**Ending**		**fE/fB**
			Freq. [Hz]	**Q [adim]**	**Freq. [Hz]**	**Q [adim]**	**[%]**
MP1	+X	Up	9.02	4.82	3.32	4.34	-63.2%
MP2	-X	Up	9.02	7.77	3.42	6.55	-62.1%

Y DIRECTION							
Point ID	**Direction**	**Sweep Direction**	**Beginning**		**Ending**		**fE/fB**
			Freq. [Hz]	**Q [adim]**	**Freq. [Hz]**	**Q [adim]**	**[%]**
MP1	-Y	Up	3.64	3.84	3.04	2.67	-16.5%
MP2	-Y	Up	3.69	5.64	3.10	3.91	-16.0%
			16.66	2.97	15.94	2.64	-4.3%

4.1.2. Transportation Test along Z direction

ID samp #	ID unit #	Date executio test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration of conformity[4]
Yespan pano	2024 0973	Beginning 07/08/2024 Ending 07/08/2024	*(Transportati on test - Truck Profile: Low level) §12.4.1, Table 2, ASTM D4169-23	Conditions: Not operational during testing. # Unit in final transport packaging. # Rigid metal support surface. # **RUN01** Frequency range: 1,00 ÷ 200,00 Hz Excitation level: Low level See §2.4.3 Crest factor: 3 DOF: 240 Duration [hh:mm:ss]: 00:40:00 Filter: High Pass 0,5 Hz; Low pass 102400 Hz Tolerances not respected: - Temperature env.: 28,0°C	As a result of the test, there was no damage observed on the products, which indicates that the product meets the condition of damage-free (Product is damage-free). No damage was observed in the packaging either (Package is intact)	§ 7.2, ASTM D4169-23	Criterion 3 - Product and packaging undamaged (Both criteria 1 and 2)	Compliant[4] (only for visual inspection of the packaging)
		Beginning 07/08/2024 Ending 07/08/2024	*(Transportati on test - Truck Profile: Medium level) §12.4.1, Table 2, ASTM D4169-23	Conditions: Not operational during testing. # Unit in final transport packaging. # Rigid metal support surface. # **RUN02** Frequency range: 1,00 ÷ 200,00 Hz Excitation level: Medium level See §2.4.3 Crest factor: 3 DOF: 240				

[4] The performances requirements and declaration of compliance of the unit operation is performed by the Customer. P&P LMC S.r.l. declares compliance only on the basis of a visual inspection to assess deformations and mechanical alterations.

ID samp #	ID unit #	Date executio test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration of conformity[4]
				Duration [hh:mm:ss]: 00:15:00 Filter: High Pass 0,5 Hz; Low pass 102400 Hz Tolerances not respected: - Temperature env.: 28,0°C				
		Beginning 07/08/2024 Ending 07/08/2024	*(Transportation test - Truck Profile: High level) §12.4.1, Table 2, ASTM D4169-23	Conditions: Not operational during testing. # Unit in final transport packaging. # Rigid metal support surface. # **RUN03** Frequency range: 1,00 ÷ 200,00 Hz Excitation level: High level See §2.4.3 PSD @ 1 Hz modified due to shaker stroke limits from 0,00072 to 0,00005 g^2/Hz Crest factor: 3 DOF: 240 Duration [hh:mm:ss]: 00:05:00 Filter: High Pass 0,5 Hz; Low pass 102400 0Hz Tolerances not respected: - Temperature env.: 28,0°C				
		Beginning 07/08/2024 Ending 07/08/2024	*(Transportation test - Truck Profile: Low level) §12.4.1, Table 2,	Conditions: Not operational during testing. # Unit in final transport packaging. #				

ID samp #	ID unit #	Date executio test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration of conformity[4]
			ASTM D4169-23	Rigid metal support surface. # **RUN04** Frequency range: 1,00 ÷ 200,00 Hz Excitation level: Low level See §2.4.3 Crest factor: 3 DOF: 240 Duration [hh:mm:ss]: 00:40:00 Filter: High Pass 0,5 Hz; Low pass 102400 Hz Tolerances not respected: - Temperature env.: 28,0°C				
		Beginning 07/08/2024 Ending 07/08/2024	*(Transportation test - Truck Profile: Medium level) §12.4.1, Table 2, ASTM D4169-23	Conditions: Not operational during testing. # Unit in final transport packaging. # Rigid metal support surface. # **RUN05** Frequency range: 1,00 ÷ 200,00 Hz Excitation level: Medium level See §2.4.3 Crest factor: 3 DOF: 240 Duration [hh:mm:ss]: 00:15:00 Filter: High Pass 0,5 Hz; Low pass 102400 Hz PSD @ 1 Hz modified due to shaker stroke limits from 0,00072 to 0,0004 g^2/Hz				

ID samp #	ID unit #	Date executio test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration of conformity[4]
				Tolerances not respected: - Temperature env.: 28,1°C				
		Beginning 07/08/2024 Ending 07/08/2024	*(Transportation test - Truck Profile: High level) §12.4.1, Table 2, ASTM D4169-23	Conditions: Not operational during testing. # Unit in final transport packaging. # Rigid metal support surface. # **RUN06** Frequency range: 1,00 ÷ 200,00 Hz Excitation level: High level See §2.4.3 PSD @ 1 Hz modified due to shaker stroke limits from 0,00072 to 0,00005 g^2/Hz Crest factor: 3 DOF: 240 Duration [hh:mm:ss]: 00:05:00 Filter: High Pass 0,5 Hz; Low pass 102400 0Hz Tolerances not respected: - Temperature env.: 28,2°C				
		Beginning 07/08/2024 Ending 07/08/2024	*(Transportation test - Truck Profile: Low level) §12.4.1, Table 2, ASTM D4169-23	Conditions: Not operational during testing. # Unit in final transport packaging. # Rigid metal support surface. # **RUN07** Frequency range: 1,00 ÷ 200,00 Hz Excitation level:				

ID samp #	ID unit #	Date executio test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration of conformity[4]
				Low level See §2.4.3 Crest factor: 3 DOF: 240 Duration [hh:mm:ss]: 00:40:00 Filter: High Pass 0,5 Hz; Low pass 102400 Hz Tolerances not respected: - Temperature env.: 28,4°C				
		Beginning 07/08/2024 Ending 07/08/2024	*(Transportation test - Truck Profile: Medium level) §12.4.1, Table 2, ASTM D4169-23	Conditions: Not operational during testing. # Unit in final transport packaging. # Rigid metal support surface. # **RUN08** Frequency range: 1,00 ÷ 200,00 Hz Excitation level: Medium level See §2.4.3 Crest factor: 3 DOF: 240 Duration [hh:mm:ss]: 00:15:00 Filter: High Pass 0,5 Hz; Low pass 102400 Hz PSD @ 1 Hz modified due to shaker stroke limits from 0,00072 to 0,0004 g^2/Hz Tolerances not respected: - Temperature env.: 28,4°C				

ID samp #	ID unit #	Date executio test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration of conformity[4]
		Beginning 07/08/2024 Ending 07/08/2024	*(Transportation test - Truck Profile: High level) §12.4.1, Table 2, ASTM D4169-23	Conditions: Not operational during testing. # Unit in final transport packaging. # Rigid metal support surface. # **RUN09** Frequency range: 1,00 ÷ 200,00 Hz Excitation level: High level See §2.4.3 PSD @ 1 Hz modified due to shaker stroke limits from 0,00072 to 0,00005 g^2/Hz Crest factor: 3 DOF: 240 Duration [hh:mm:ss]: 00:05:00 Filter: High Pass 0,5 Hz; Low pass 102400 0Hz Tolerances not respected: - Temperature env.: 28,4°C				

4.1.3. Vibration Tests along Z direction

ID sample[#]	ID unit[#]	Date execution test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration of conformity
Yespan pano	20240973	Beginning 08/08/2024 Ending 08/08/2024	(initial vibration response investigation) § 8.2, IEC 60068-2-6:2007 § 5.4.1.5 Telcordia Technologies Generic Requirements GR-63-CORE Issue no. 05, date 2017 § 9.2, IEC 60068-3-3:2019	Conditions: Operational during testing (400 V power supply) **RUN01** Test Parameters: See §2.4.1 Excitation levels: 2,00 ÷ 50,0 Hz @ ± 0,10 g (Sweep down and up) Tolerances not respected: ± 15 % on the control signal at the reference point; 50 % @ ≤ 500 Hz of specified amplitude at the check points (MP3) in any axis perpendicular to the excitation direction Temperature env.: 25 ÷ 29 °C	See §§4.1.1 Tolerances not respected: See Figure 13, Figure 16	-	-	-
		Beginning 08/08/2024 Ending 08/08/2024	(Earthquake test method) § 5.4, Telcordia Technologies Generic Requirements GR-63-CORE § 4.4, IEC 60068-2-57:2013	Conditions: Operational during testing (400 V power supply) **RUN02** Test Parameters: See §2.4.2 Tolerances not respected: ≤ +30 % @ 1 ÷ 7 Hz of RRS. 0 ÷ +50 % of RRS; > 50 % is permitted @ > 1/3·f2 If a small portion of the individual points lies outside the tolerance zone the test must still be acceptable Temperature env.: 25 ÷ 29 °C	Visually unaltered after test Tolerances not respected: See Figure 21	§ 4.4, IEC 60068-3-3:2019	Criterion 0: Equipment subjected to seismic testing which experienced no malfunction either during or after the test.	Compliant[5] (conformity verified only by visual inspection)
		Beginning 08/08/2024 Ending 08/08/2024	(final vibration response investigation)	Conditions: Operational during testing (400 V power supply)	See §§4.1.1 Tolerance not respected:	§§ 11, A.9 IEC 60068-2-6:2007	Comparison of the initial and final resonant frequencies without	

ID sample#	ID unit#	Date execution test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration of conformity
			§ 8.2, IEC 60068-2-6:2007 § 5.4.1.5 Telcordia Technologies Generic Requirements GR-63-CORE Issue no. 05, date 2017 § 9.2, IEC 60068-3-3:2019	**RUN03** Test Parameters: See §2.4.1 Excitation levels: 2,00 ÷ 50,0 Hz @ ± 0,10 g Tolerances not respected: ± 15 % on the control signal at the reference point; 50 % @ ≤ 500 Hz of specified amplitude at the check points (MP3) in any axis perpendicular to the excitation direction Temperature env.: 25 ÷ 29 °C	See Figure 23, Figure 26		acceptance or refusal criteria provided by the Customer	

4.1.4. Vibration Tests along X direction

ID sample[#]	ID unit[#]	Date execution test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration of conformity
Yespan pano	20240973	Beginning 08/08/2024 Ending 08/08/2024	(initial vibration response investigation) § 8.2, IEC 60068-2-6:2007 § 5.4.1.5 Telcordia Technologies Generic Requirements GR-63-CORE Issue no. 05, date 2017 § 9.2, IEC 60068-3-3:2019	Conditions: Operational during testing (400 V power supply) **RUN04** Test Parameters: See §2.4.1 Excitation levels: 2,00 ÷ 50,0 Hz @ ± 0,10 g Tolerances not respected: - Temperature env.: 25 ÷ 29 °C	See §§4.1.1	-	-	-
		Beginning 08/08/2024 Ending 08/08/2024	(Earthquake test method) § 5.4, Telcordia Technologies Generic Requirements GR-63-CORE § 4.4, IEC 60068-2-57:2013	Conditions: Operational during testing (400 V power supply) **RUN05** Test Parameters: See §2.4.2 Tolerances not respected: ≤ +30 % @ 1 ÷ 7 Hz of RRS. 0 ÷ +50 % of RRS ; > 50 % is permitted @ > 1/3·f2 If a small portion of the individual points lies outside the tolerance zone the test must still be acceptable. Temperature env.: 25 ÷ 29 °C	Visually unaltered after test Tolerance not respected: See Figure 35	§ 4.4, IEC 60068-3-3:2019	Criterion 0: Equipment subjected to seismic testing which experienced no malfunction either during or after the test.	Compliant[5] (conformity verified only by visual inspection)
		Beginning 09/08/2024 Ending 09/08/2024	(final vibration response investigation) § 8.2, IEC 60068-2-6:2007	Conditions: Operational during testing (400 V power supply) **RUN06**	See §§4.1.1	§§ 11, A.9 IEC 60068-2-6:2007	Comparison of the initial and final resonant frequencies without acceptance or refusal criteria	-

ID sample#	ID unit#	Date execution test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration of conformity
			§ 5.4.1.5 Telcordia Technologies Generic Requirements GR-63-CORE Issue no. 05, date 2017 § 9.2, IEC 60068-3-3:2019	Test Parameters: See §2.4.1 Excitation levels: 2,00 ÷ 50,0 Hz @ ± 0,10 g Tolerances not respected: - Temperature env.: 25 ÷ 29 °C			provided by the Customer.	

4.1.5. Vibration Tests along Y direction

ID sample#	ID unit#	Date execution test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration o conformity
Yespan pano	20240973	Beginning 09/08/2024 Ending 09/08/2024	(initial vibration response investigation) § 8.2, IEC 60068-2-6:2007 § 5.4.1.5 Telcordia Technologies Generic Requirements GR-63-CORE Issue no. 05, date 2017 § 9.2, IEC 60068-3-3:2019	Conditions: Operational during testing (400 V power supply) **RUN07** Test Parameters: See §2.4.1 Excitation levels: 2,00 ÷ 50,0 Hz @ ± 0,10 g Tolerances not respected: - Temperature env.: 25 ÷ 29 °C	See §§4.1.1	-	-	-
		Beginning 09/08/2024 Ending 09/08/2024	(Earthquake test method) § 5.4, Telcordia Technologies Generic Requirements GR-63-CORE § 4.4, IEC 60068-2-57:2013	Conditions: Operational during testing (400 V power supply) **RUN08** Test Parameters: See §2.4.2 Tolerances not respected: ≤ +30 % @ 1 ÷ 7 Hz of RRS. 0 ÷ +50 % of RRS ; > 50 % is permitted @ > 1/3·f2 If a small portion of the individual points lies outside the tolerance zone the test must still be acceptable. Temperature env.: 25 ÷ 29 °C	Visually unaltered after test Tolerance not respected: See Figure 49	§ 4.4, IEC 60068-3-3:2019	Criterion 0: Equipment subjected to seismic testing which experienced no malfunction either during or after the test.	Compliant[5] (conformity verified only by visual inspection)

[5] The performances requirements and declaration of compliance of the unit operation is performed by the Customer. P&P LMC S.r.l. declares compliance only on the basis of a visual inspection to assess deformations and mechanical alterations.

ID sample[#]	ID unit[#]	Date execution test	Test method	Test parameters	Inspection after test and results	Reference technical documents	Reference value	Declaration o conformity
		Beginning 09/08/2024 Ending 09/08/2024	(final vibration response investigation) § 8.2, IEC 60068-2-6:2007 § 5.4.1.5 Telcordia Technologies Generic Requirements GR-63-CORE Issue no. 05, date 2017 § 9.2, IEC 60068-3-3:2019	Conditions: Operational during testing (400 V power supply) **RUN09** Test Parameters: See §2.4.1 Excitation levels: 2,00 ÷ 50,0 Hz @ ± 0,10 g Tolerances not respected: - Temperature env.: 25 ÷ 29 °C	See §§4.1.1	§§ 11, A.9 IEC 60068-2-6:2007	Comparison of the initial and final resonant frequencies without acceptance or refusal criteria provided by the Customer.	-

4.1.6. Summary of test results

4.1.6.1. Transportation test

Date of test: 07/08/2024

RUN	Axis	Test type	Parameters	Results
01	Z	*Transportation test: Schedule E – Vehicle vibration: Truck profile: Low Level	*Frequency range*: 1,00 ÷ 200,0 Hz *Excitation levels*: Low Level (see § 2.4.3) *RMS*: 0,40g *Duration* [hh:mm:ss]: 00:40:00	Visually unaltered after test[4]
02		*Transportation test: Schedule E – Vehicle vibration: Truck profile: Medium Level	*Frequency range*: 1,00 ÷ 200,0 Hz *Excitation levels*: Medium Level (see § 2.4.3) *RMS*: 0,54g *Duration* [hh:mm:ss]: 00:15:00	Visually unaltered after test[4]
03		*Transportation test: Schedule E – Vehicle vibration:	*Frequency range*: 1,00 ÷ 200,0 Hz *Excitation levels*: High Level (see § 2.4.3) *RMS*: 0,70g *Duration* [hh:mm:ss]: 00:05:00	Visually unaltered after test[4]

RUN	Axis	Test type	Parameters	Results
		Truck profile: High Level	PSD @ 1 Hz modified due to shaker stroke limits from 0,00072 to 0,0003 g^2/Hz	
04		*Transportation test: Schedule E – Vehicle vibration: Truck profile: Low Level	*Frequency range*: 1,00 ÷ 200,0 Hz *Excitation levels*: Low Level (see § 2.4.3) *RMS*: 0,40g *Duration* [hh:mm:ss]: 00:40:00	Visually unaltered after test[4]
05		*Transportation test: Schedule E – Vehicle vibration: Truck profile: Medium Level	*Frequency range*: 1,00 ÷ 200,0 Hz *Excitation levels*: Medium Level (see § 2.4.3) *RMS*: 0,54g *Duration* [hh:mm:ss]: 00:15:00	Visually unaltered after test[4]
06		*Transportation test: Schedule E – Vehicle vibration: Truck profile: High Level	*Frequency range*: 1,00 ÷ 200,0 Hz *Excitation levels*: High Level (see § 2.4.3) *RMS*: 0,70g *Duration* [hh:mm:ss]: 00:05:00 PSD @ 1 Hz modified due to shaker stroke limits from 0,00072 to 0,0003 g^2/Hz	Visually unaltered after test[4]
07		*Transportation test: Schedule E – Vehicle vibration: Truck profile: Low Level	*Frequency range*: 1,00 ÷ 200,0 Hz *Excitation levels*: Low Level (see § 2.4.3) *RMS*: 0,4g *Duration* [hh:mm:ss]: 00:40:00	Visually unaltered after test[4]
08		*Transportation test: Schedule E – Vehicle vibration: Truck profile: Medium Level	*Frequency range*: 1,00 ÷ 200,0 Hz *Excitation levels*: Medium Level (see § 2.4.3) *RMS*: 0,54g *Duration* [hh:mm:ss]: 00:15:00	Visually unaltered after test[4]
09		*Transportation test: Schedule E – Vehicle vibration: Truck profile: High Level	*Frequency range*: 1,00 ÷ 200,0 Hz *Excitation levels*: High Level (see § 2.4.3) *RMS*: 0,70g *Duration* [hh:mm:ss]: 00:05:00 PSD @ 1 Hz modified due to shaker stroke limits from 0,00072 to 0,0003 g^2/Hz	Visually unaltered after test, no damage observed both in product and packaging[4] EUT meets criterion 3 condition specified in ASTM D4169-16[4]

4.1.6.2. Seismic test

Date of test: 08/08/2024 ÷ 09/08/2024

RUN	Axis	Test type	Parameters	Results
01	Z	Vibration response investigation	*Frequency range*: 2,00 ÷ 50,0 Hz *Excitation levels*: ± 0,10 g *Sweep rate*: 1 oct/min *Duration* [hh:mm:ss]: 00:09:17	Visually unaltered after test[4] No resonance frequency found
02		Earthquake test method	*Frequency range*: 2,80 ÷ 50,0 Hz *Excitation levels*: Severity level Zone IV *ZPA*: 1,6g *Duration* [hh:mm:ss]: 00:00:30 *Damping*: 2%	Visually unaltered after test[4] EUT provides the seismic criteria of IEC 60068-3-3:2019[4]
03		Vibration response investigation	*Frequency range*: 2,00 ÷ 50,0 Hz *Excitation levels*: ± ± 0,10 g *Sweep rate*: 1 oct/min *Duration* [hh:mm:ss]: 00:09:17	Visually unaltered after test[4] No resonance frequency found
04	X	Vibration response investigation	*Frequency range*: 2,00 ÷ 50,0 Hz *Excitation levels*: ± ± 0,10 g *Sweep rate*: 1 oct/min *Duration* [hh:mm:ss]: 00:09:17	Visually unaltered after test[4] Resonance frequency found: see § 4.1.1
05		Earthquake test method	*Frequency range*: 2,80 ÷ 50,0 Hz *Excitation levels*: Severity level Zone IV *ZPA*: 1,6g *Duration* [hh:mm:ss]: 00:00:30 *Damping*: 2%	Visually unaltered after test[4] EUT provides the seismic criteria of IEC 60068-3-3:2019[4]
06		Vibration response investigation	*Frequency range*: 2,00 ÷ 50,0 Hz *Excitation levels*: ± ± 0,10 g *Sweep rate*: 1 oct/min *Duration* [hh:mm:ss]: 00:09:17	Visually unaltered after test[4] Resonance frequency found: see § 4.1.1
07	Y	Vibration response investigation	*Frequency range*: 2,00 ÷ 50,0 Hz *Excitation levels*: ± ± 0,10 g *Sweep rate*: 1 oct/min *Duration* [hh:mm:ss]: 00:09:17	Visually unaltered after test[4] Resonance frequency found: see § 4.1.1
08		Earthquake test method	*Frequency range*: 2,80 ÷ 50,0 Hz *Excitation levels*: Severity level Zone IV	Visually unaltered after test[4]

RUN	Axis	Test type	Parameters	Results
			ZPA: 1,6g *Duration* [hh:mm:ss]: 00:00:30 *Damping*: 2%	EUT provides the seismic criteria of IEC 60068-3-3:2019[4]
09		Vibration response investigation	*Frequency range*: 2,00 ÷ 50,0 Hz *Excitation levels*: ± 0,10 g *Sweep rate*: 1 oct/min *Duration* [hh:mm:ss]: 00:09:17	Visually unaltered after test[4] Resonance frequency found: see § 4.1.1

4.1.7. Declaration of conformity

The declarations of conformity for each test direction are indicated in §§ 4.1.2, 4.1.3, 4.1.4 and 4.1.5.
*For each transportation test performed, the unit under test was found to comply with the Criterion 3 of the corresponding test method ASTM D4169-23 [5].
For each direction and for each test performed, the unit under test was found to comply with the reference value of the corresponding test method IEC 60068-2-6:2007 [5].
For each direction and for each test performed, the unit under test was found to comply with the reference value of the corresponding test method IEC 60068-3-3:2019 [5].

4.2. Opinions and interpretations - Not subject to ACCREDIA accreditation

-

PHOTO DOCUMENTATION

LIST OF FIGURES

Photo 1 – Transportation test - setup

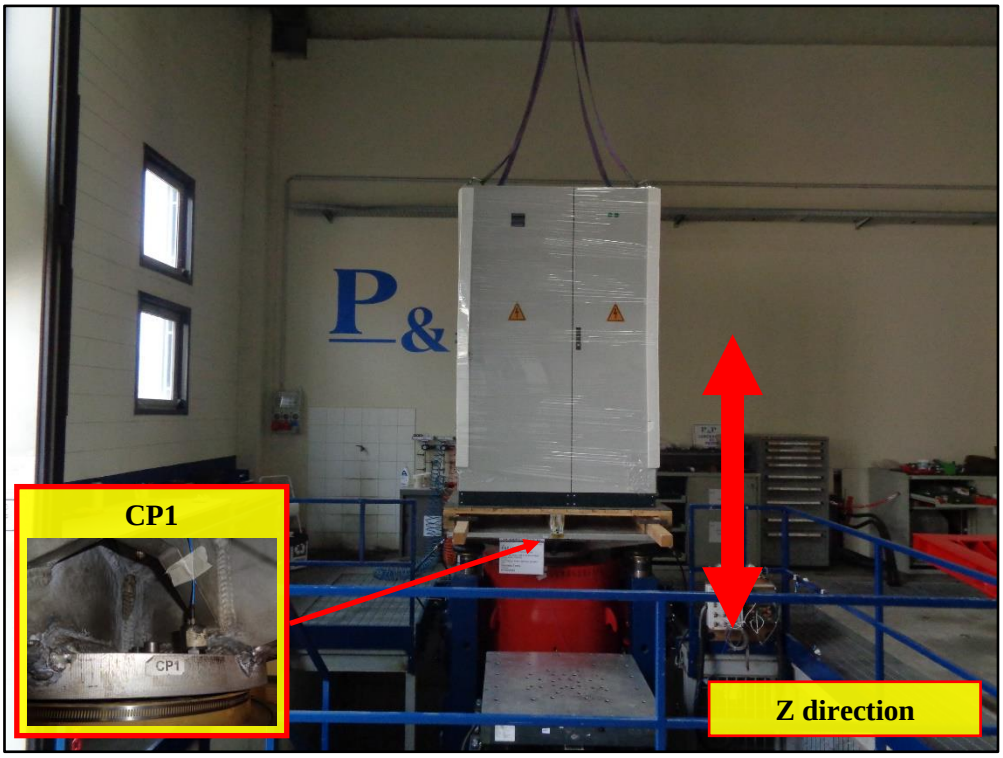

Photo 2 - Test configuration in Z direction – Constraining setup

Photo 3 – Visual inspection after transportation test

Photo 4 - Test configuration in Y direction

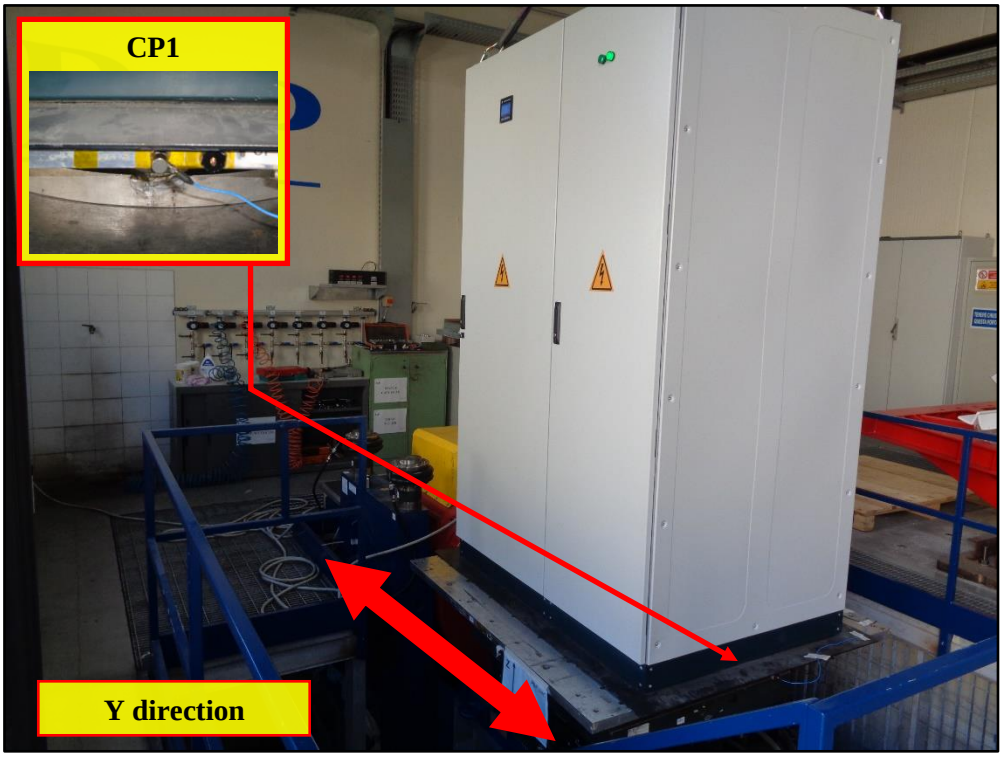

Photo 5 - Test configuration in Z direction

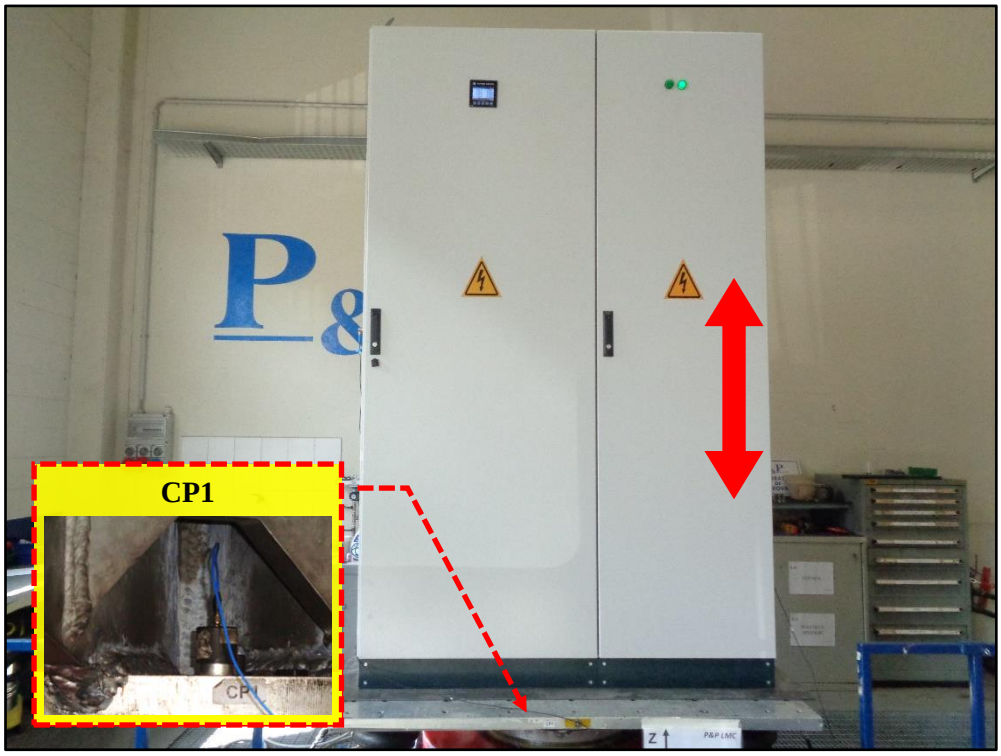

Photo 6 - Measuring point on the unit (MP1 and MP3)

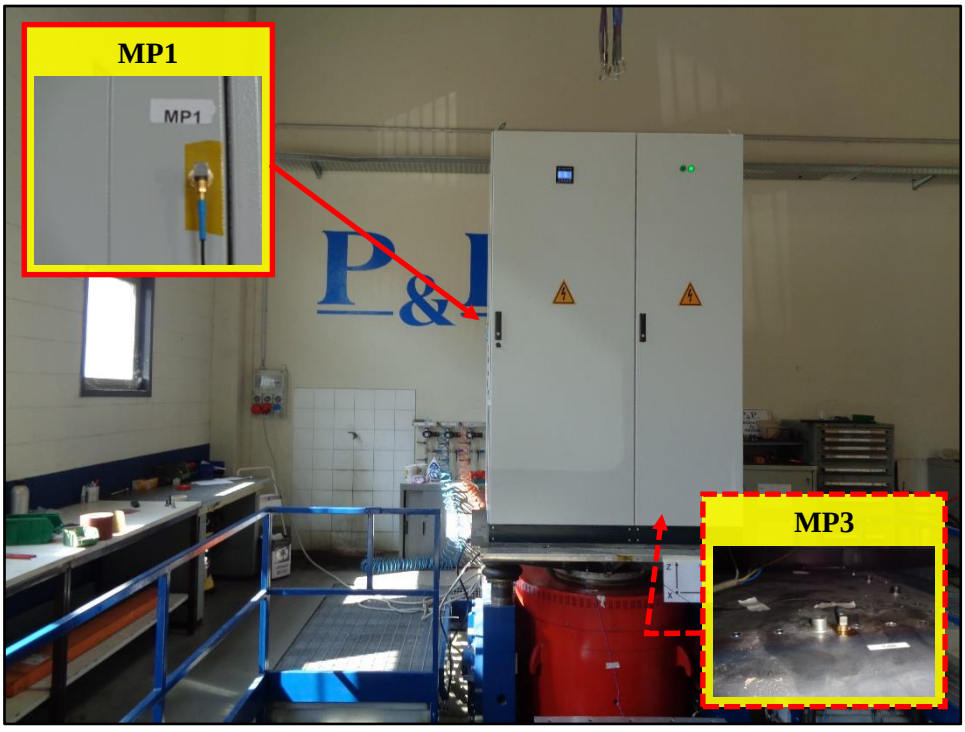

Photo 7 - Measuring points on the unit (MP2)

Photo 8 – Mounting technique – Z direction configuration

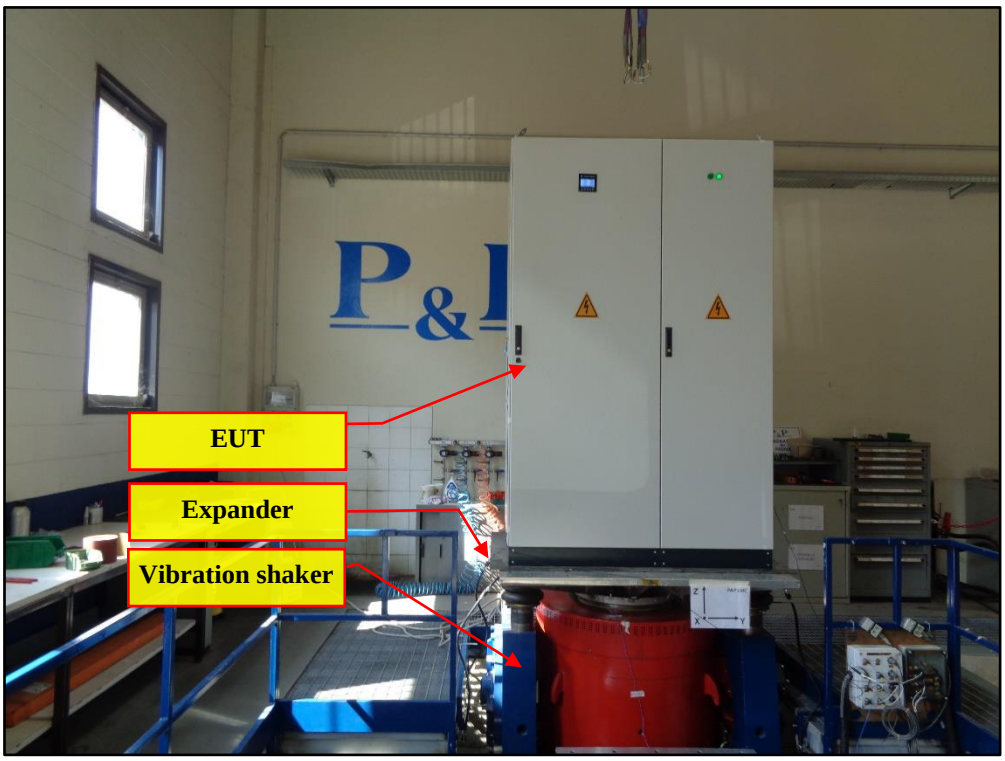

Photo 9 – Mounting technique – X and Y directions configuration

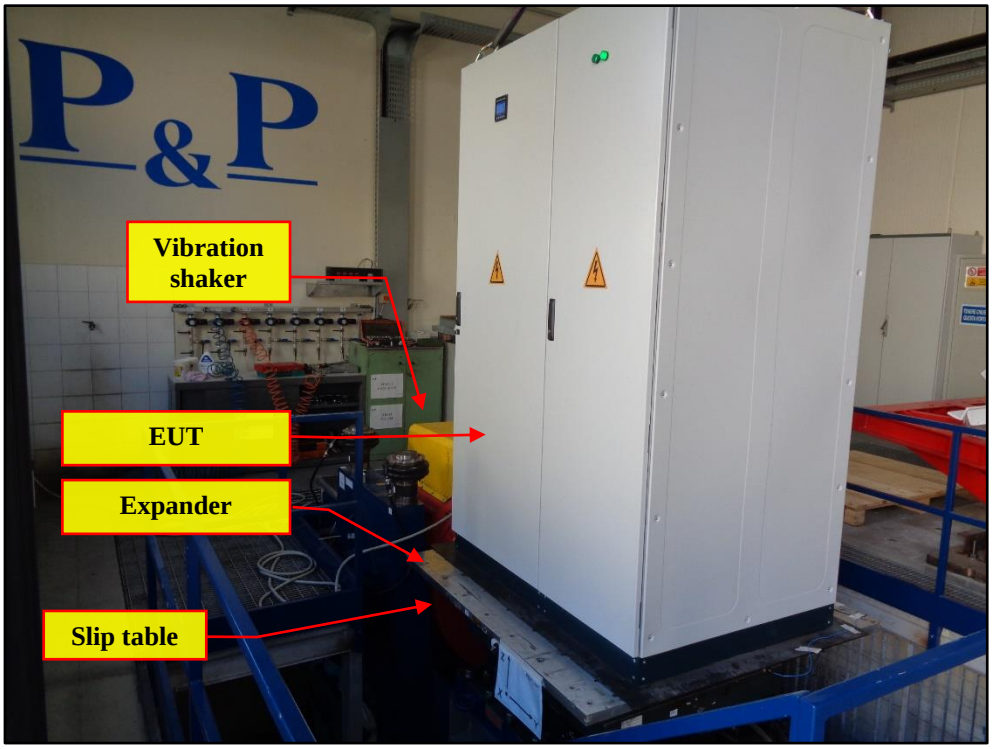

Photo 10 – Mounting technique – Fixing points of expander-Fixture-EUT

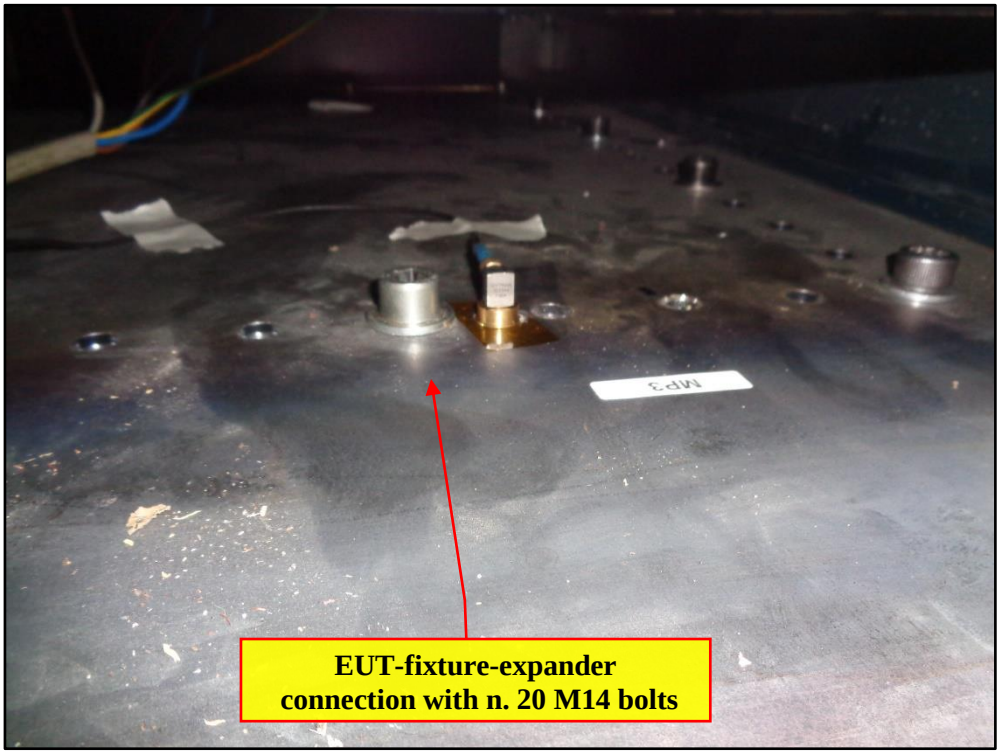

Photo 11 – Weight of EUT

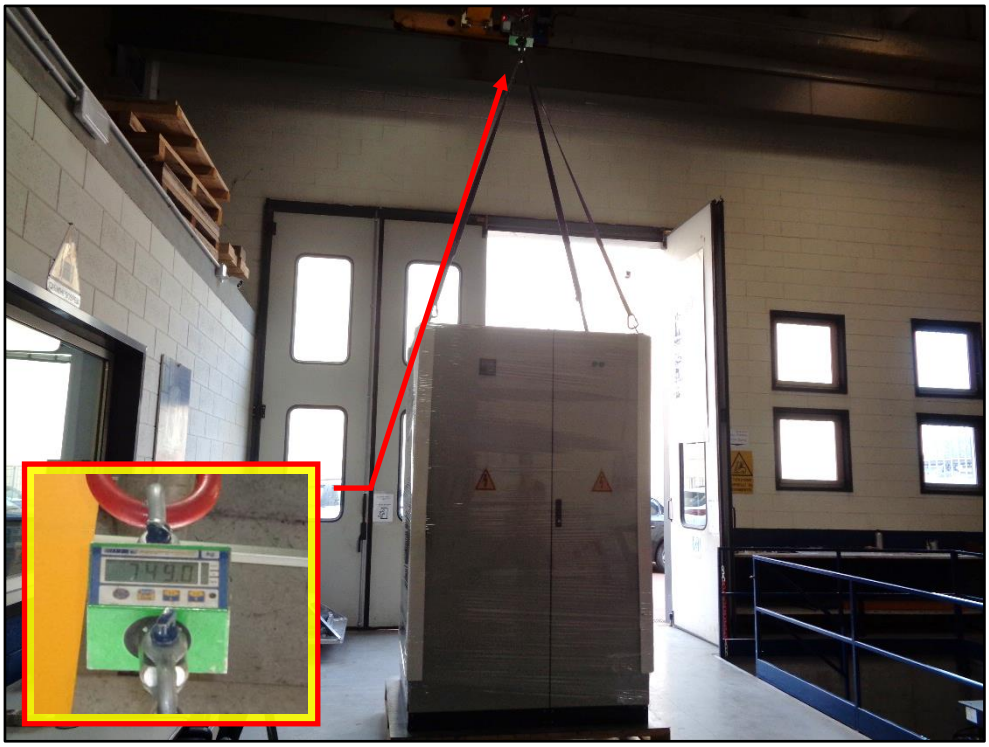

Photo 12 – Visual inspection after all tests

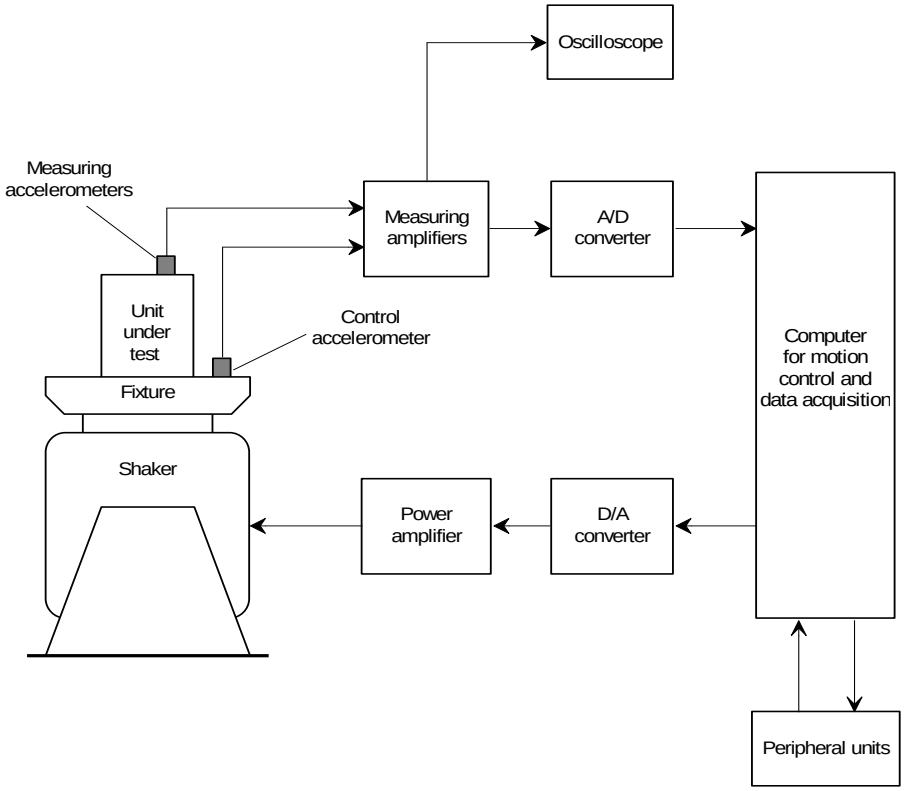

Figure 1 - Block diagram of the test equipment

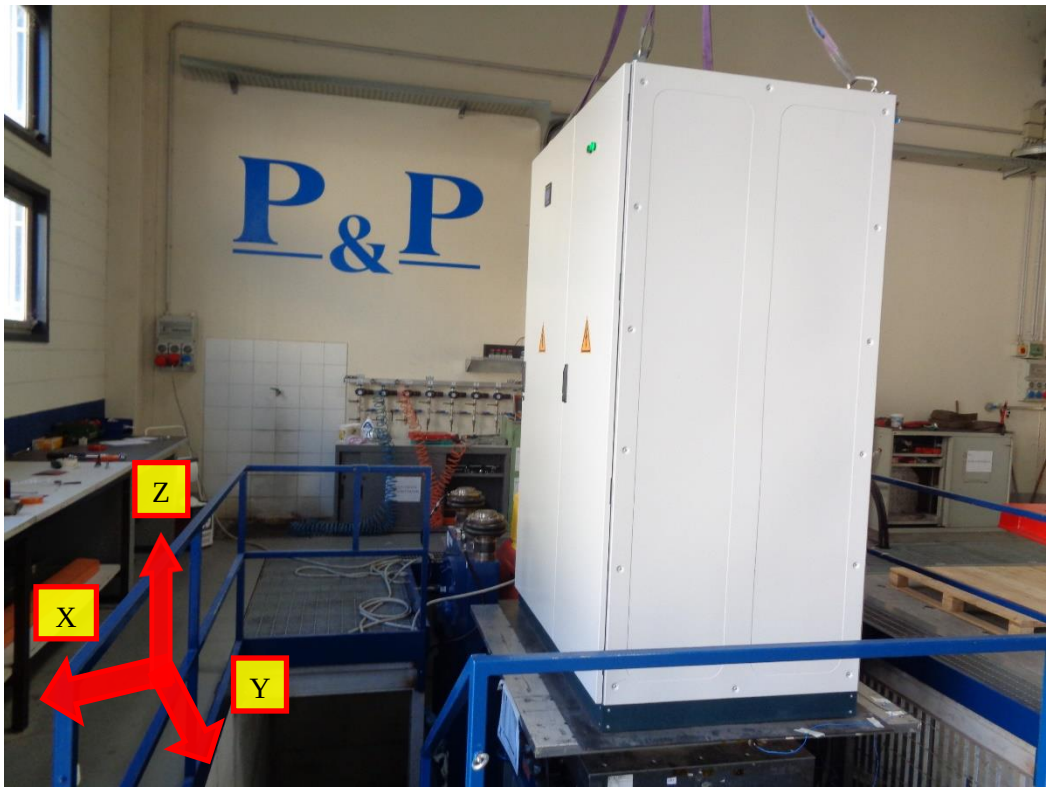

Figure 2 – Reference axis X, Y, Z of the tests

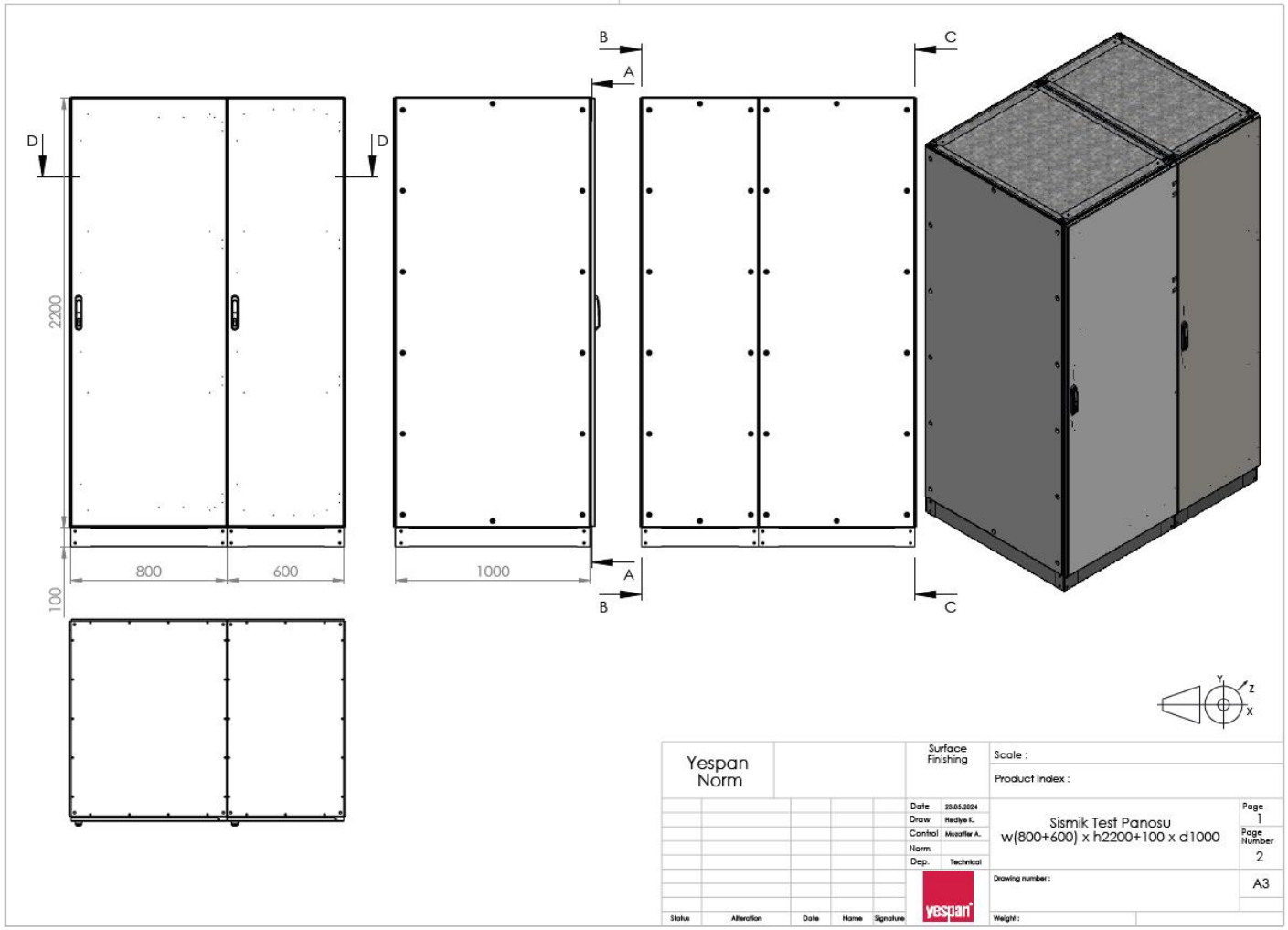

Figure 3 –EUT technical drawing (Errore. L'origine riferimento non è stata trovata.**)**

Project: PRO-MTL-ELE24-029
Section: RANDOM TRUCK LOW LEVEL
Run: RUN01_RTLL_1
Date: Wed Aug 07 2024 11:22:05
Point id: Reference
Number of controls: 1
Control strategy: Average .
Accumulated time at full level: 0:40:00.07

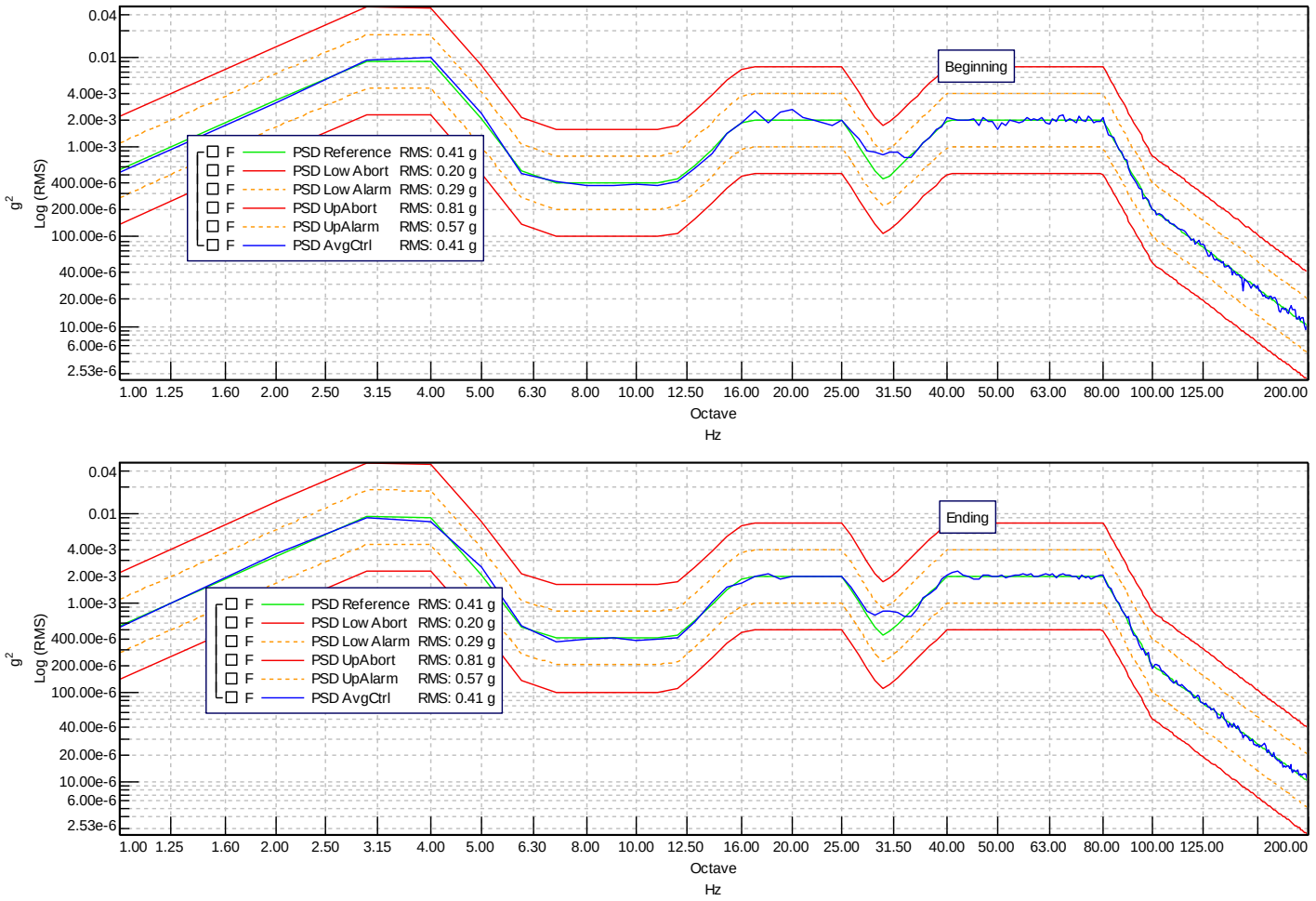

Figure 4 – Z Axis – AvgCtrl: Diagram of random truck low level

Project: PRO-MTL-ELE24-029
Section: RANDOM TRUCK MEDIUM
Run: RUN02_RTML_1
Date: Wed Aug 07 2024 12:12:09
Point id: Reference
Number of controls: 1
Control strategy: Average .
Accumulated time at full level: 0:15:00.04

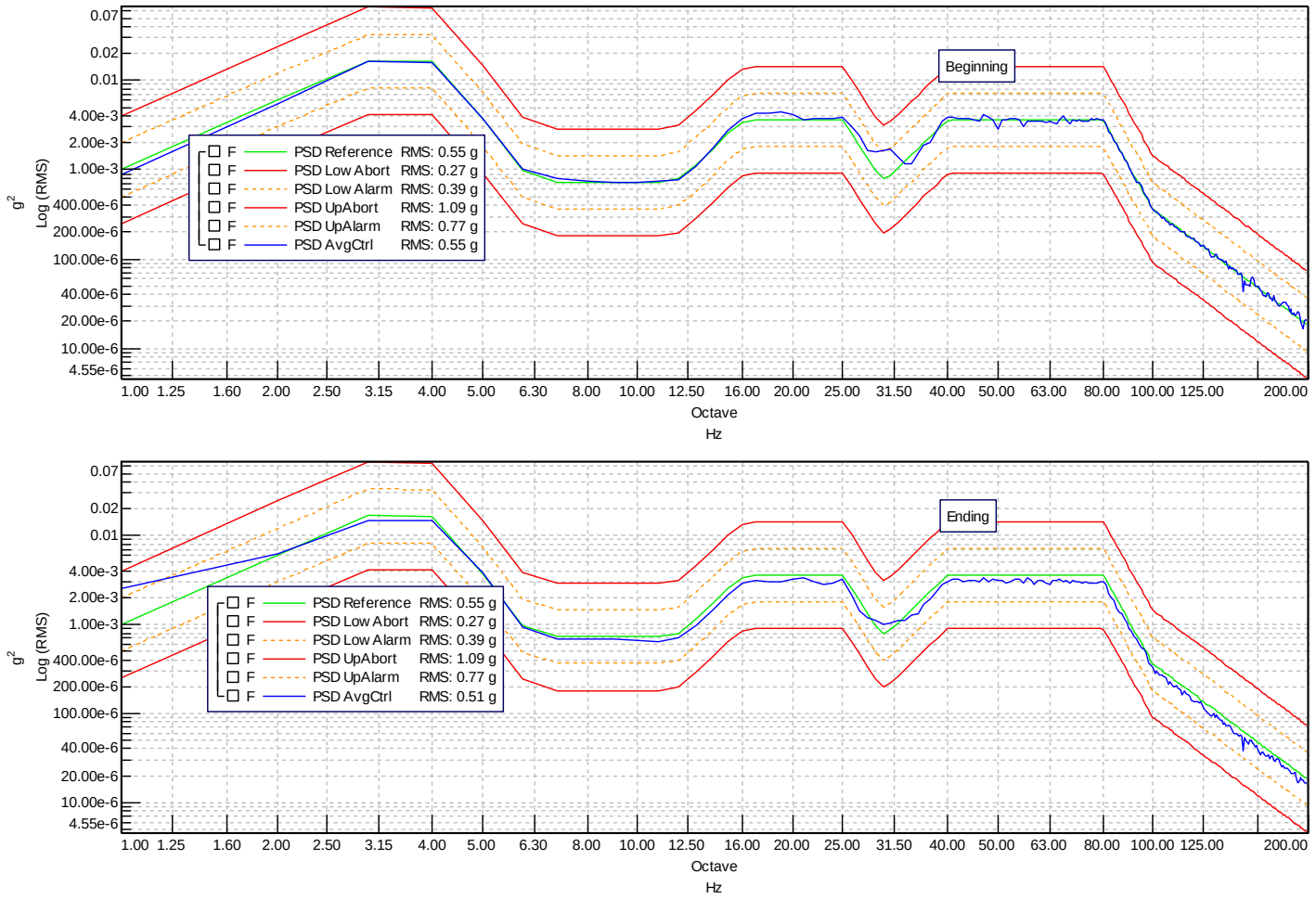

Figure 5 – Z Axis – AvgCtrl: Diagram of random truck medium level

Project: PRO-MTL-ELE24-029
Section: RANDOM TRUCK HIGH LEVEL
Run: RUN03_RTHL_1
Date: Wed Aug 07 2024 12:43:42
Point id: Reference
Number of controls: 1
Control strategy: Average .
Accumulated time at full level: 0:05:00.10

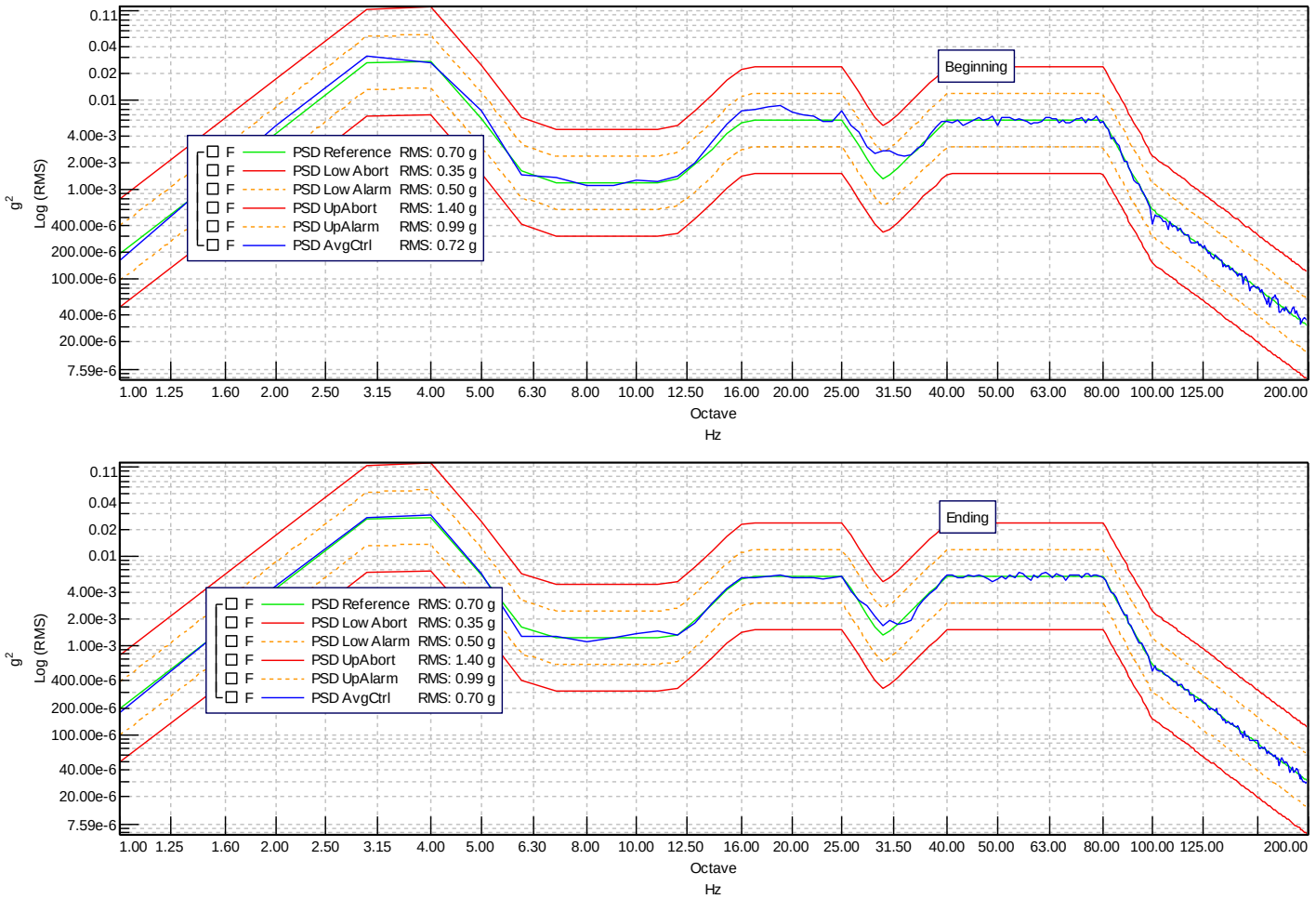

Figure 6 – Z Axis – AvgCtrl: Diagram of random truck high level

Project: PRO-MTL-ELE24-029
Section: RANDOM TRUCK LOW LEVEL
Run: RUN04_RTLL_1
Date: Wed Aug 07 2024 12:58:26
Point id: Reference
Number of controls: 1
Control strategy: Average .
Accumulated time at full level: 0:40:00.05

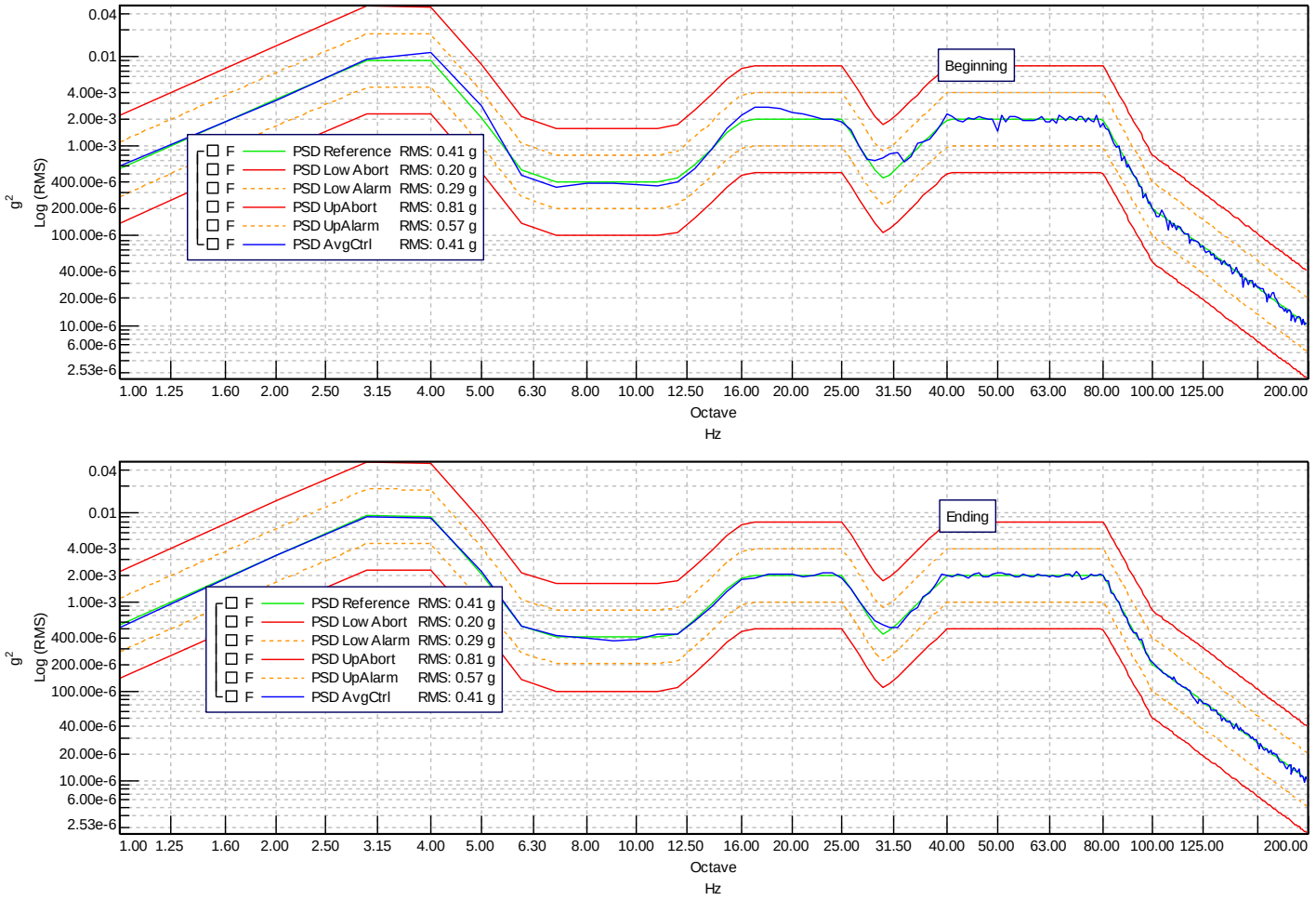

Figure 7 – Z Axis – AvgCtrl: Diagram of random truck low level

Project: PRO-MTL-ELE24-029
Section: RANDOM TRUCK MEDIUM
Run: RUN05_RTML_1
Date: Wed Aug 07 2024 14:00:35
Point id: Reference
Number of controls: 1
Control strategy: Average .
Accumulated time at full level: 0:15:00.11

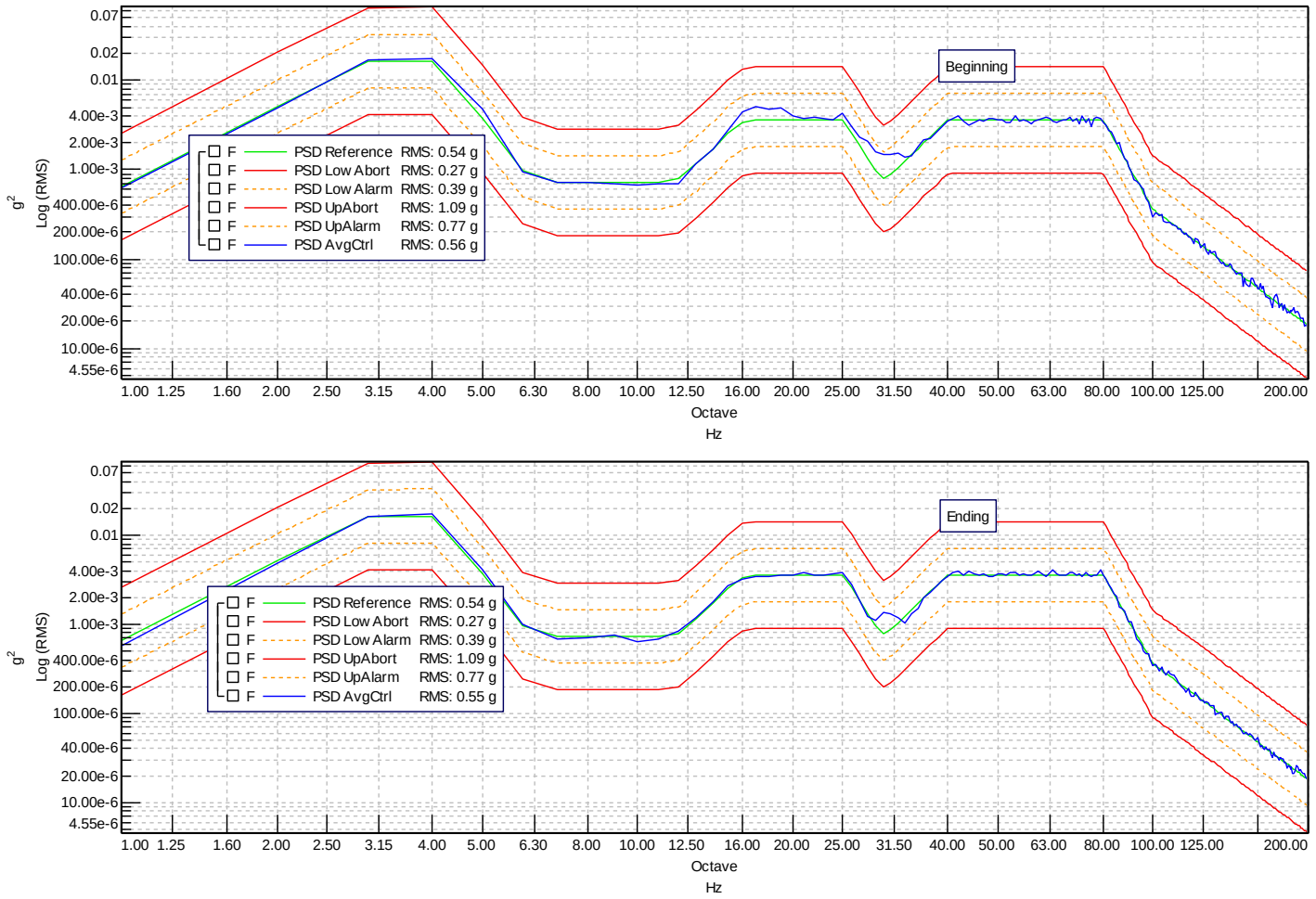

Figure 8 – Z Axis – AvgCtrl: Diagram of random truck medium level

Project: PRO-MTL-ELE24-029
Section: RANDOM TRUCK HIGH LEVEL
Run: RUN06_RTHL_1
Date: Wed Aug 07 2024 14:26:03
Point id: Reference
Number of controls: 1
Control strategy: Average .
Accumulated time at full level: 0:05:00.09

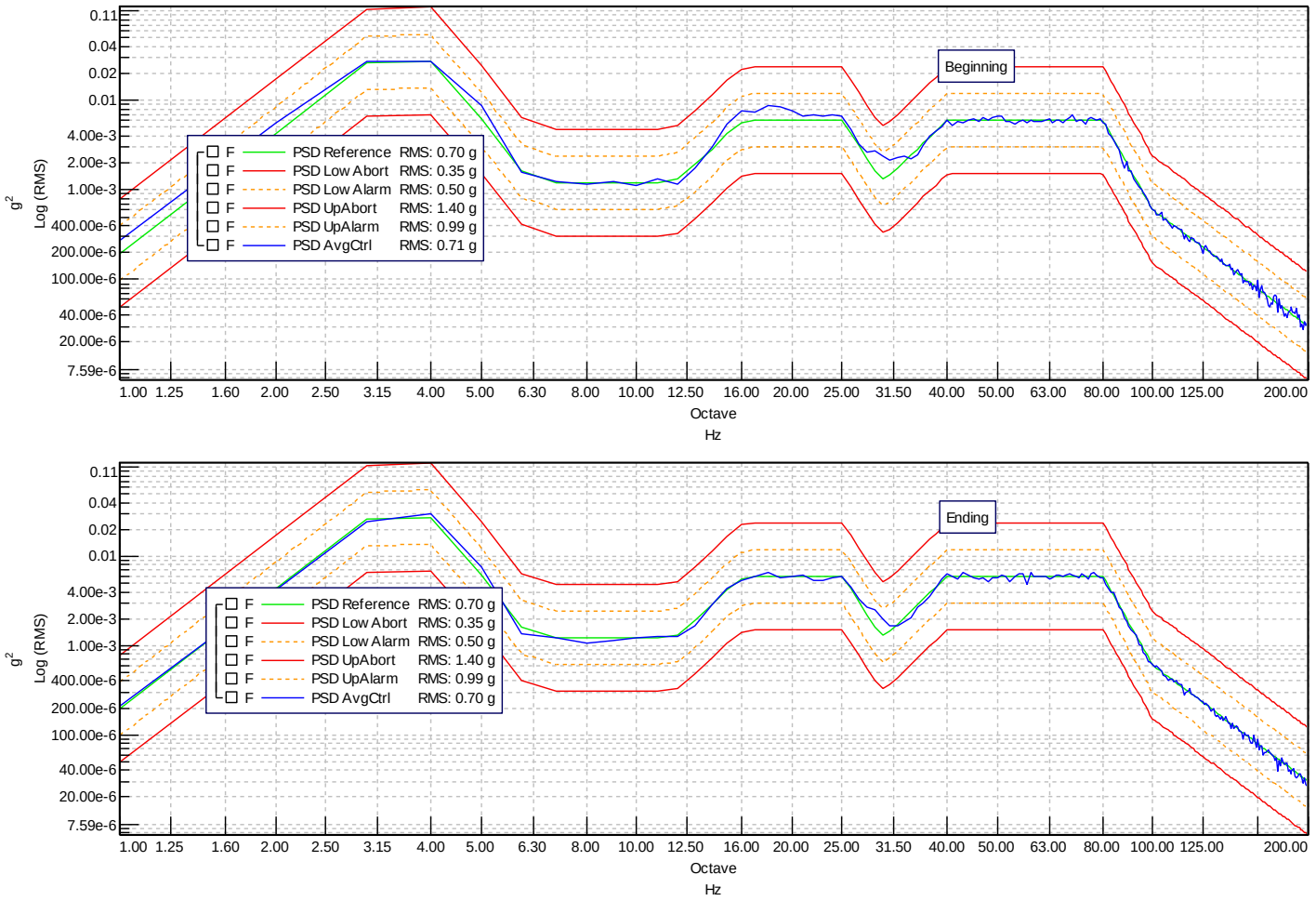

Figure 9 – Z Axis – AvgCtrl: Diagram of random truck high level

Project: PRO-MTL-ELE24-029
Section: RANDOM TRUCK LOW LEVEL
Run: RUN07_RTLL_1
Date: Wed Aug 07 2024 14:38:42
Point id: Reference
Number of controls: 1
Control strategy: Average .
Accumulated time at full level: 0:40:00.07

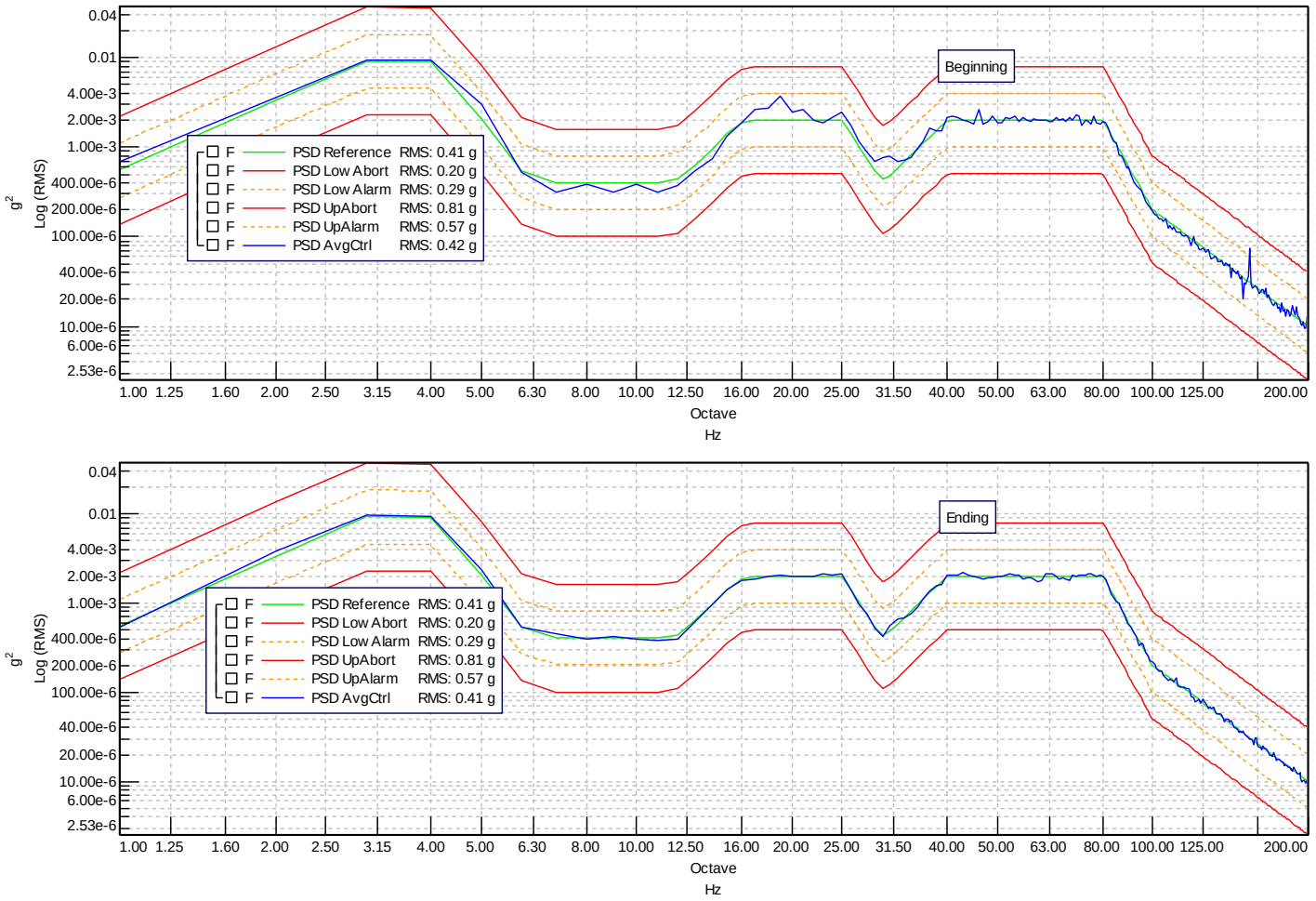

Figure 10 – Z Axis – AvgCtrl: Diagram of random truck low level

Project: PRO-MTL-ELE24-029
Section: RANDOM TRUCK MEDIUM
Run: RUN08_RTML_1
Date: Wed Aug 07 2024 15:25:04
Point id: Reference
Number of controls: 1
Control strategy: Average .
Accumulated time at full level: 0:15:00.02

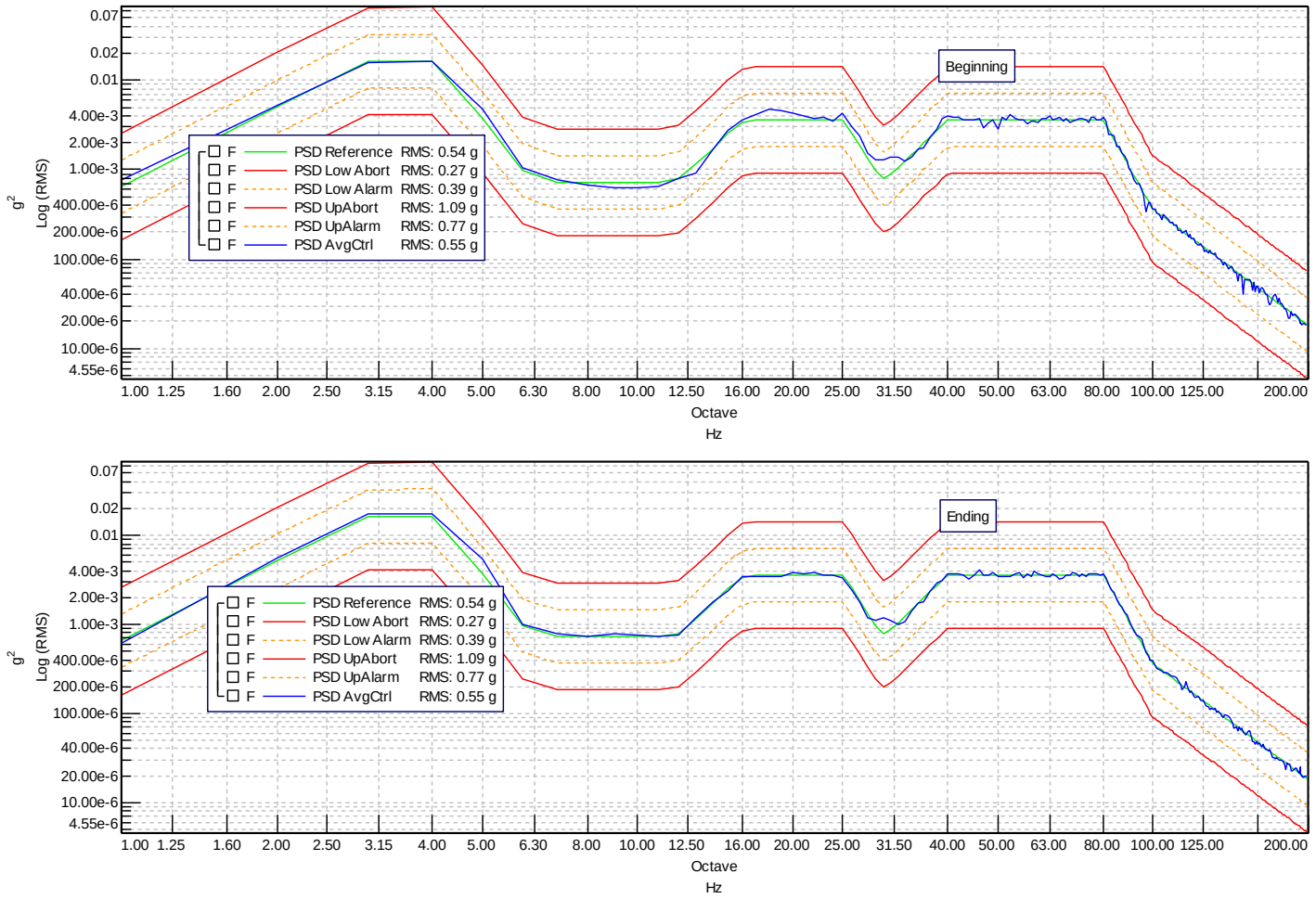

Figure 11 – Z Axis – AvgCtrl: Diagram of random truck medium level

Project: PRO-MTL-ELE24-029
Section: RANDOM TRUCK HIGH LEVEL
Run: RUN09_RTHL_1
Date: Wed Aug 07 2024 15:50:28
Point id: Reference
Number of controls: 1
Control strategy: Average .
Accumulated time at full level: 0:05:00.07

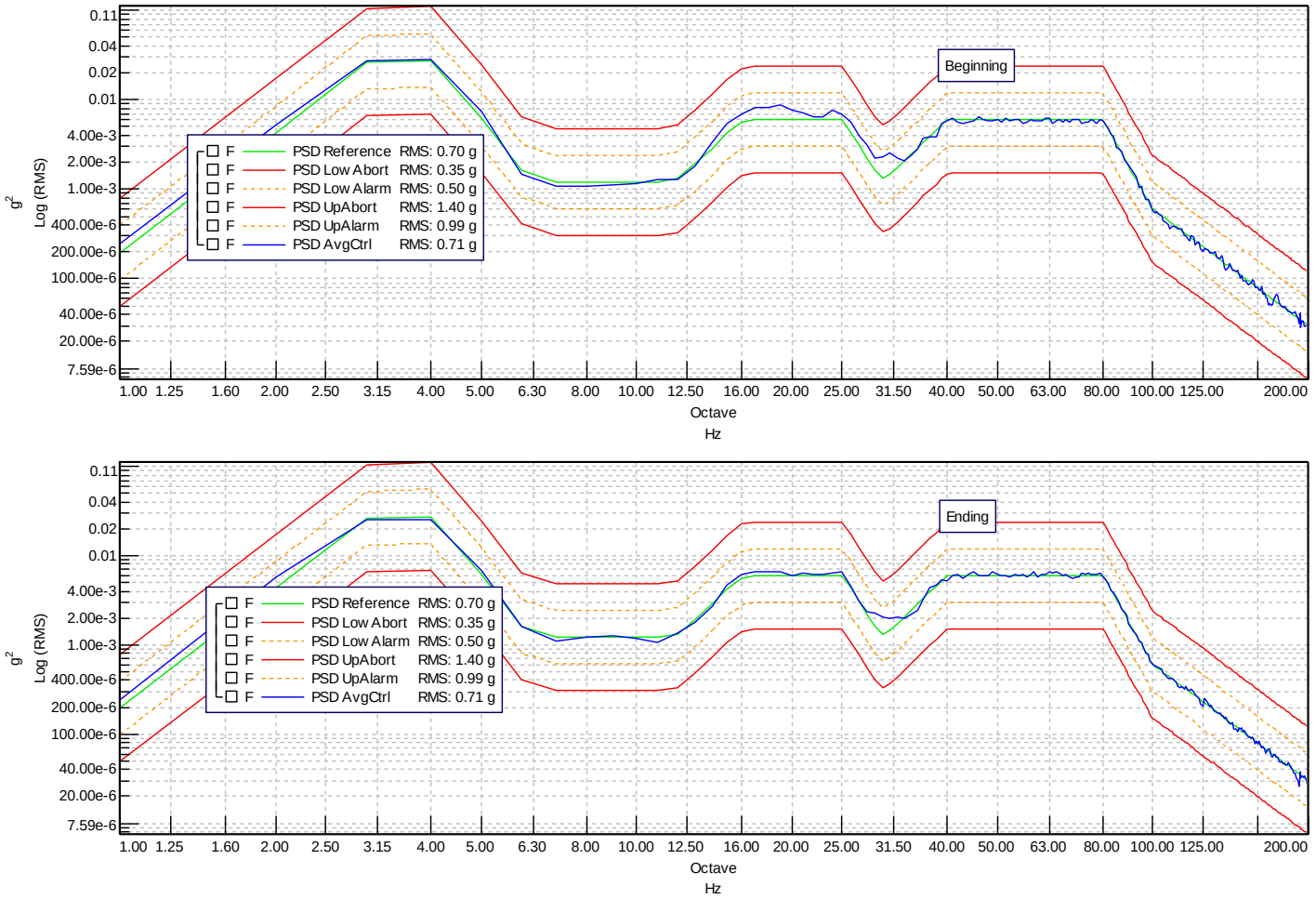

Figure 12 – Z Axis – AvgCtrl: Diagram of random truck high level

Project: PRO-MTL-ELE24-029_seismic
Section: Z_AXIS
Run: RUN01_SINE_1
Date: Thu Aug 08 2024 16:21:55
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Number of control channels: 1
Point id: AvgCtrl
Control strategy: Average

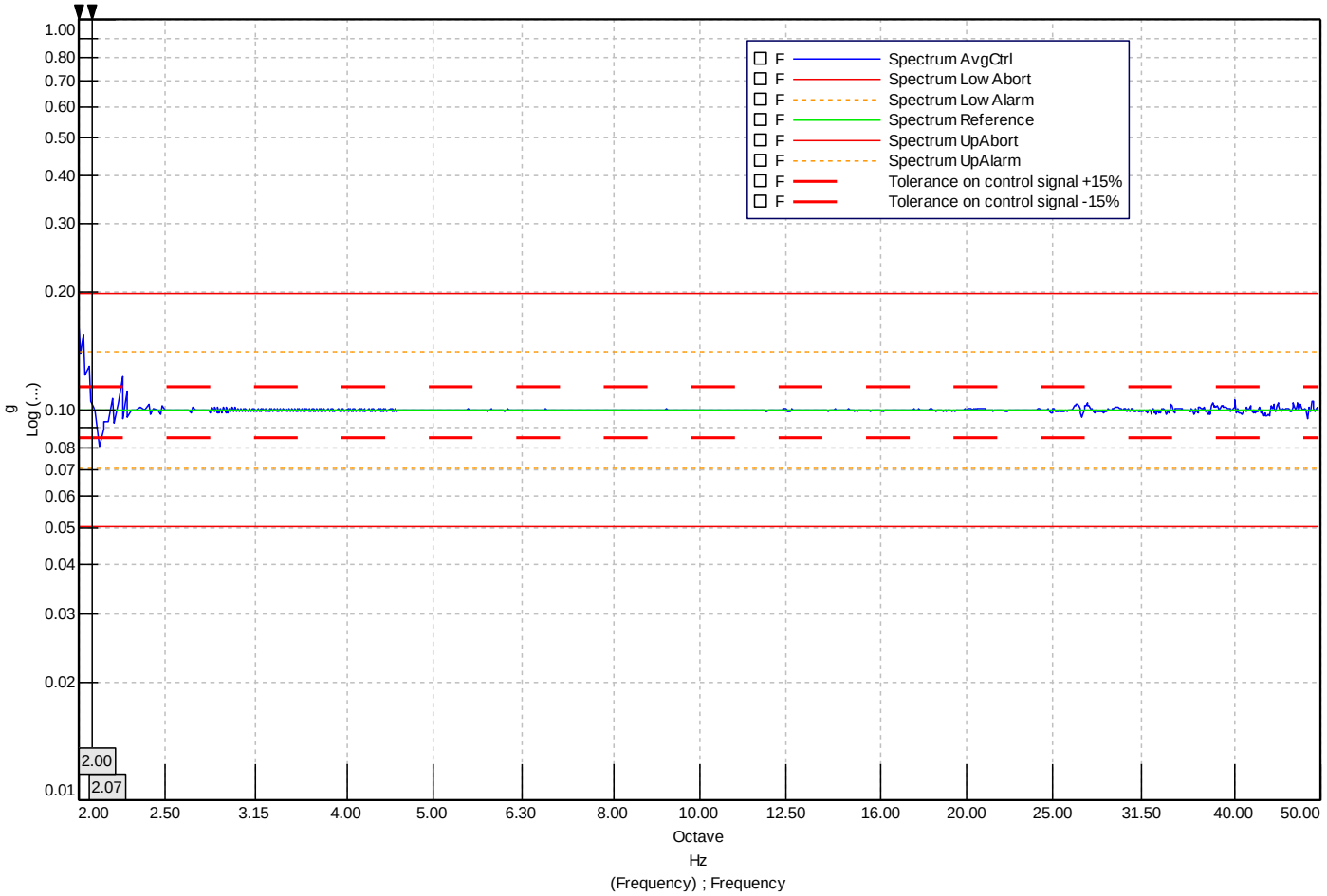

Figure 13 – Z Axis – AvgCtrl: Diagram of initial vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Z_AXIS
Run: RUN01_SINE_1
Date: Thu Aug 08 2024 16:21:55
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP1B
Control strategy: Average

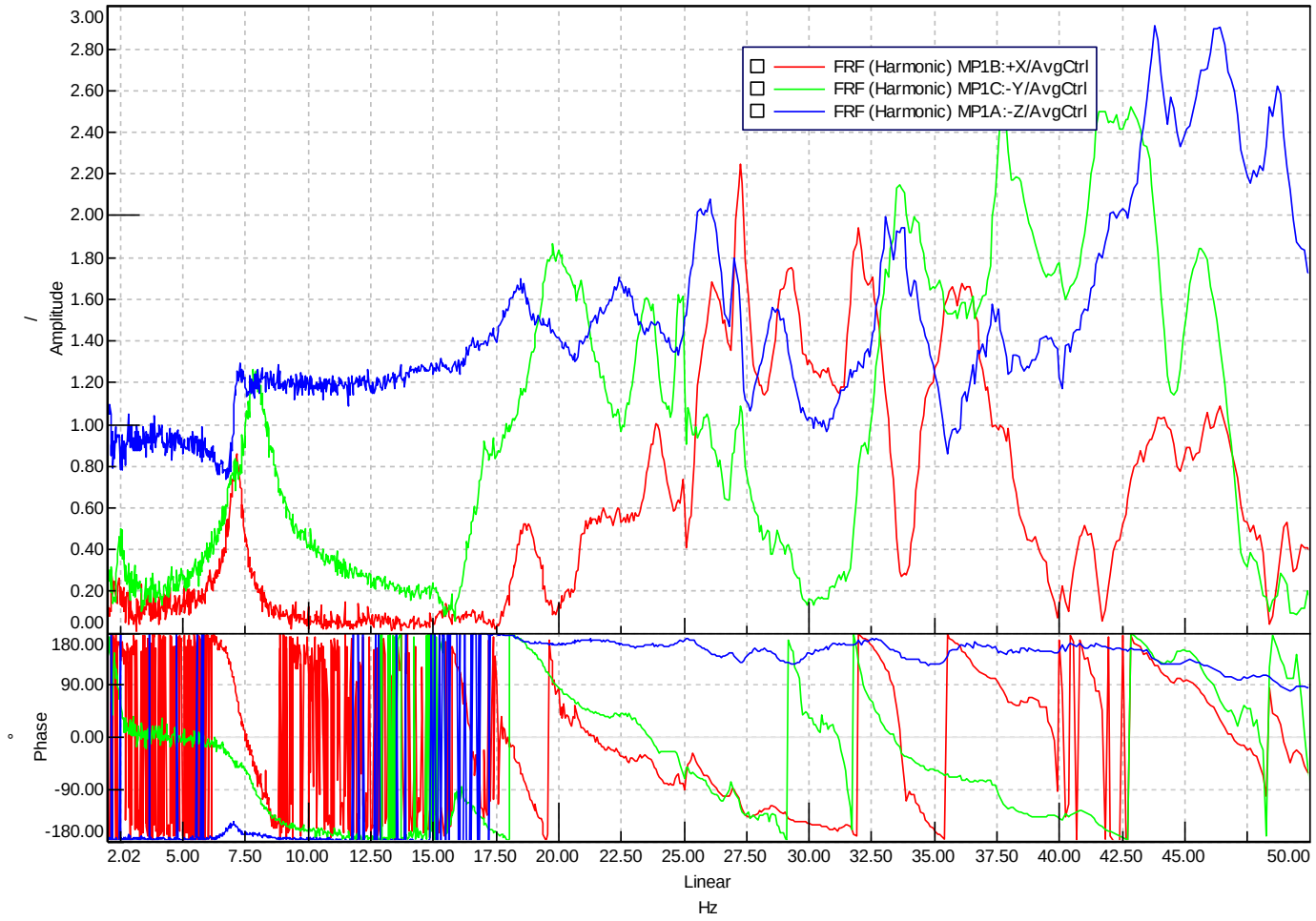

Figure 14 – Z Axis – MP1: Diagram of initial vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Z_AXIS
Run: RUN01_SINE_1
Date: Thu Aug 08 2024 16:21:55
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP2C
Control strategy: Average

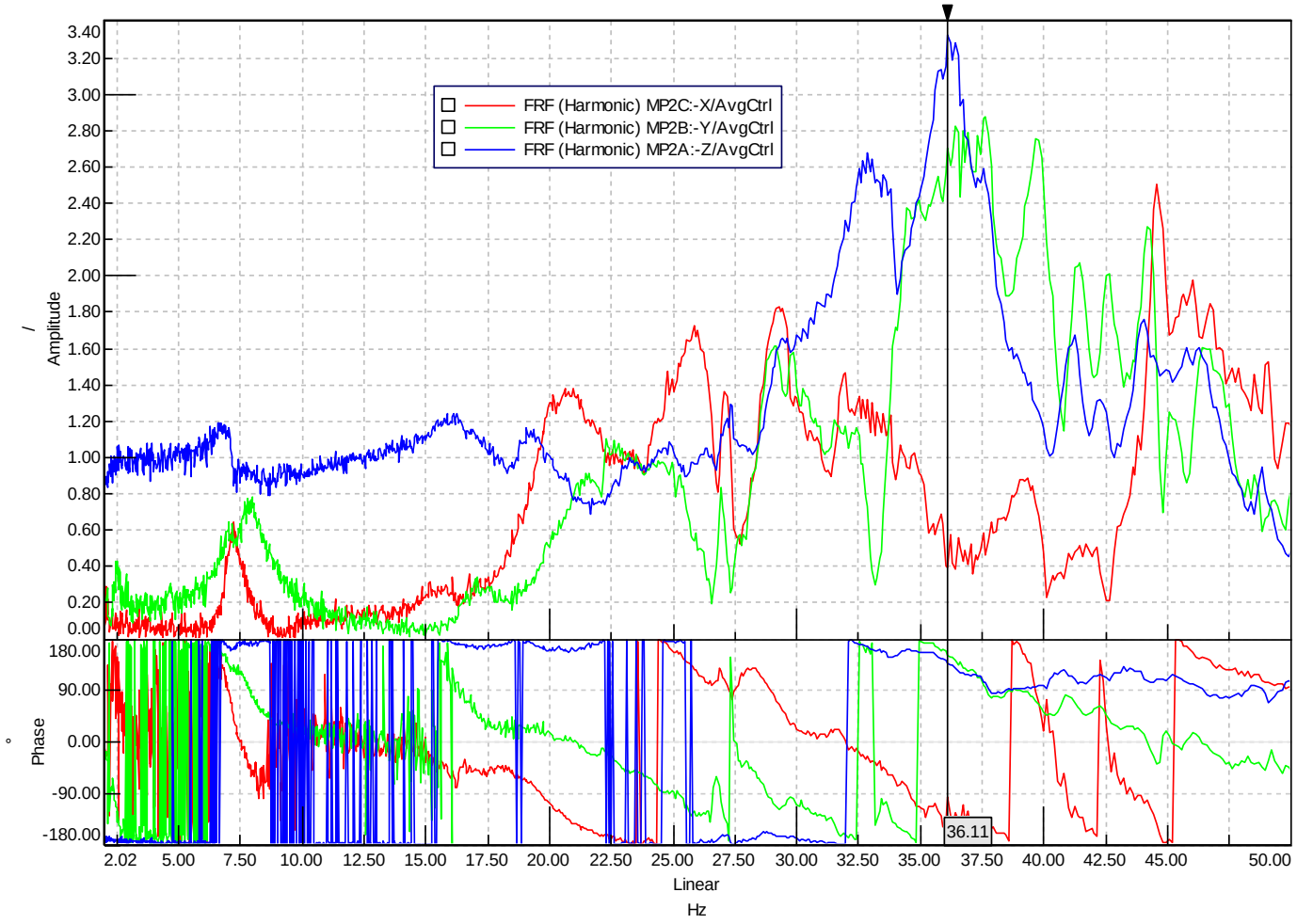

Figure 15 – Z Axis – MP2: Diagram of initial vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Z_AXIS
Run: RUN01_SINE_1
Date: Thu Aug 08 2024 16:21:55
Sweep Direction: Up
Sweep Rate: 1 Oct/min
Sweep done: 2
Point id: MP3A
Control strategy: Average

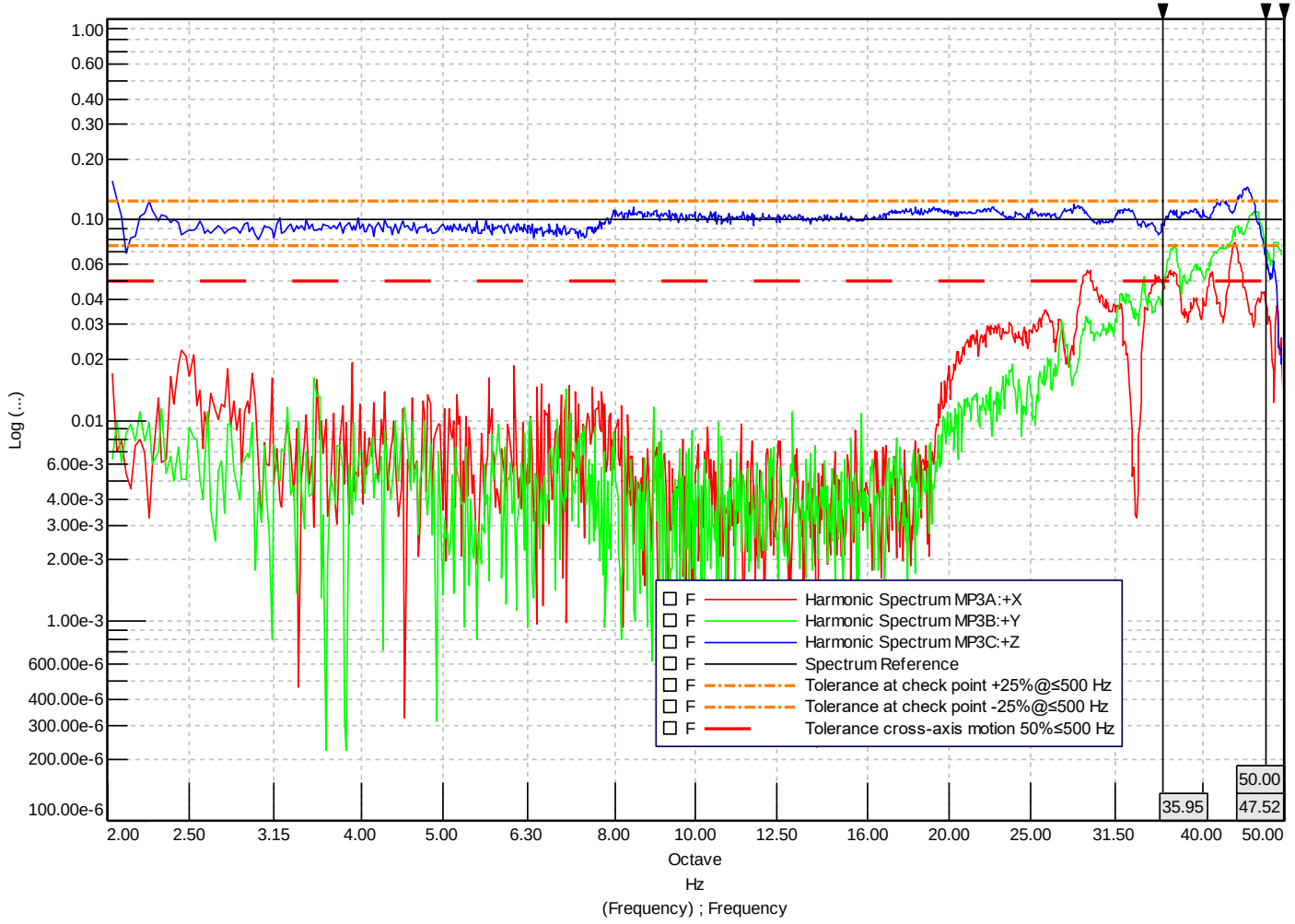

Figure 16 – Z Axis – MP3: Diagram of initial vibration response investigation test – Tolerances – Sweep Up

Project:PRO-MTL-ELE24-029_seismic
Section: Z_AXIS
Run: RUN02_SHOCK_2
Date:Thu Aug 08 2024 16:41:23
Point ID: CP1

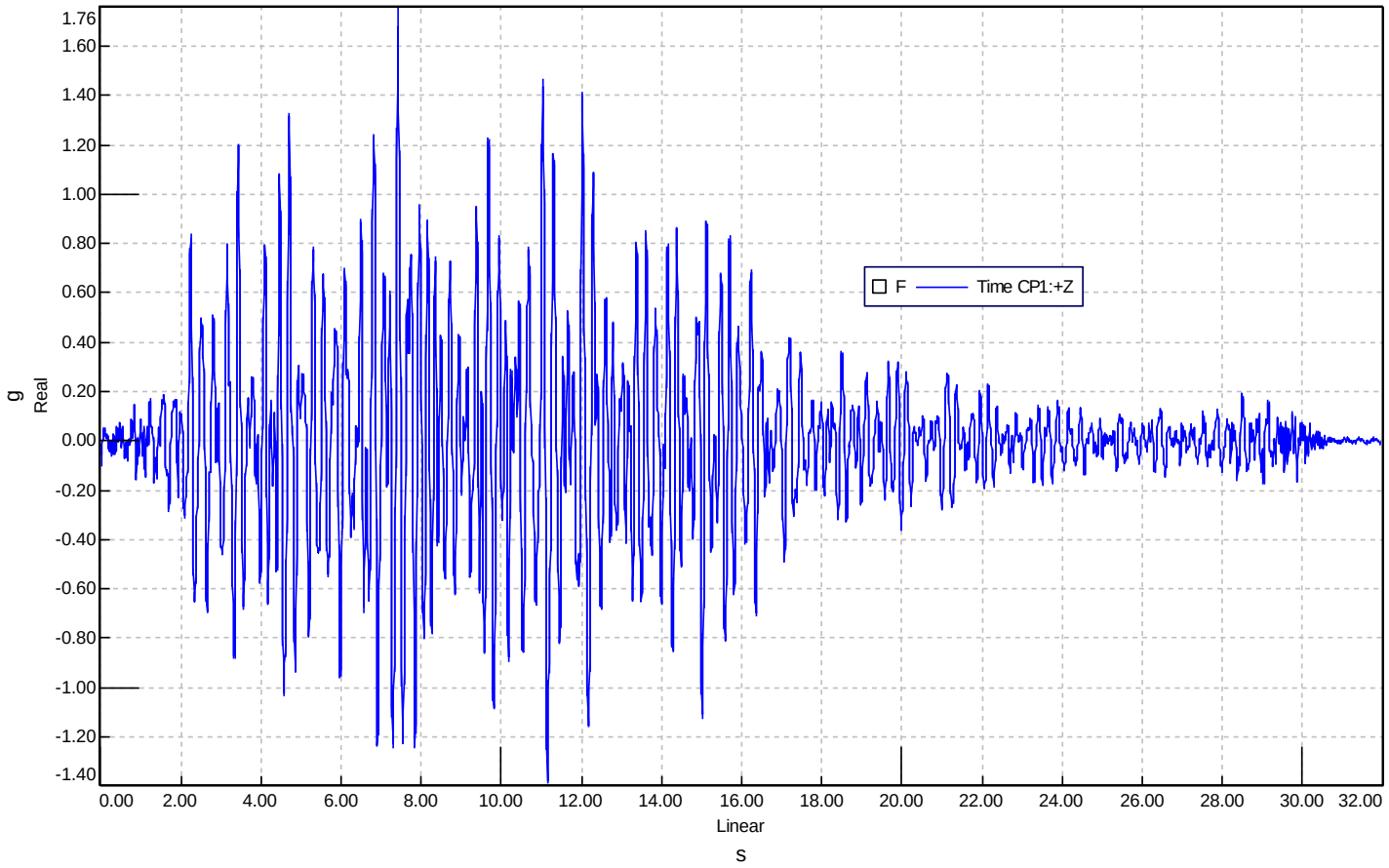

Figure 17 – Z Axis – CP1: Diagram of Seismic Test

Project: **PRO-MTL-ELE24-**
Section: **Z_AXIS**
Run: **RUN02_SHOCK_2**
Date:Thu Aug 08 2024 16:41:23
Point ID: MP1B

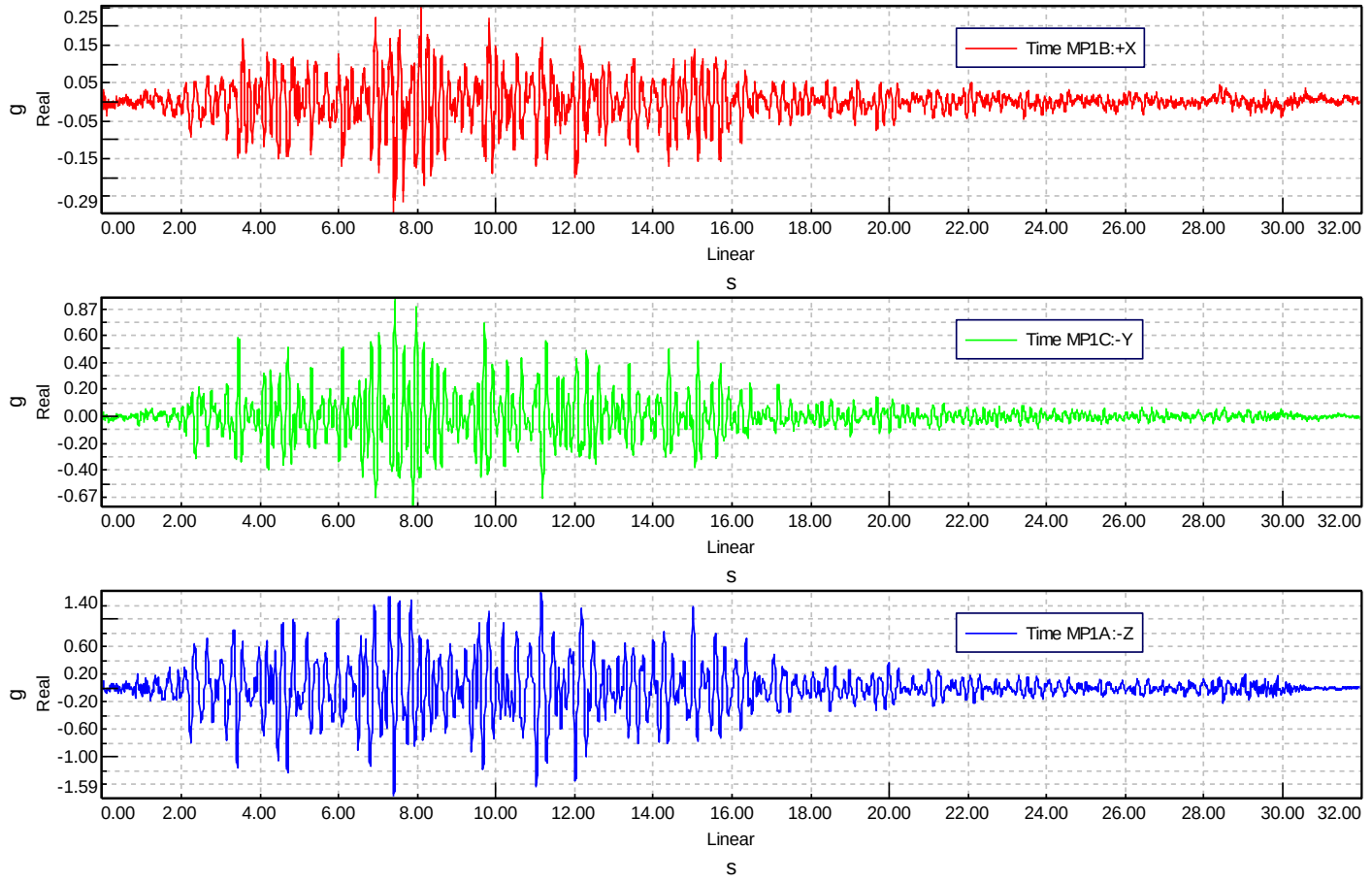

Figure 18 – Z Axis – MP1: Diagram of Seismic Test

Project:PRO-MTL-ELE24-029_seismic
Section:Z_AXIS
Run:RUN02_SHOCK_2
Date:Thu Aug 08 2024 16:41:23
Point ID: MP2C

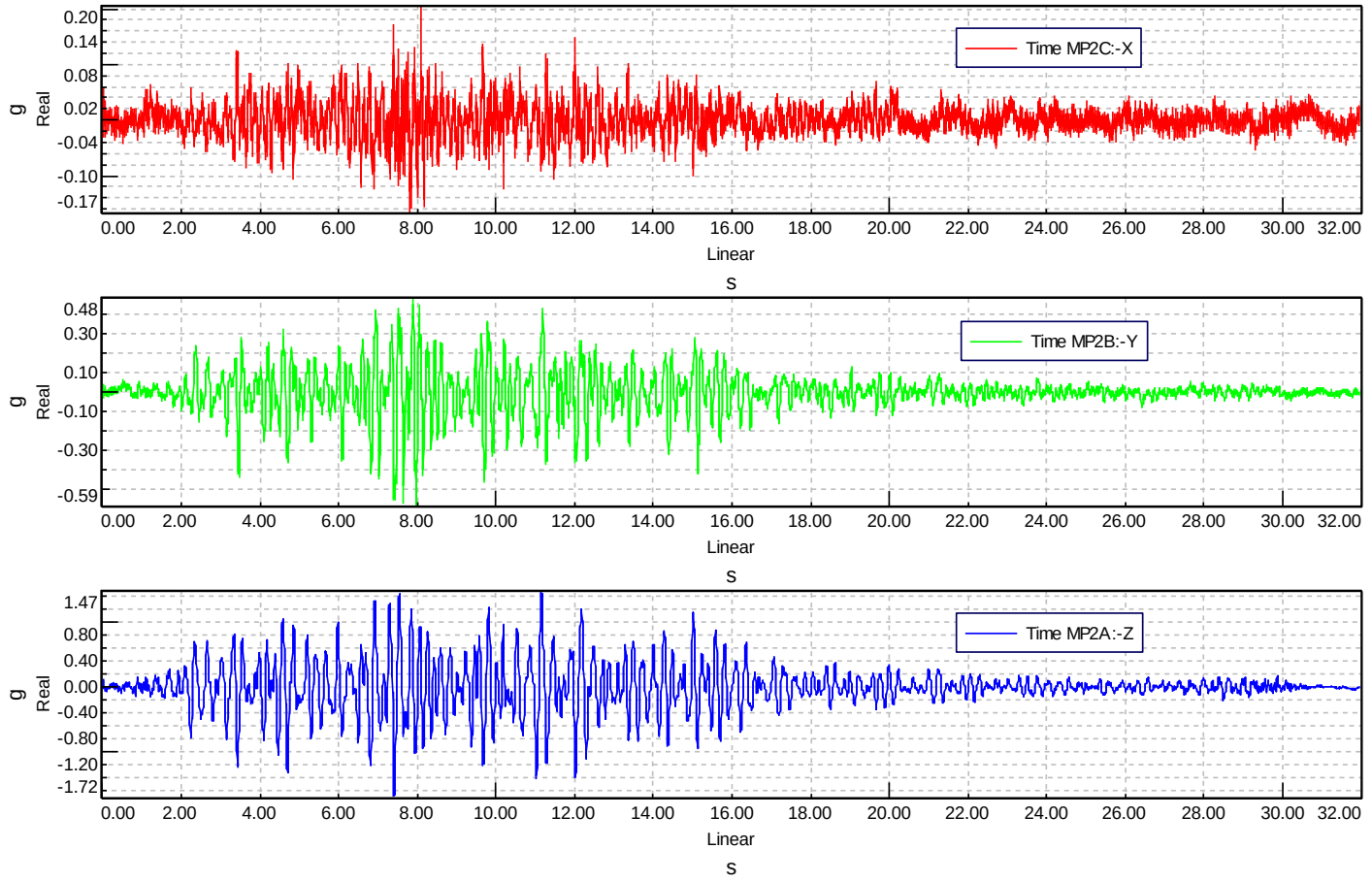

Figure 19 – Z Axis – MP2: Diagram of Seismic Test

Project:PRO-MTL-ELE24-029_seismic
Section:Z_AXIS
Run:RUN02_SHOCK_2
Date:Thu Aug 08 2024 16:41:23
Point ID: MP3A

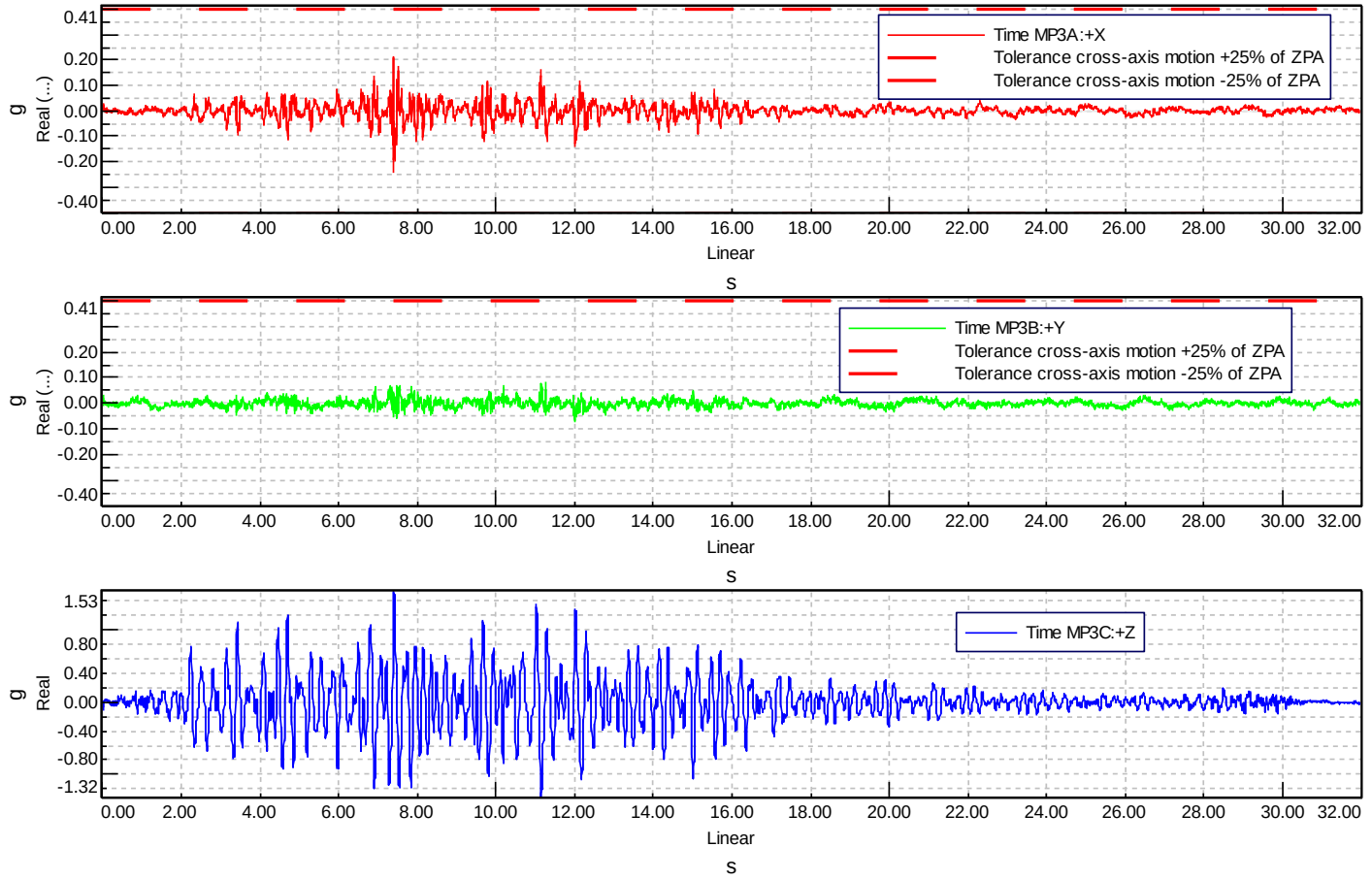

Figure 20 – Z Axis – MP3: Diagram of Seismic Test – Tolerances

Project:PRO-MTL-ELE24-029_seismic
Section: Z_AXIS
Run: RUN02_SHOCK_2
Date:Thu Aug 08 2024 16:41:23
Point ID: CP1

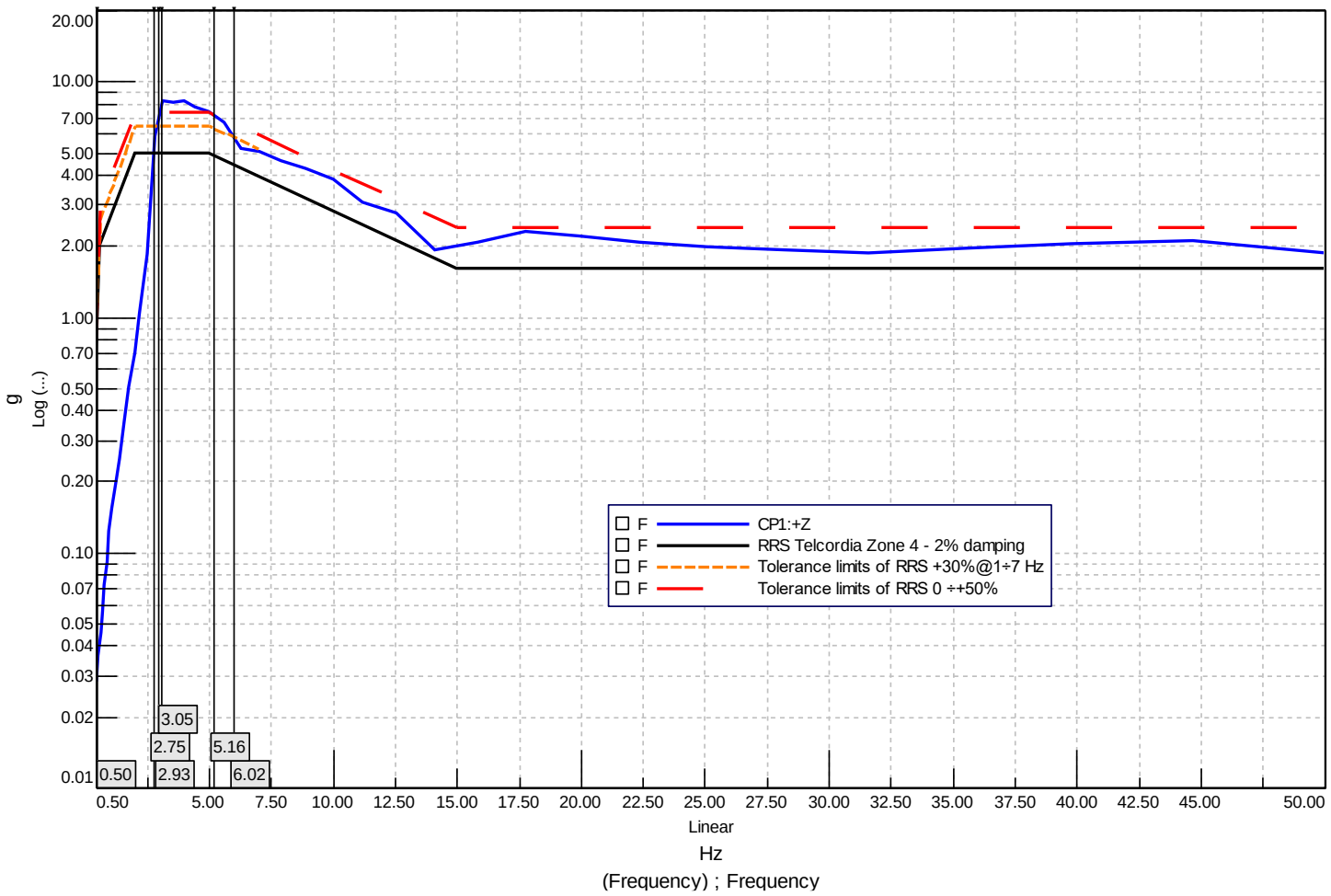

Figure 21 – Z Axis – AvgCtrl: Diagram of Test Response Spectrum

Project:PRO-MTL-ELE24-029_seismic

Section: Z_AXIS

Run: RUN02_SHOCK_2

Date:Thu Aug 08 2024 16:41:23

Point ID: MP2-MP3

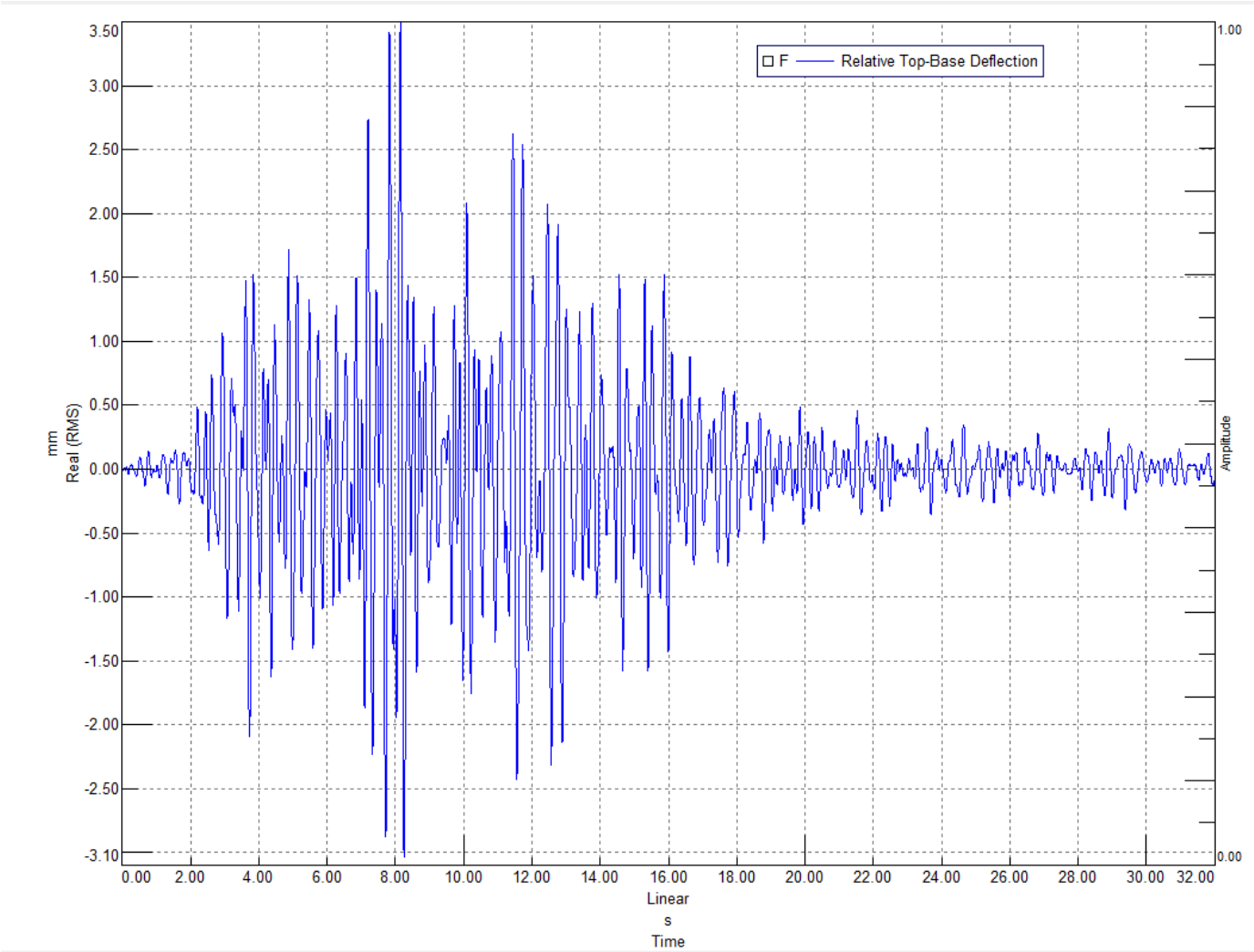

Figure 22 – Z Axis – MP2-MP3: Diagram of Seismic Test – Time-history of the relative displacement between the frame top and base of the EUT

Project: PRO-MTL-ELE24-029_seismic
Section: Z_AXIS
Run: RUN03_SINE_1
Date: Thu Aug 08 2024 17:00:57
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Number of control channels: 1
Point id: AvgCtrl
Control strategy: Average

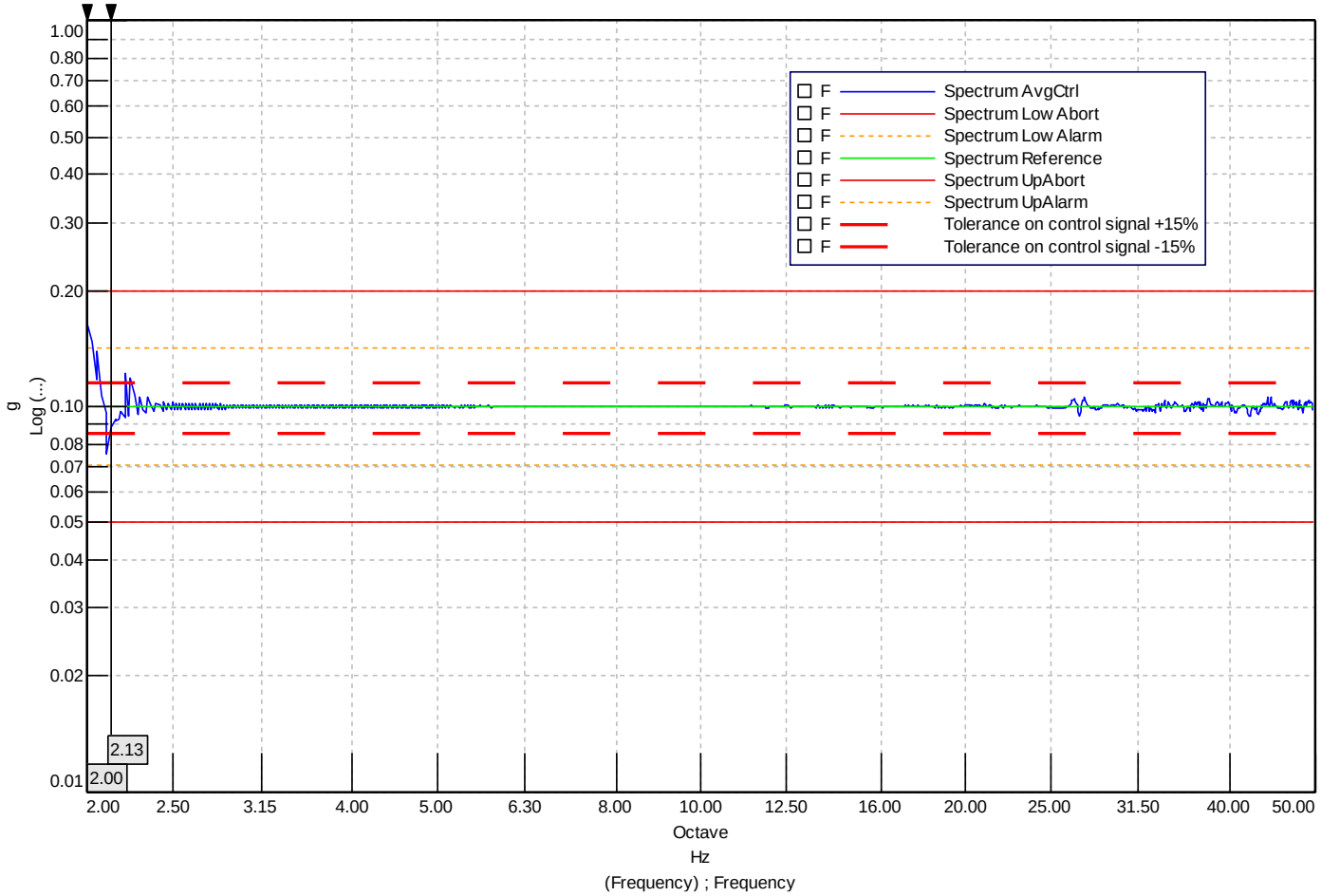

Figure 23 – Z Axis – AvgCtrl: Diagram of final vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Z_AXIS
Run: RUN03_SINE_1
Date: Thu Aug 08 2024 17:00:57
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP1B
Control strategy: Average

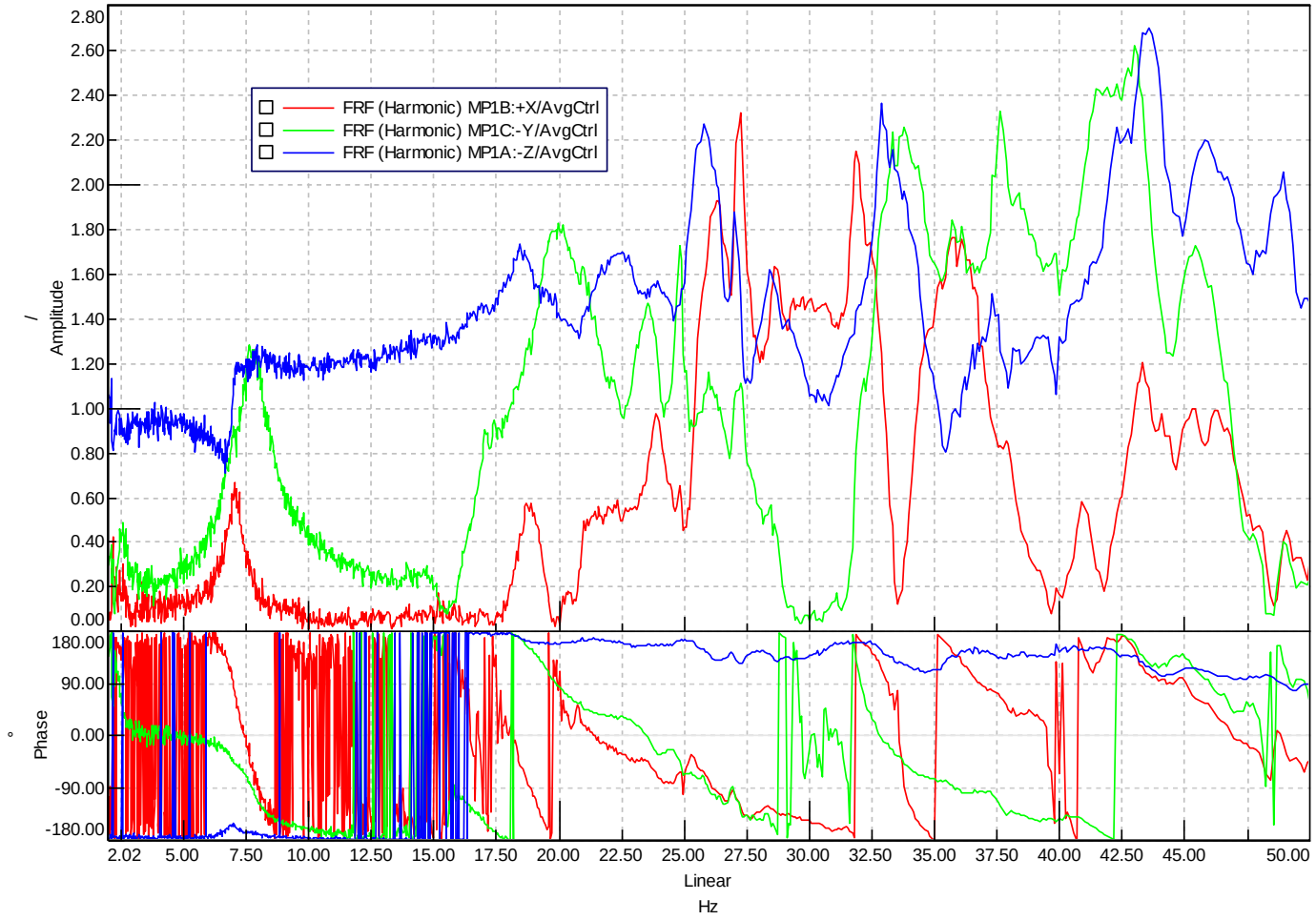

Figure 24 – Z Axis – MP1: Diagram of final vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Z_AXIS
Run: RUN03_SINE_1
Date: Thu Aug 08 2024 17:00:57
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP2C
Control strategy: Average

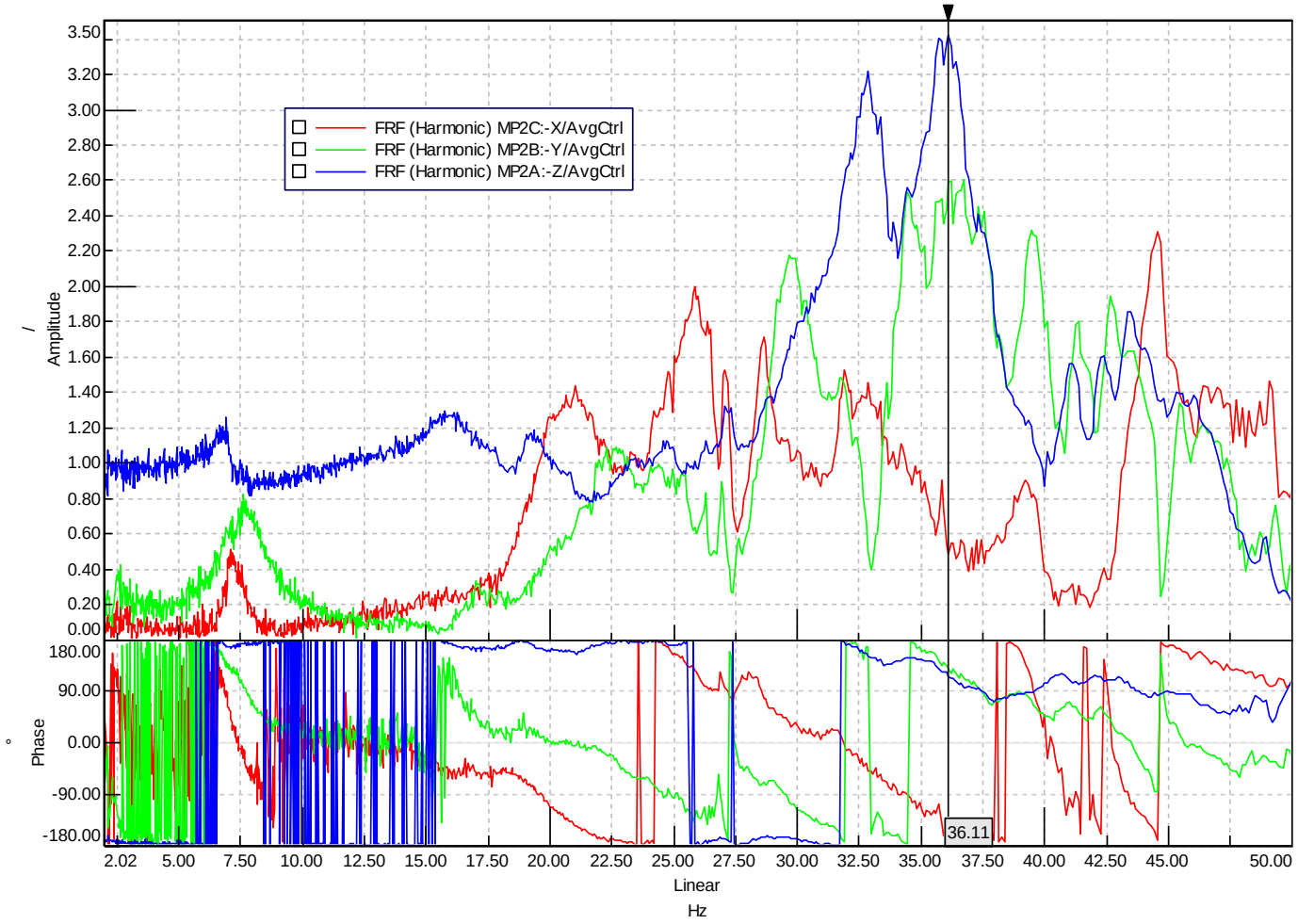

Figure 25 – Z Axis – MP2: Diagram of final vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Z_AXIS
Run: RUN03_SINE_1
Date: Thu Aug 08 2024 17:00:57
Sweep Direction: Up
Sweep Rate: 1 Oct/min
Sweep done: 2
Point id: MP3A
Control strategy: Average

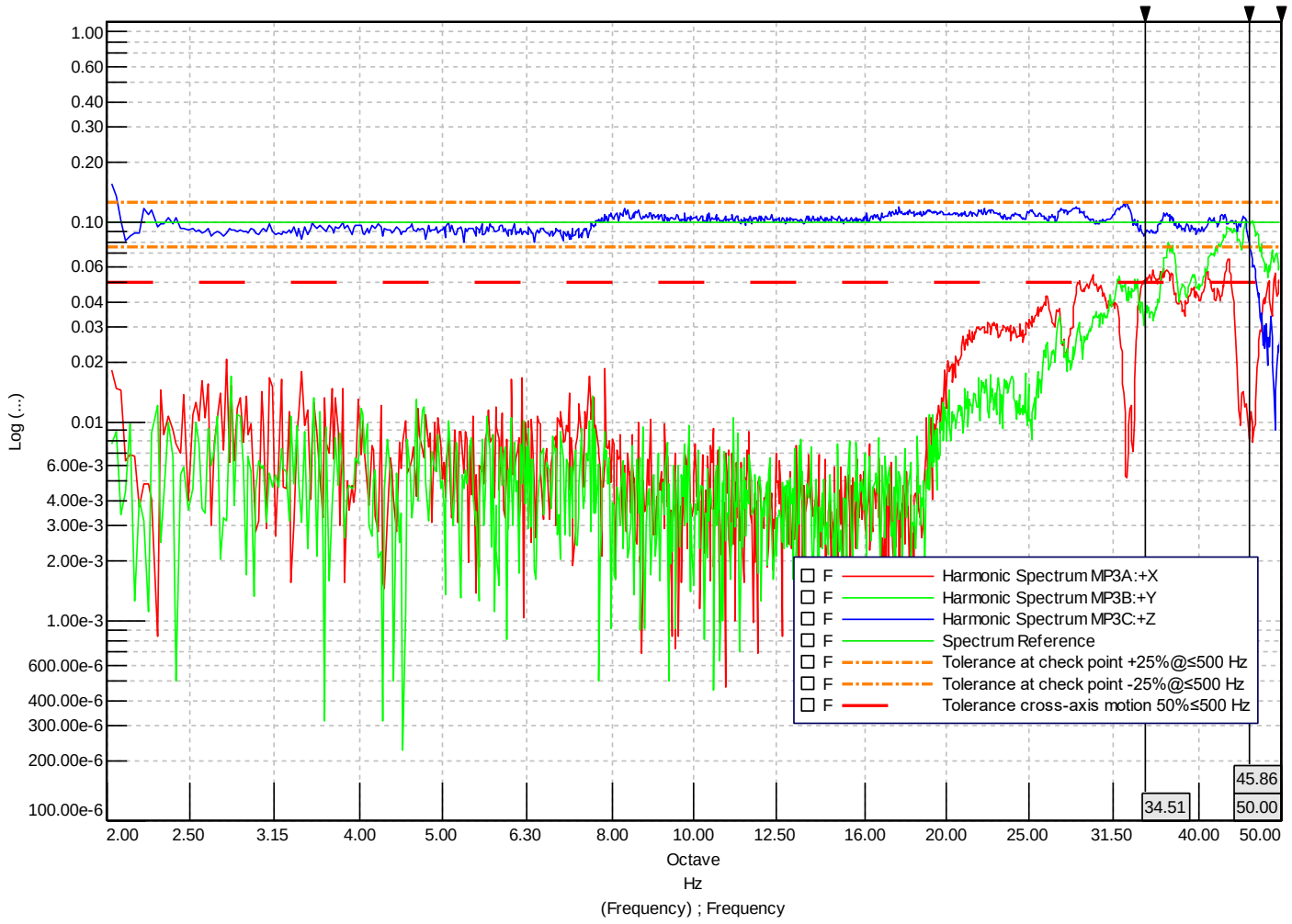

Figure 26 – Z Axis – MP3: Diagram of final vibration response investigation test – Tolerances – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: X_AXIS
Run: RUN04_SINE_3
Date: Thu Aug 08 2024 18:01:58
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Number of control channels: 1
Point id: AvgCtrl
Control strategy: Average

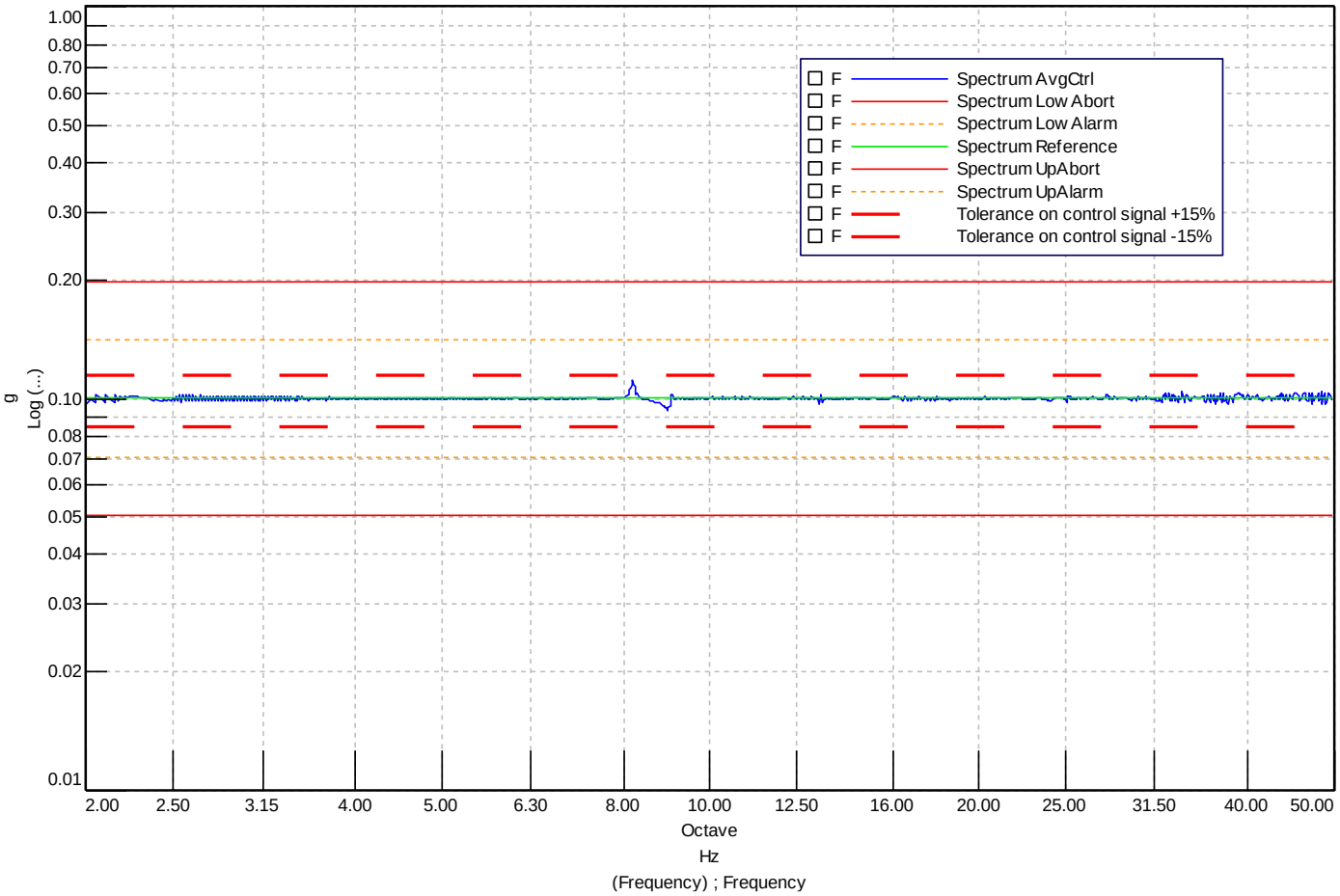

Figure 27 – X Axis – AvgCtrl: Diagram of initial vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: X_AXIS
Run: RUN04_SINE_3
Date: Thu Aug 08 2024 18:01:58
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP1B
Control strategy: Average

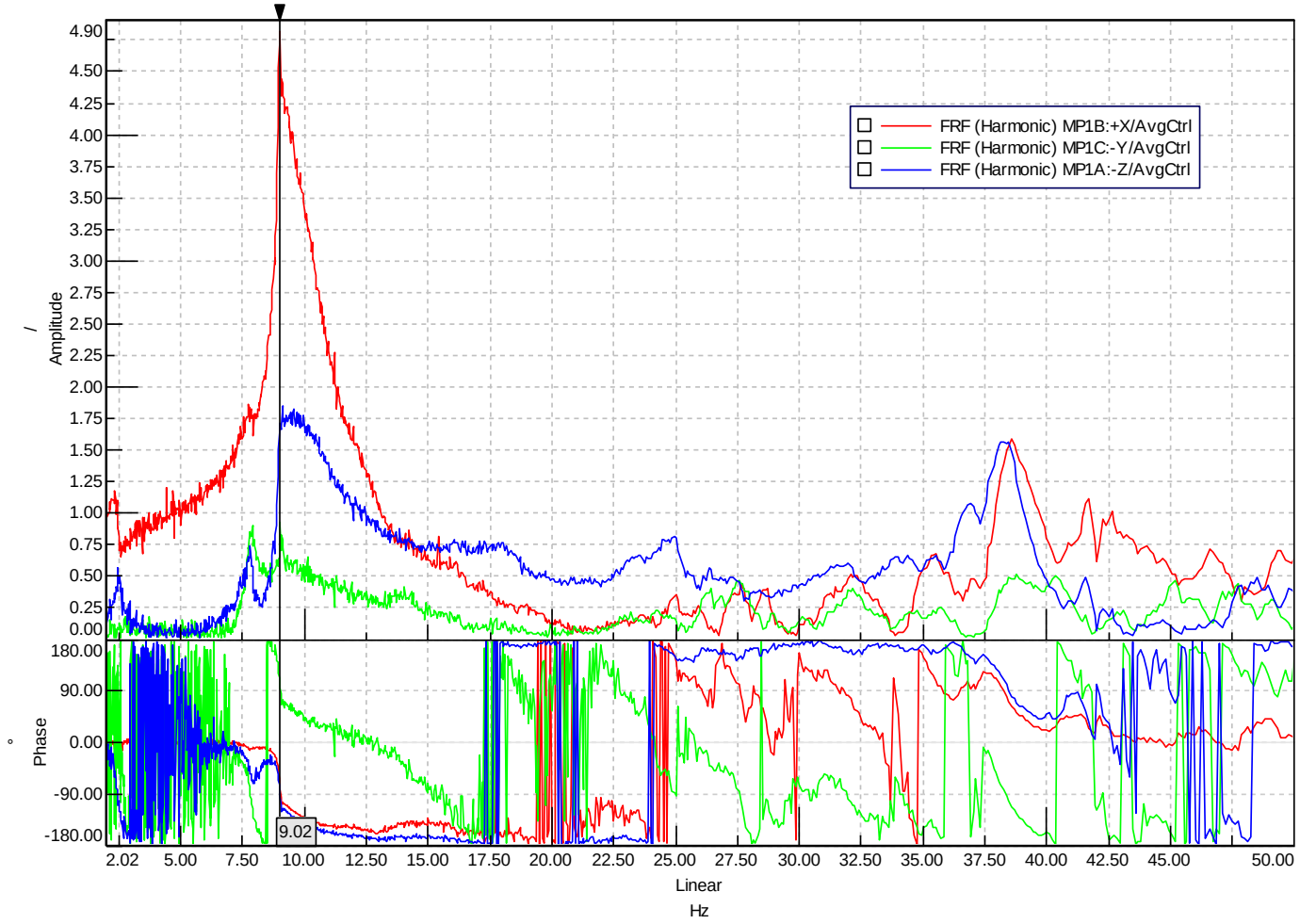

Figure 28 – X Axis – MP1: Diagram of initial vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: X_AXIS
Run: RUN04_SINE_3
Date: Thu Aug 08 2024 18:01:58
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP2C
Control strategy: Average

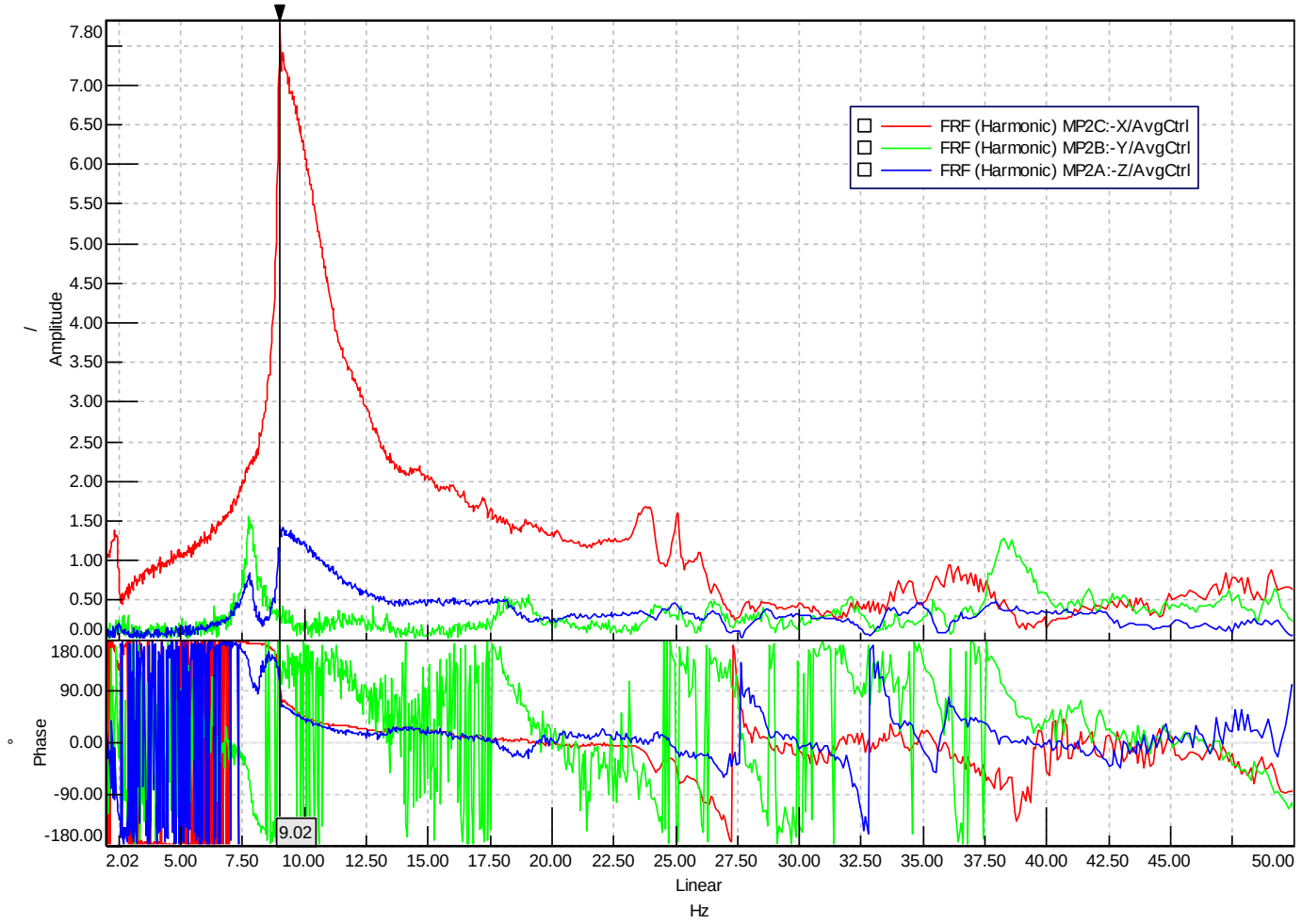

Figure 29 – X Axis – MP2: Diagram of initial vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: X_AXIS
Run: RUN04_SINE_3
Date: Thu Aug 08 2024 18:01:58
Sweep Direction: Up
Sweep Rate: 1 Oct/min
Sweep done: 2
Point id: MP3A
Control strategy: Average

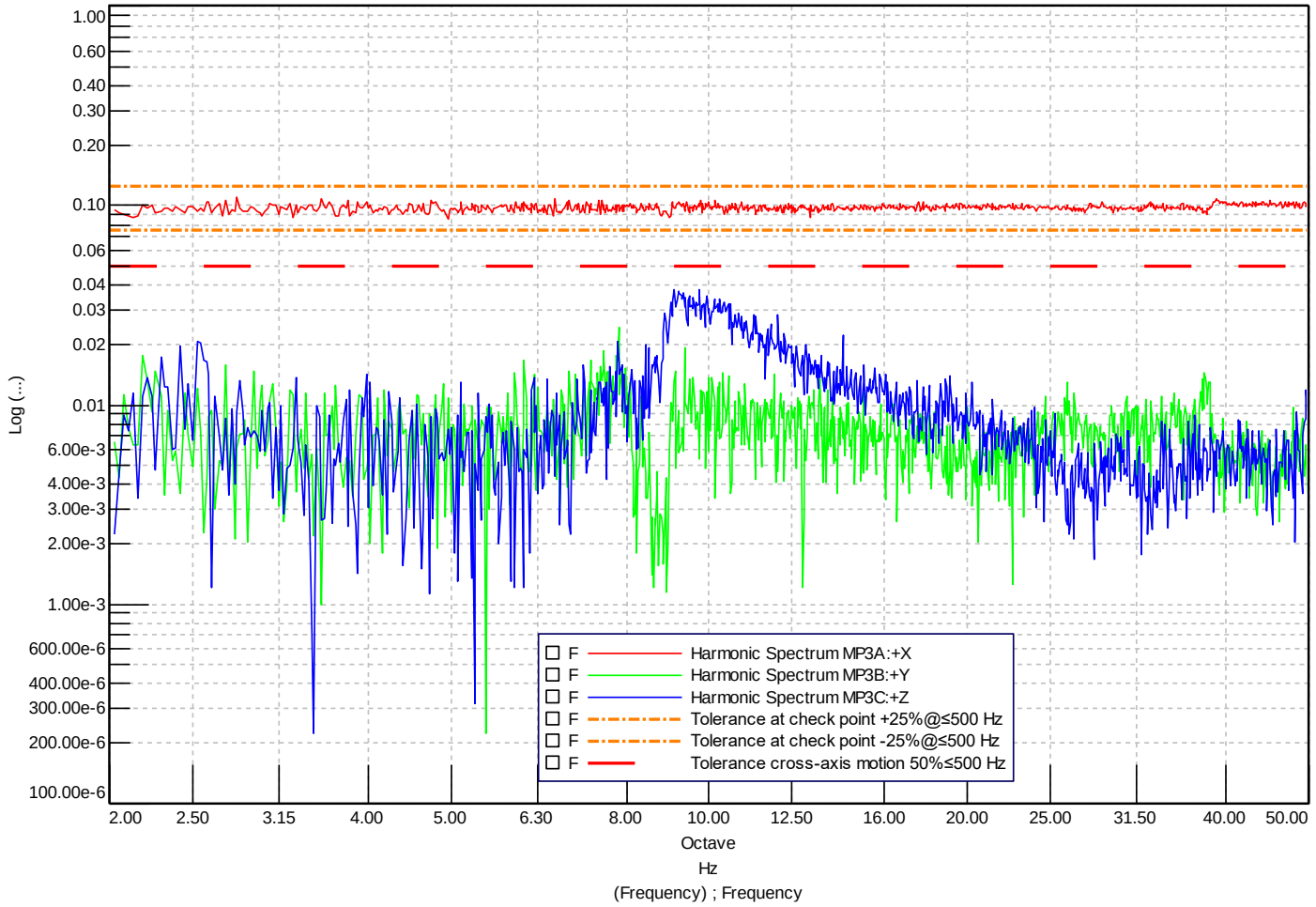

Figure 30 – X Axis – MP3: Diagram of initial vibration response investigation test – Tolerances – Sweep Up

Project:PRO-MTL-ELE24-029_seismic
Section: X_AXIS
Run: RUN05_SHOCK_2
Date: Thu Aug 08 2024 18:27:17
Point ID: CP1

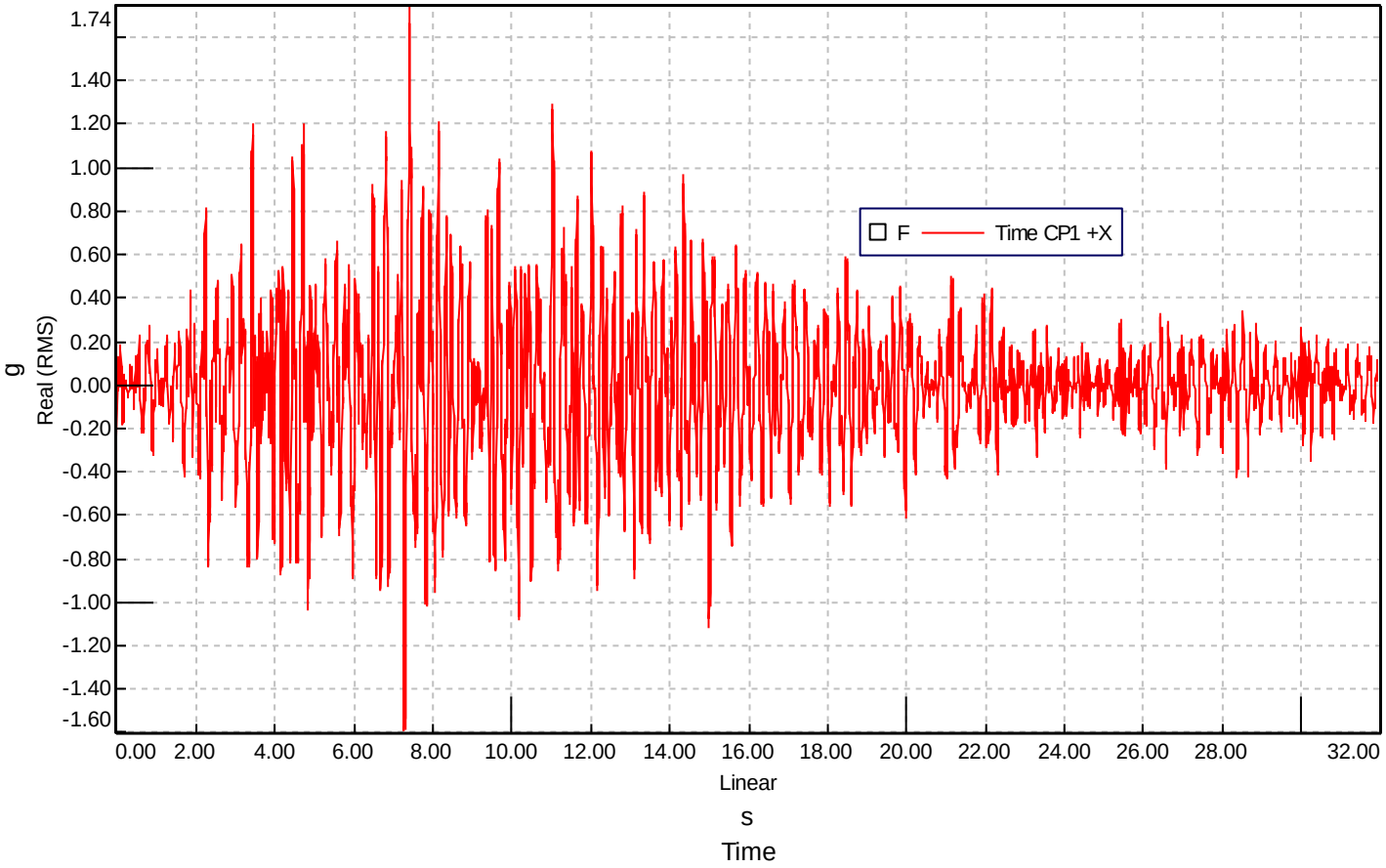

Figure 31 – X Axis – CP1: Diagram of Seismic Test

Project: **PRO-MTL-ELE24-**
Section: **X_AXIS**
Run: **RUN05_SHOCK_2**
Date: Thu Aug 08 2024 18:27:17
Point ID: MP1B

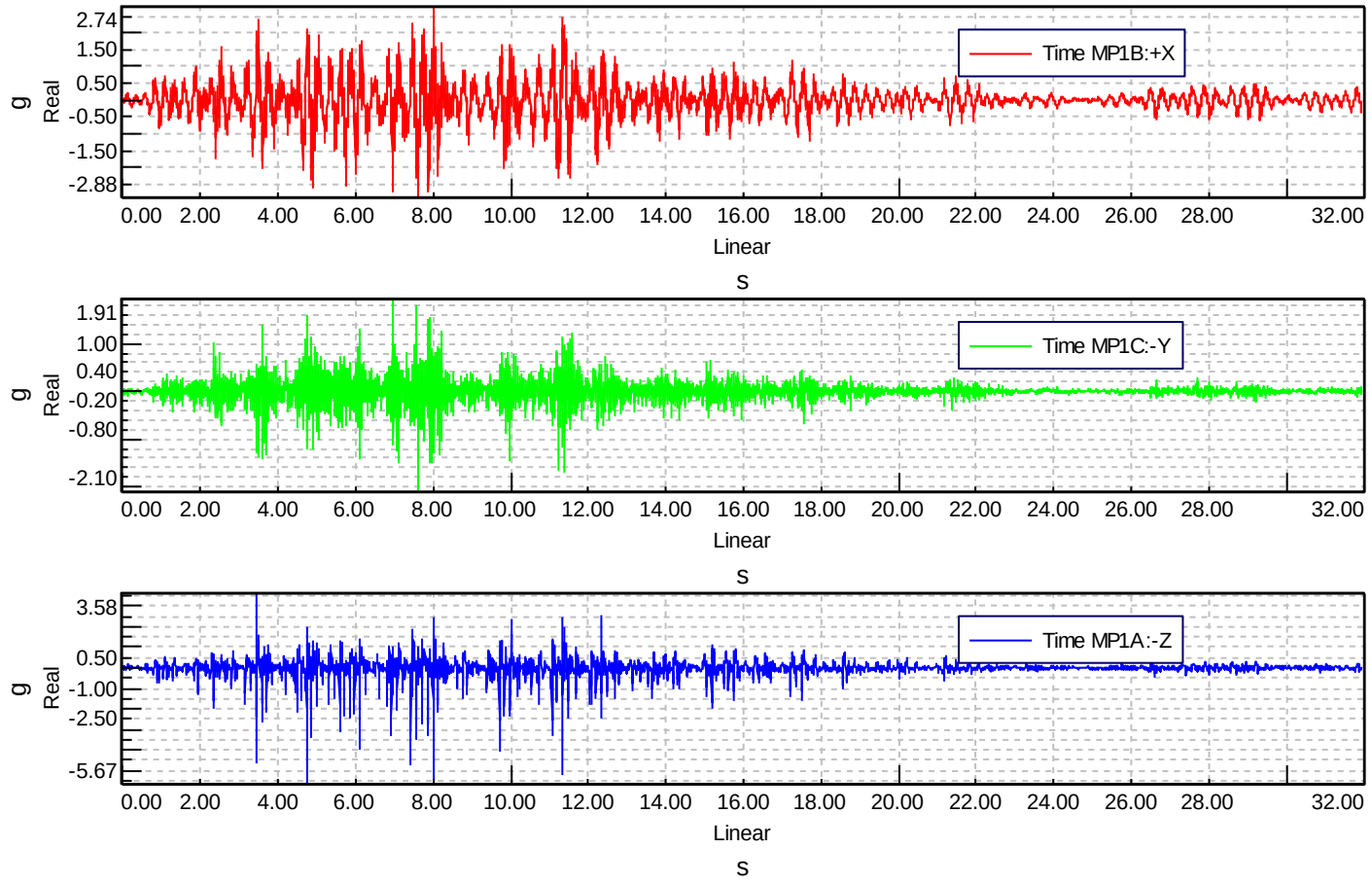

Figure 32 – X Axis – MP1: Diagram of Seismic Test

Project:PRO-MTL-ELE24-029_seismic
Section:X_AXIS
Run:RUN05_SHOCK_2
Date: Thu Aug 08 2024 18:27:17
Point ID: MP2C

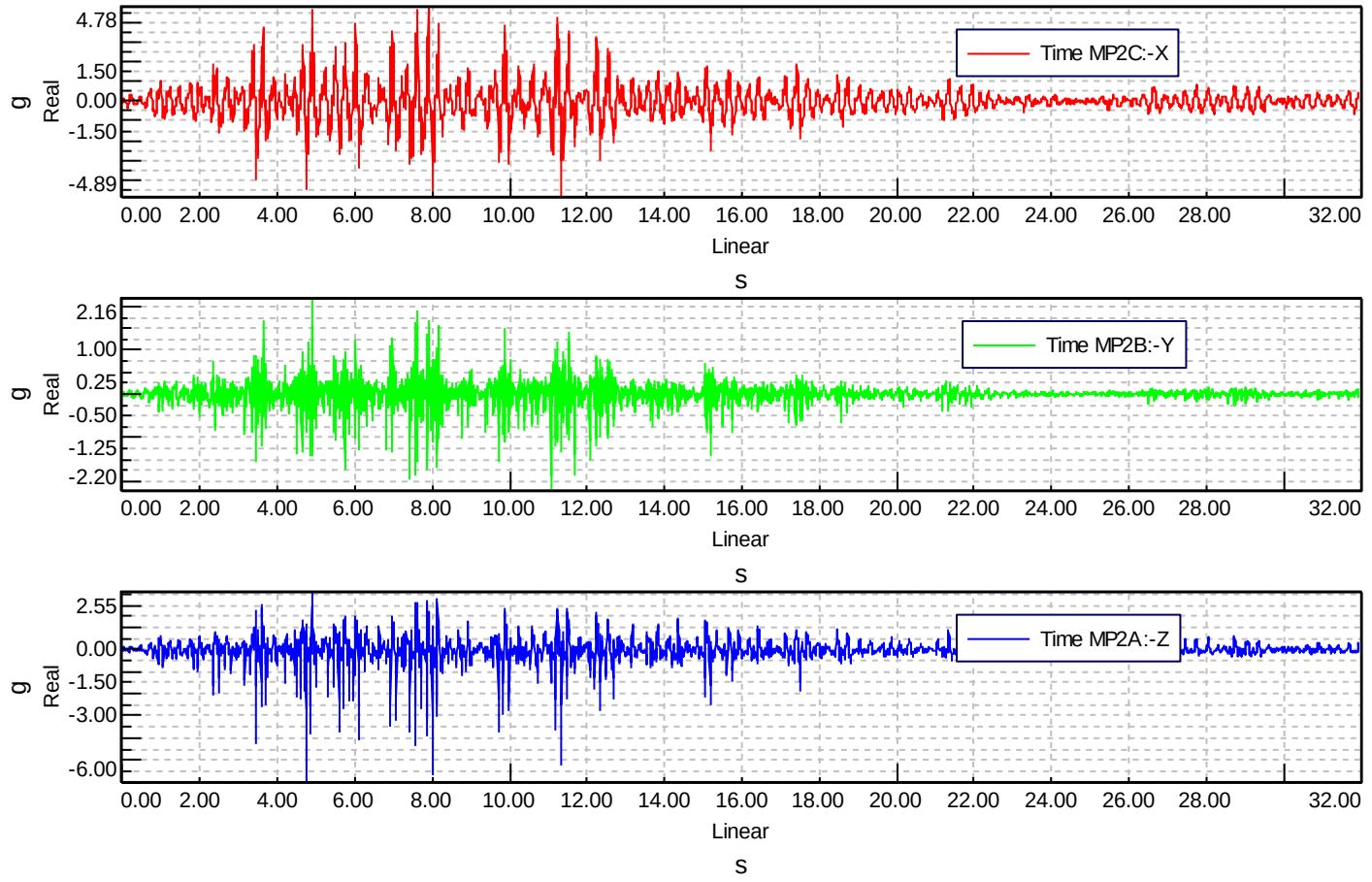

Figure 33 – X Axis – MP2: Diagram of Seismic Test

Project:PRO-MTL-ELE24-029_seismic
Section:X_AXIS
Run:RUN05_SHOCK_2
Date: Thu Aug 08 2024 18:27:17
Point ID: MP3A

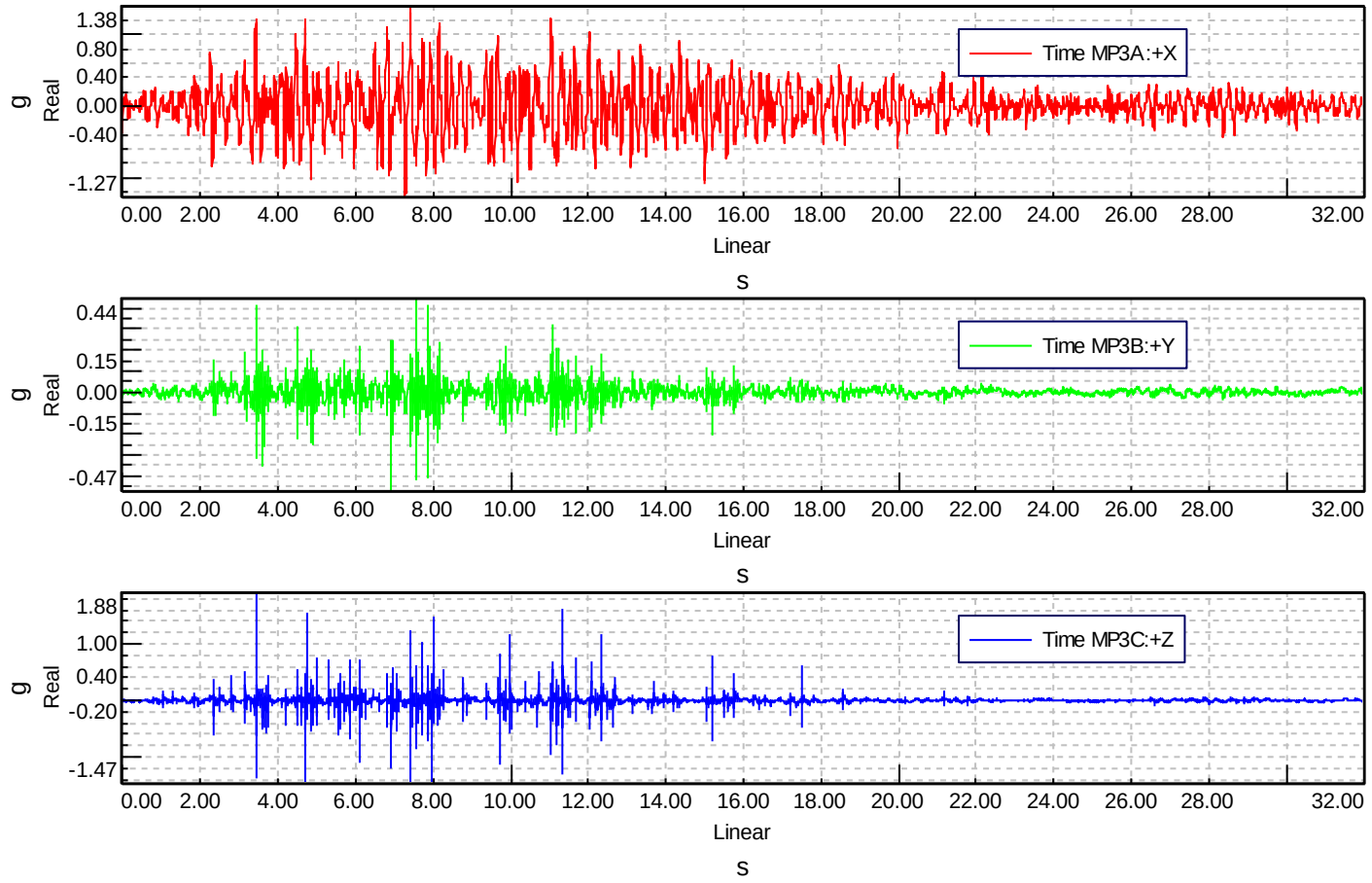

Figure 34 – X Axis – MP3: Diagram of Seismic Test – Tolerances on cross axis motion

Project: PRO-MTL-ELE24-
Section: X_AXIS
Run:RUN05_SHOCK_2
Date: Thu Aug 08 2024 18:27:17
Point ID: CP1

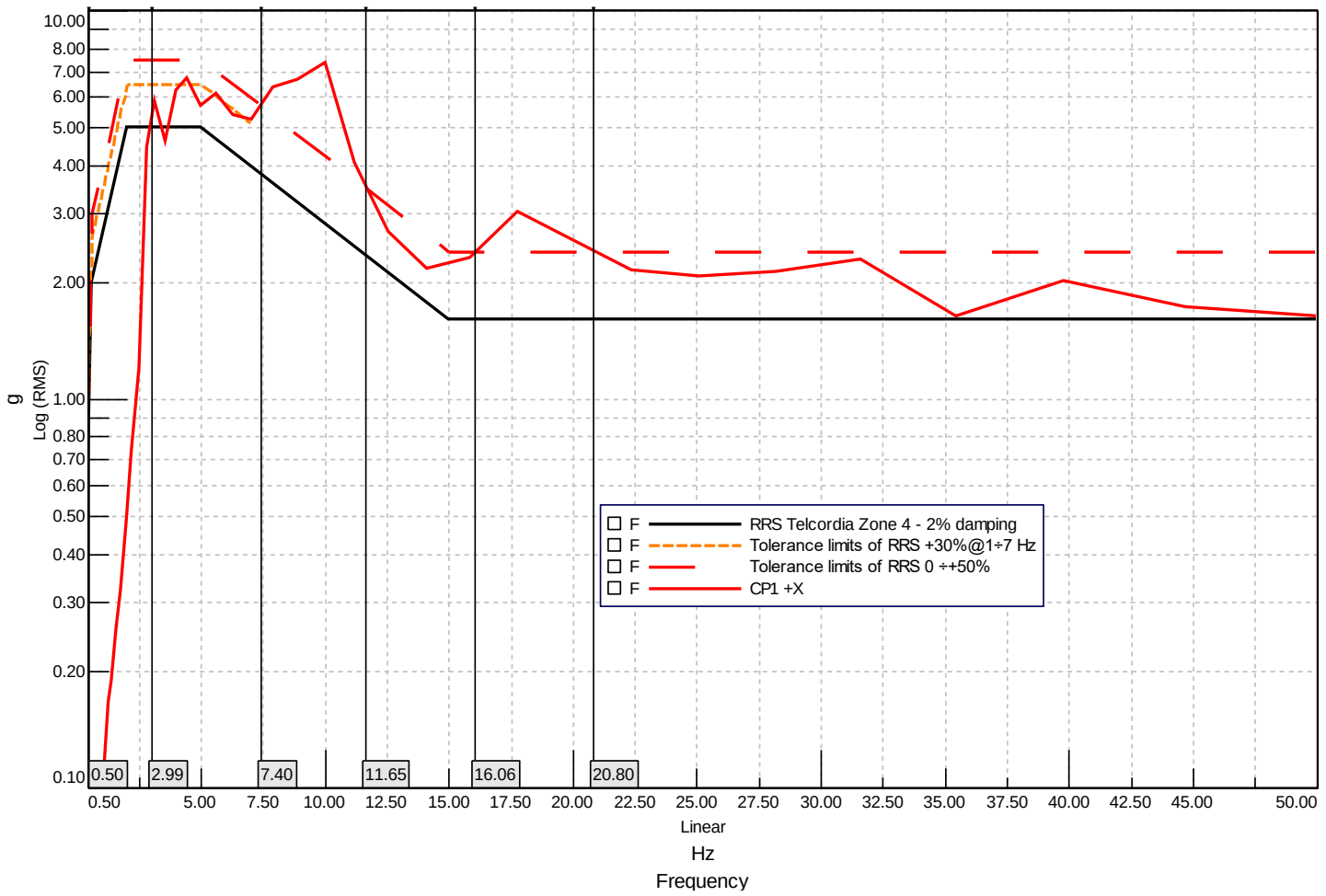

Figure 35 – X Axis – AvgCtrl: Diagram of Test Response Spectrum

Project: **PRO-MTL-ELE24-**
Section: **X_AXIS**
Run:RUN05_SHOCK_2
Date: Thu Aug 08 2024 18:27:17
Point ID: MP2-MP3

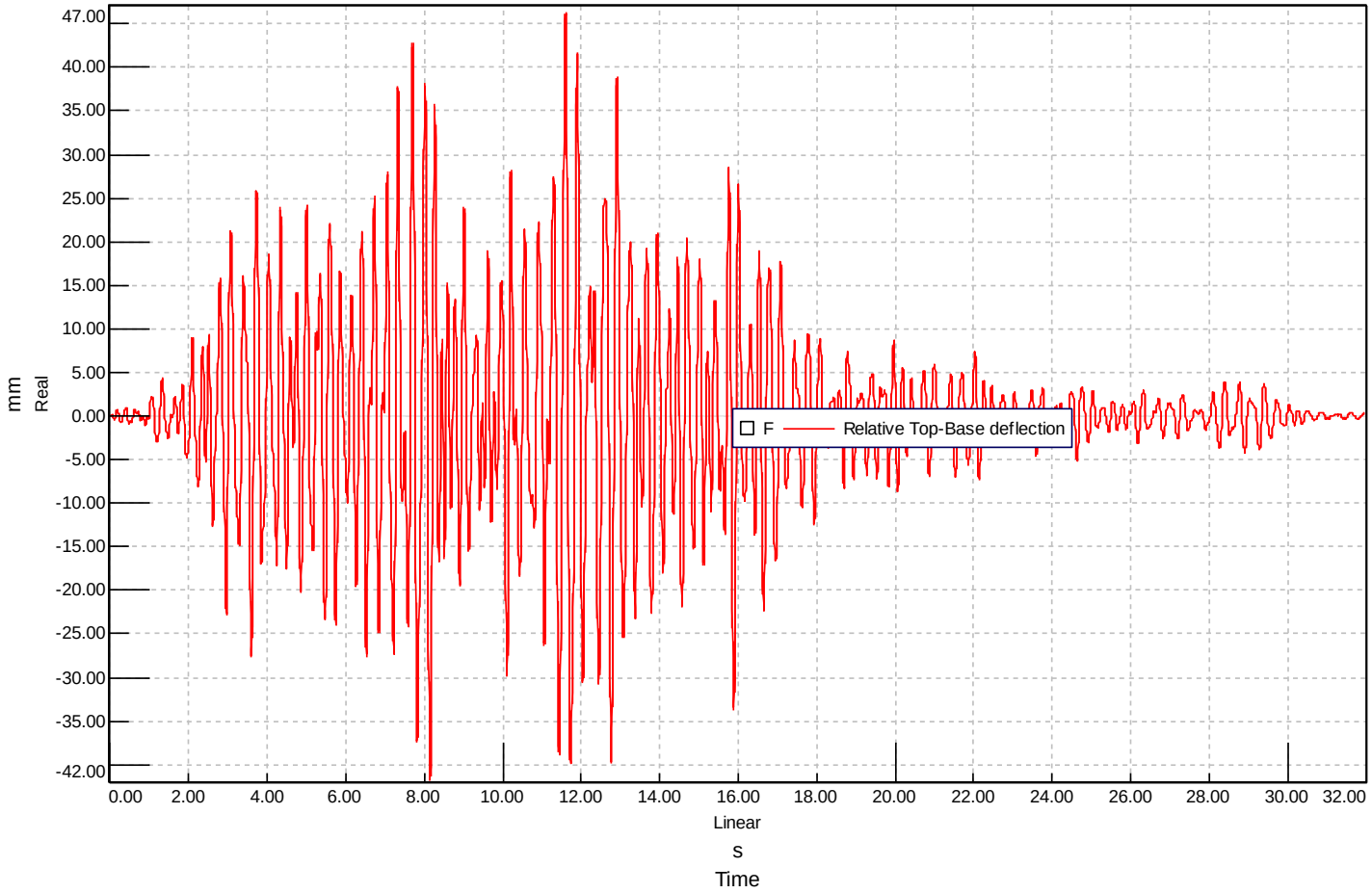

Figure 36 – X Axis – MP2-MP3: Diagram of Seismic Test – Time-history of the relative displacement between the frame top and base of the EUT

Project: PRO-MTL-ELE24-029_seismic
Section: X_AXIS
Run: Run06_sine_1
Date: Fri Aug 09 2024 07:41:21
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Number of control channels: 1
Point id: AvgCtrl
Control strategy: Average

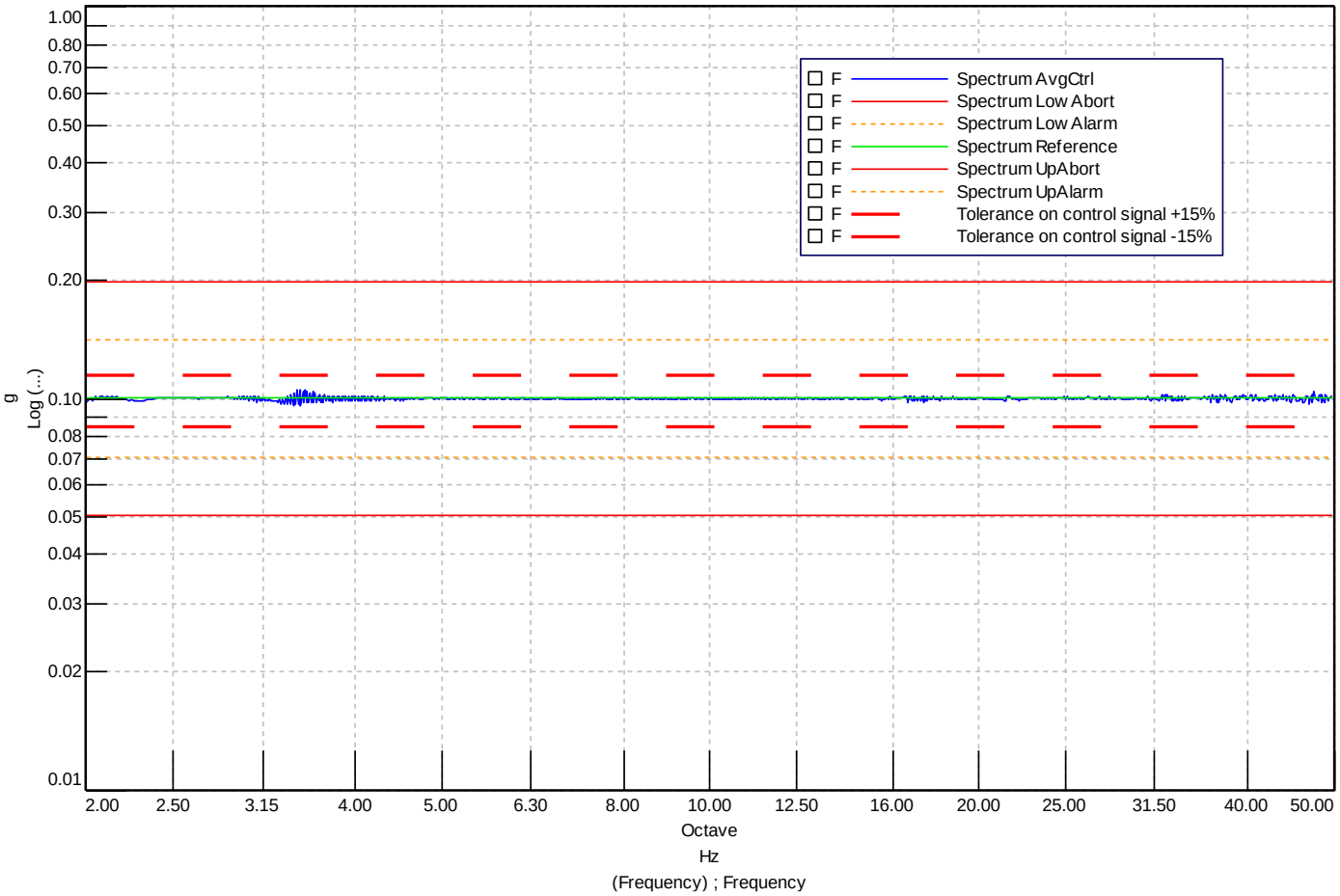

Figure 37 – X Axis – AvgCtrl: Diagram of final vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: X_AXIS
Run: Run06_sine_1
Date: Fri Aug 09 2024 07:41:21
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP1B
Control strategy: Average

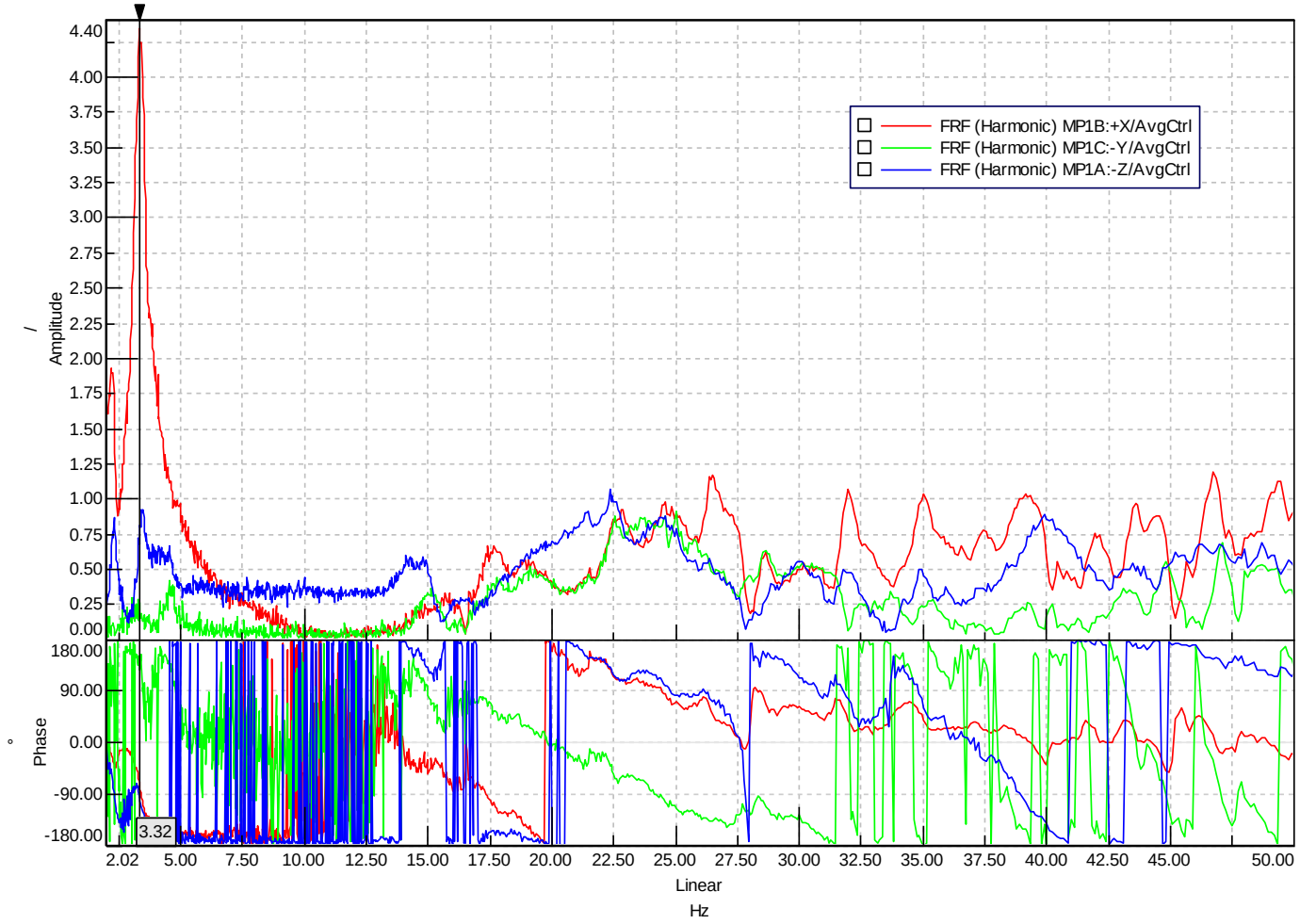

Figure 38 – X Axis – MP1: Diagram of final vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: X_AXIS
Run: Run06_sine_1
Date: Fri Aug 09 2024 07:41:21
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP2C
Control strategy: Average

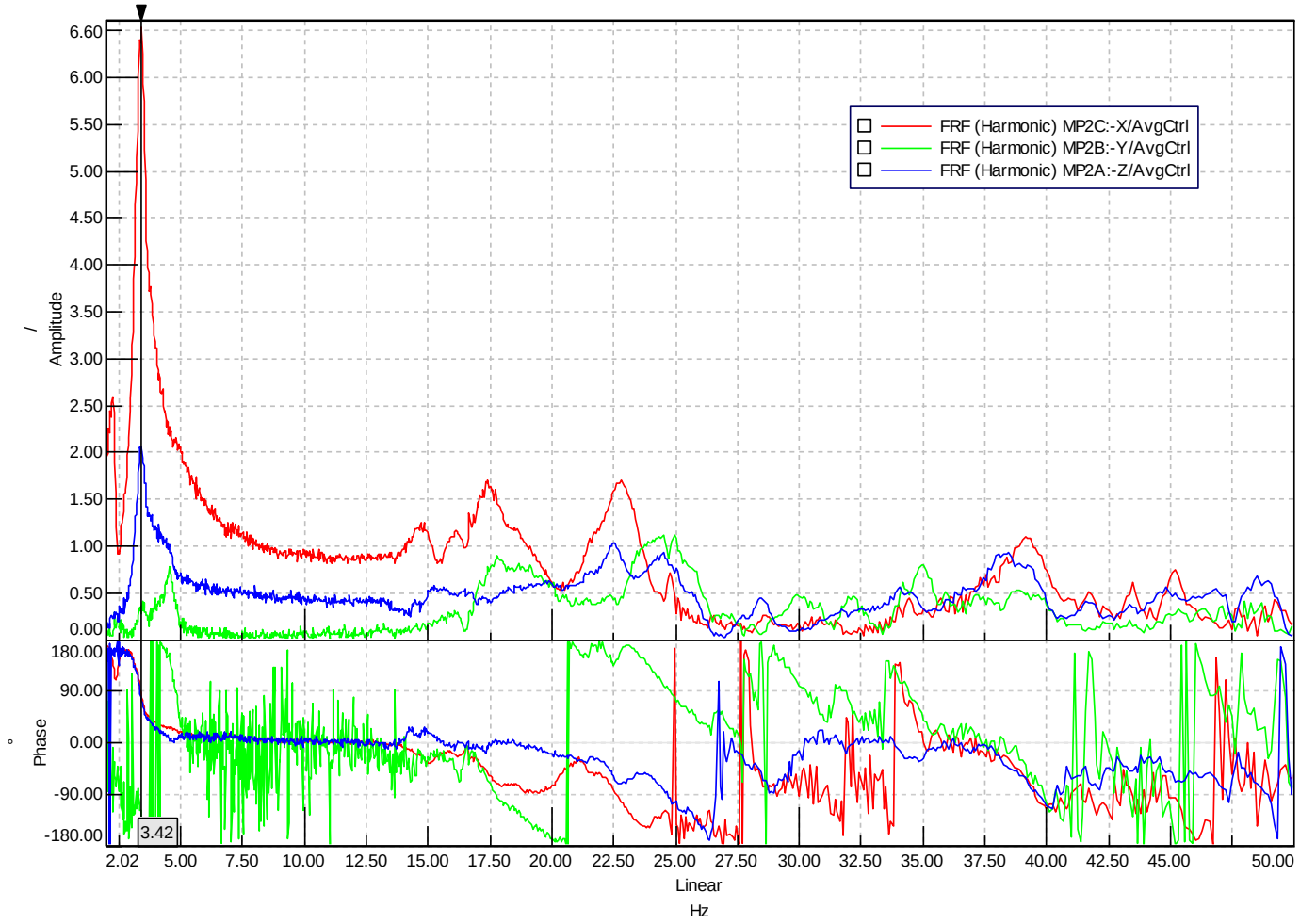

Figure 39 – X Axis – MP2: Diagram of final vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: X_AXIS
Run: Run06_sine_1
Date: Fri Aug 09 2024 07:41:21
Sweep Direction: Up
Sweep Rate: 1 Oct/min
Sweep done: 2
Point id: MP3A
Control strategy: Average

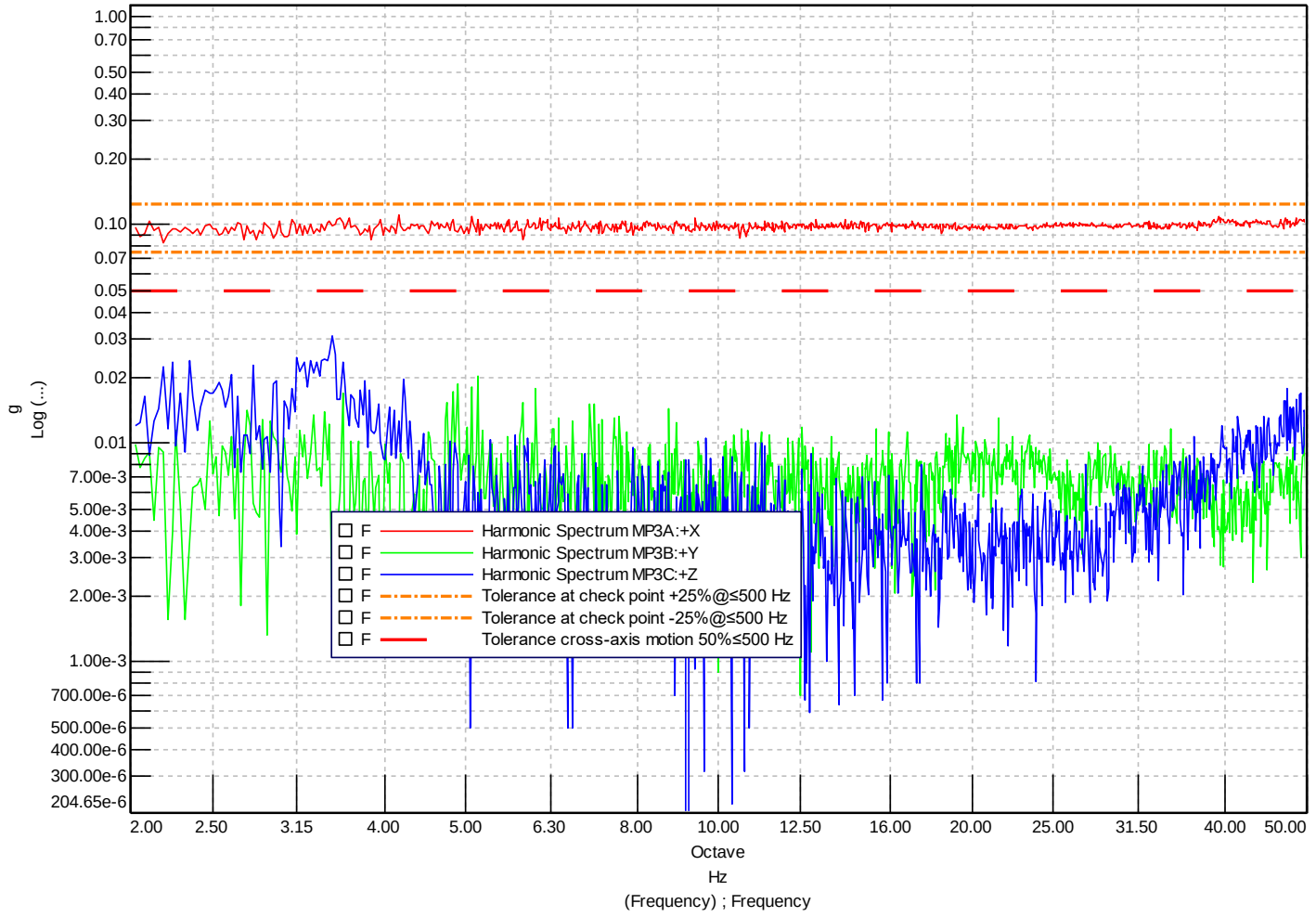

Figure 40 – X Axis – MP3: Diagram of final vibration response investigation test – Tolerances – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Y_AXIS
Run: Run7_sine_2
Date: Fri Aug 09 2024 09:33:32
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Number of control channels: 1
Point id: AvgCtrl
Control strategy: Average

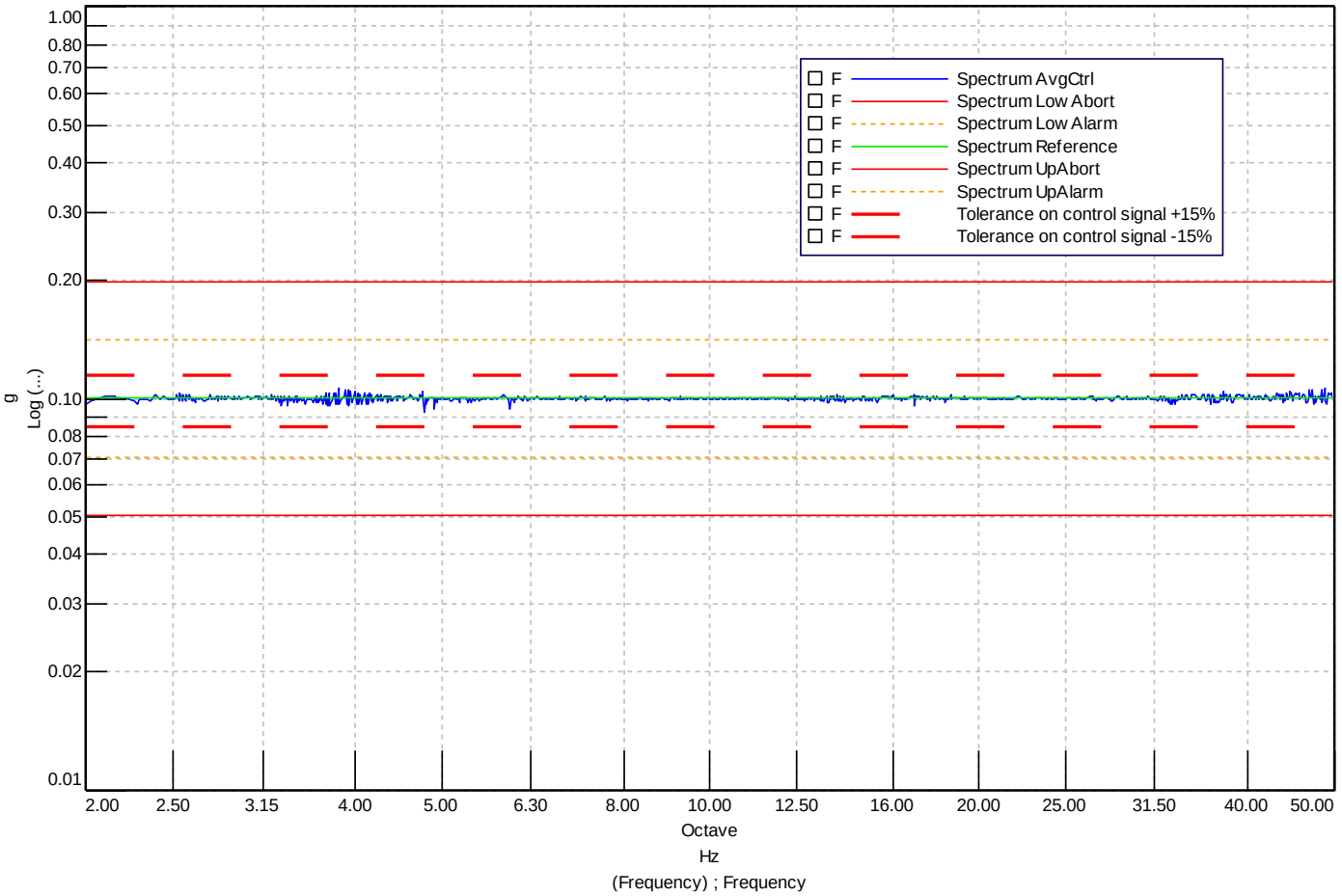

Figure 41 – Y Axis – AvgCtrl: Diagram of initial vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Y_AXIS
Run: Run7_sine_2
Date: Fri Aug 09 2024 09:33:32
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP1B
Control strategy: Average

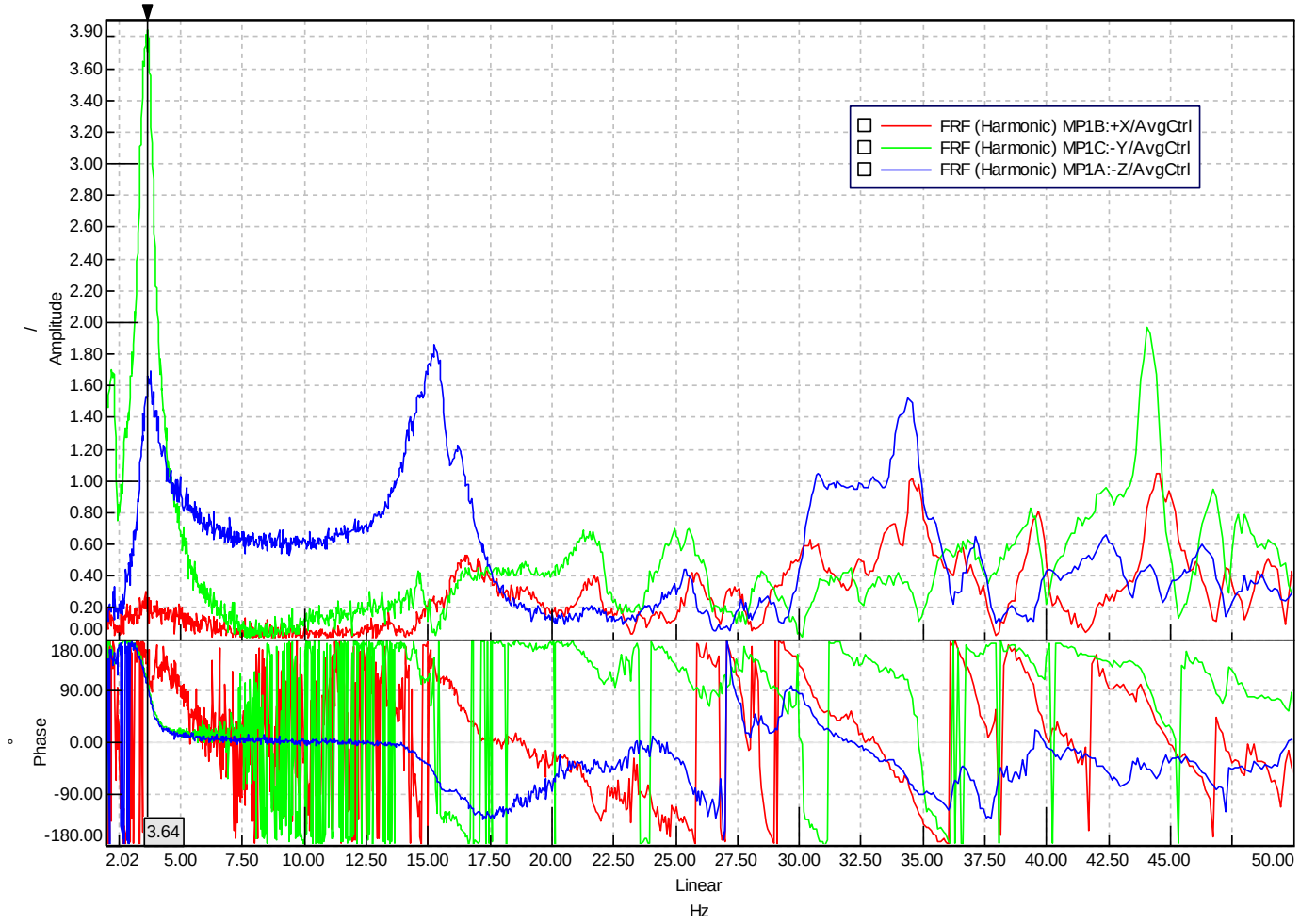

Figure 42 – Y Axis – MP1: Diagram of initial vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Y_AXIS
Run: Run7_sine_2
Date: Fri Aug 09 2024 09:33:32
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP2C
Control strategy: Average

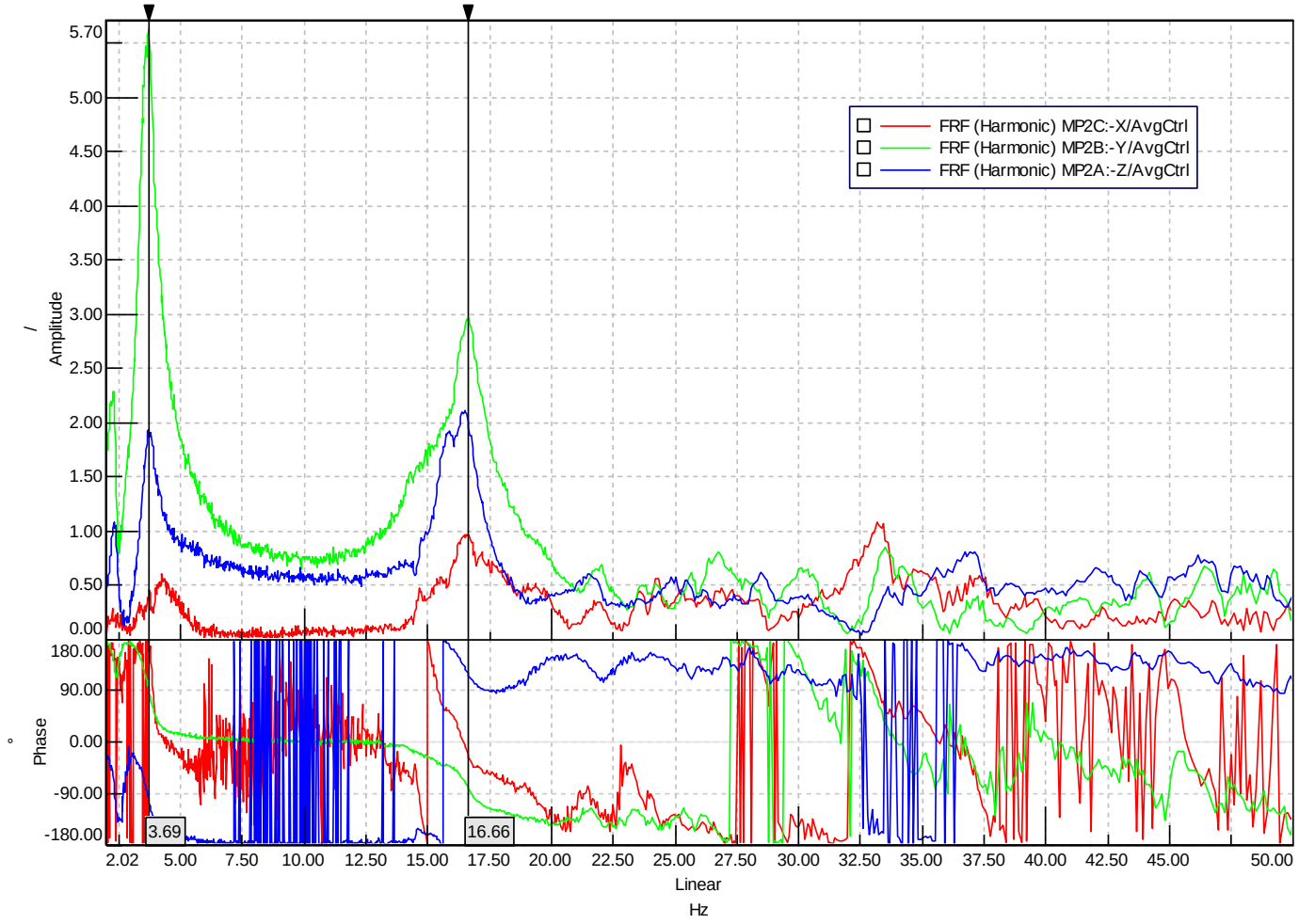

Figure 43 – Y Axis – MP2: Diagram of initial vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Y_AXIS
Run: Run7_sine_2
Date: Fri Aug 09 2024 09:33:32
Sweep Direction: Up
Sweep Rate: 1 Oct/min
Sweep done: 2
Point id: MP3A
Control strategy: Average

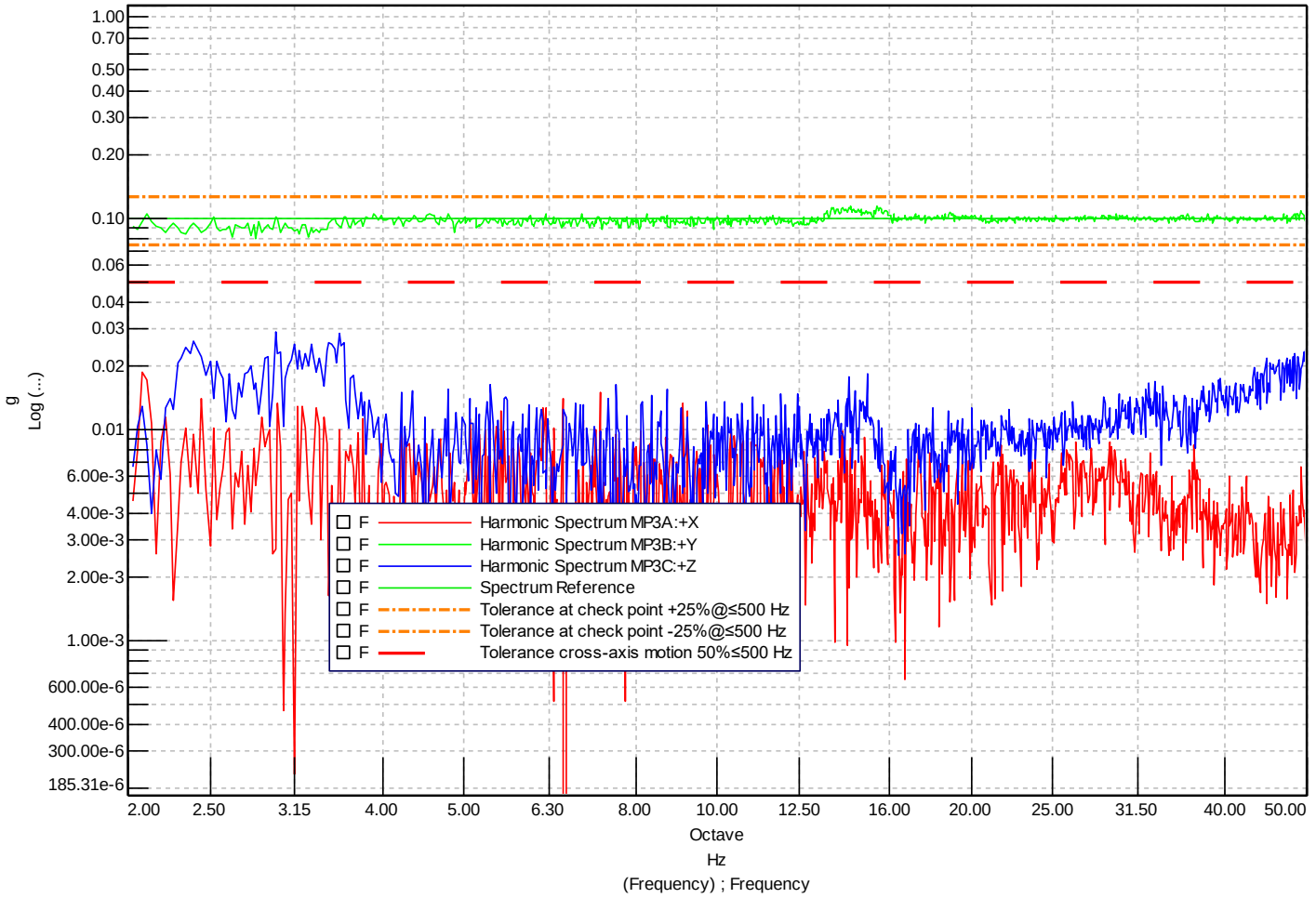

Figure 44 – Y Axis – MP3: Diagram of initial vibration response investigation test – Tolerances – Sweep Up

Project:PRO-MTL-ELE24-029_seismic
Section: Y_AXIS
Run: RUN08_SHOCK_2
Date: Fri Aug 09 2024 10:27:39
Point ID: CP1

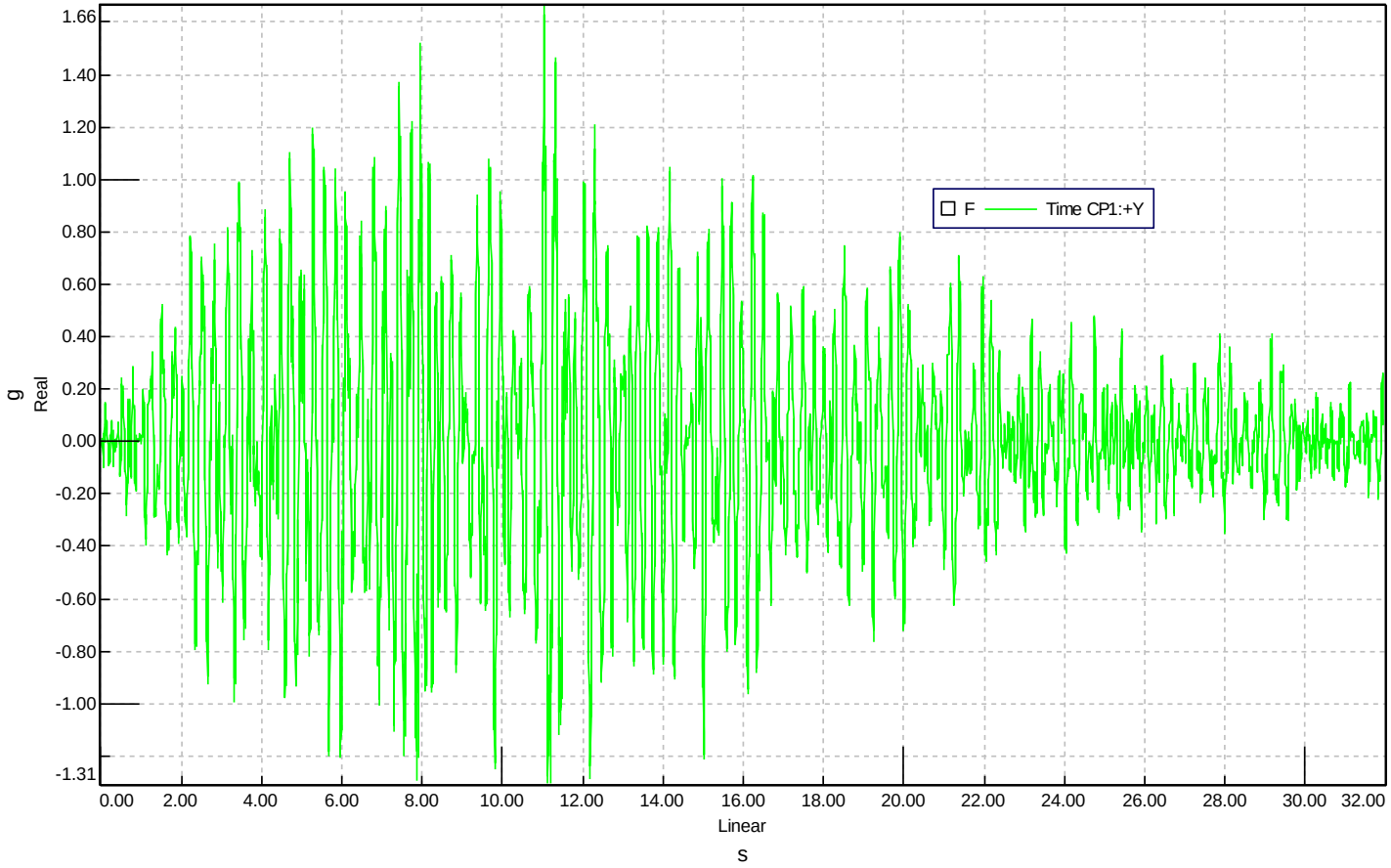

Figure 45 – Y Axis – CP1: Diagram of Seismic Test

Project: **PRO-MTL-ELE24-**
Section: **Y_AXIS**
Run: **RUN08_SHOCK_2**
Date: Fri Aug 09 2024 10:27:39
Point ID: MP1B

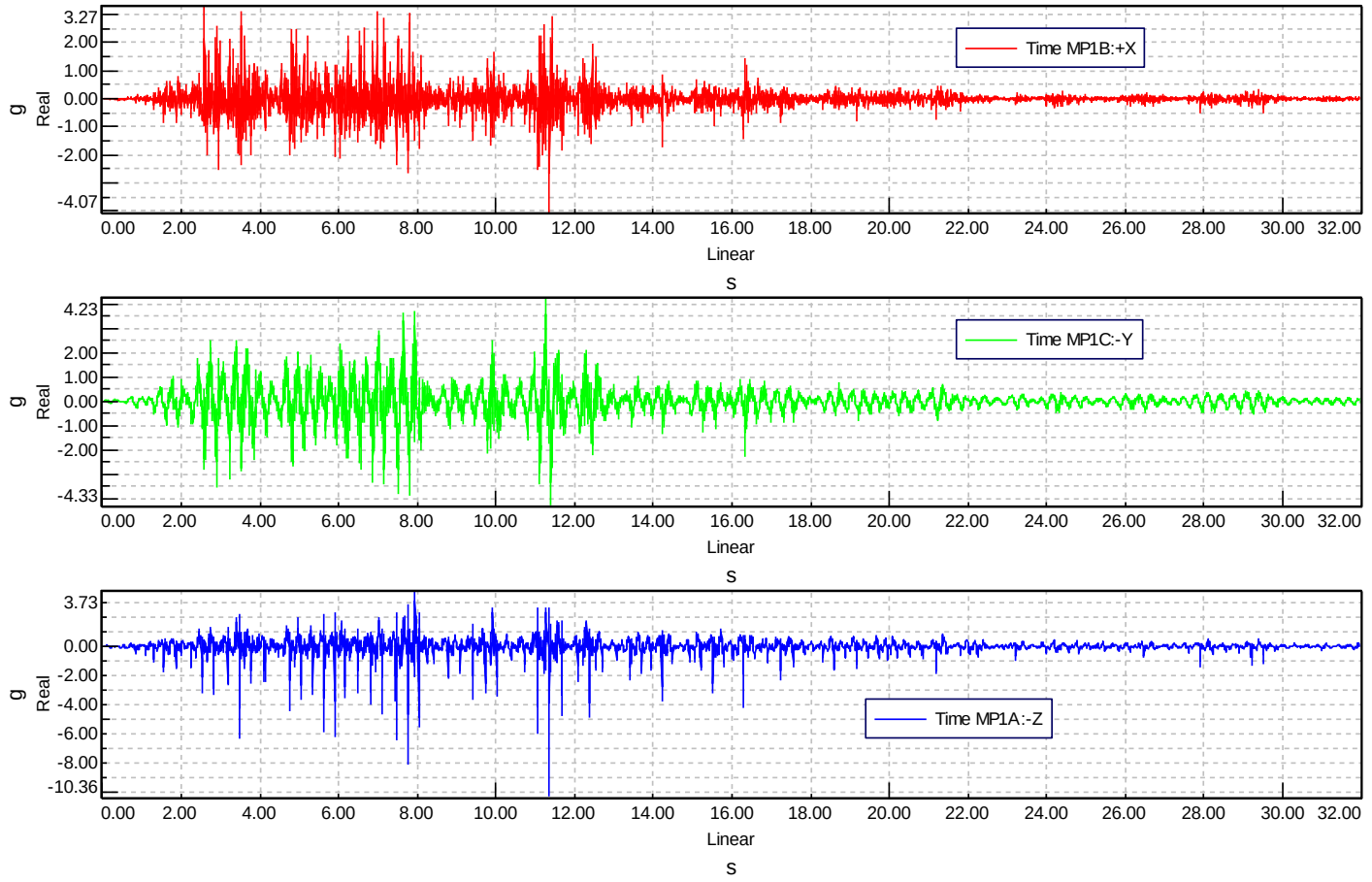

Figure 46 – Y Axis – MP1: Diagram of Seismic Test

Project:PRO-MTL-ELE24-029_seismic
Section:Y_AXIS
Run:RUN08_SHOCK_2
Date: Fri Aug 09 2024 10:27:39
Point ID: MP2C

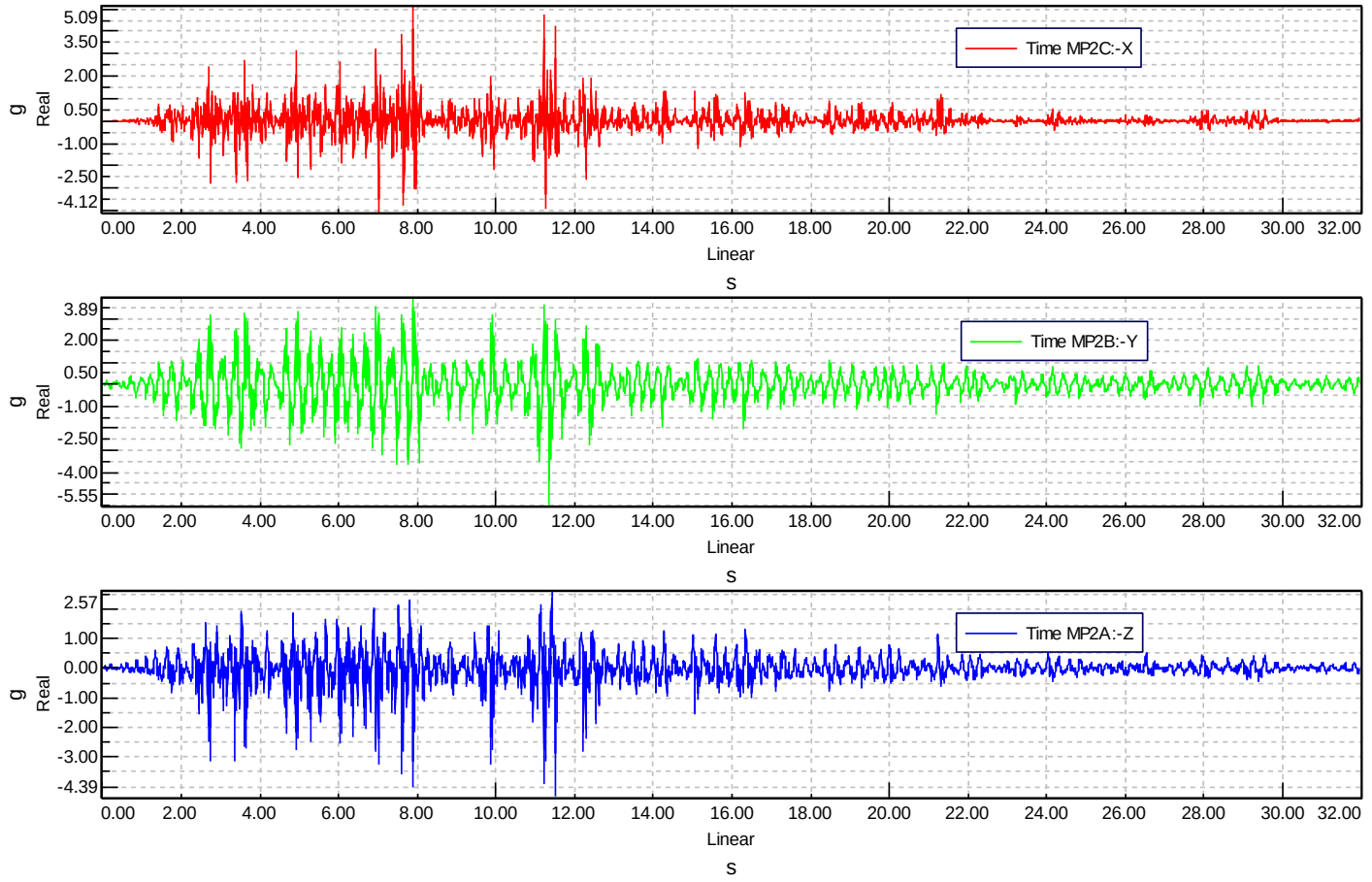

Figure 47 – Y Axis – MP2: Diagram of Seismic Test

Project:PRO-MTL-ELE24-029_seismic
Section:Y_AXIS
Run:RUN08_SHOCK_2
Date: Fri Aug 09 2024 10:27:39
Point ID: MP3A

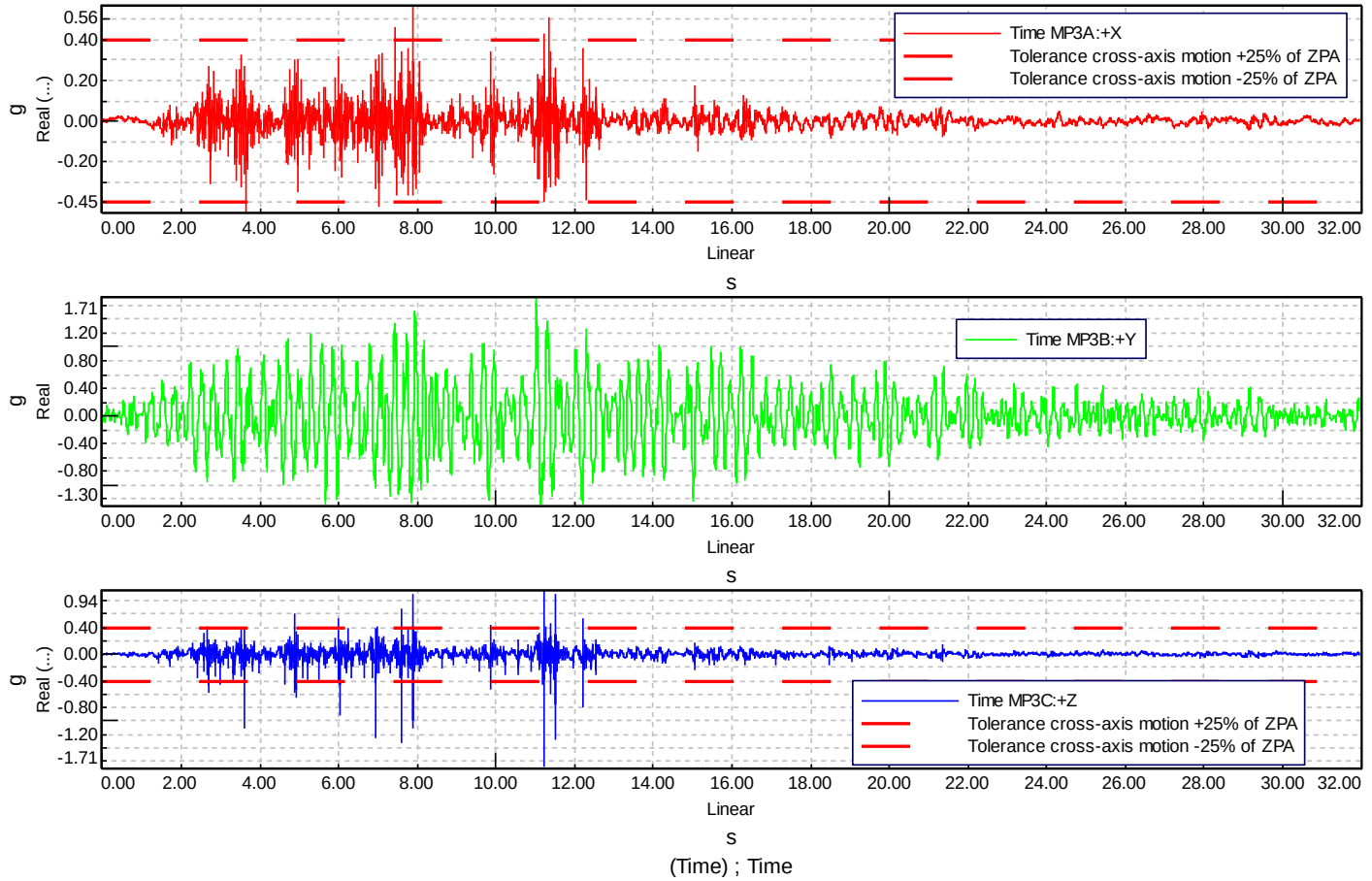

Figure 48 – Y Axis – MP3: Diagram of Seismic Test – Tolerances on cross axis motion

Project: PRO-MTL-ELE24-
Section: Y_AXIS
Run:RUN08_SHOCK_2
Date: Fri Aug 09 2024 10:27:39
Point ID: CP1

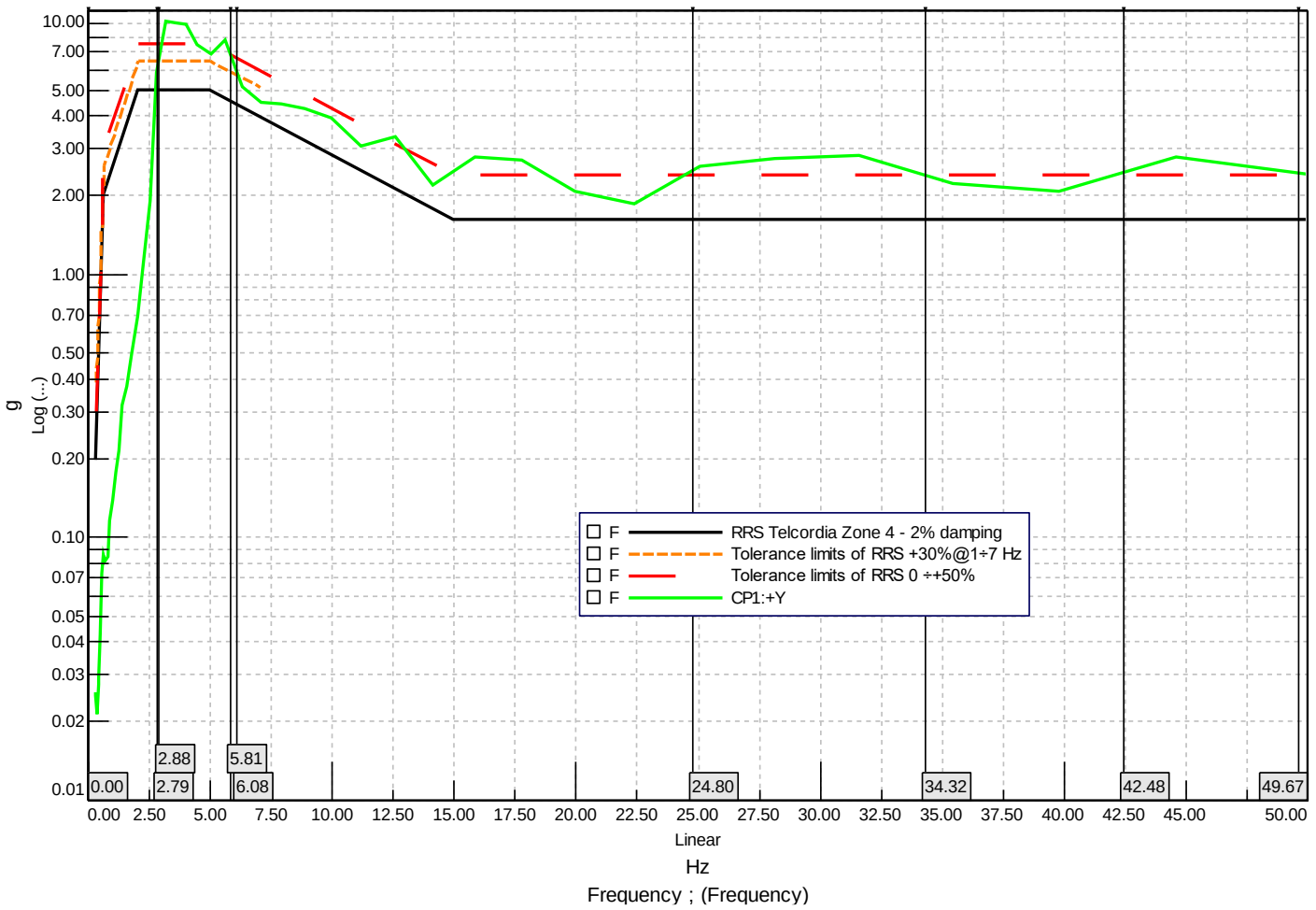

Figure 49 – Y Axis – AvgCtrl: Diagram of Test Response Spectrum

Project: PRO-MTL-ELE24-
Section: Y_AXIS
Run:RUN08_SHOCK_2
Date: Fri Aug 09 2024 10:27:39
Point ID: CP1

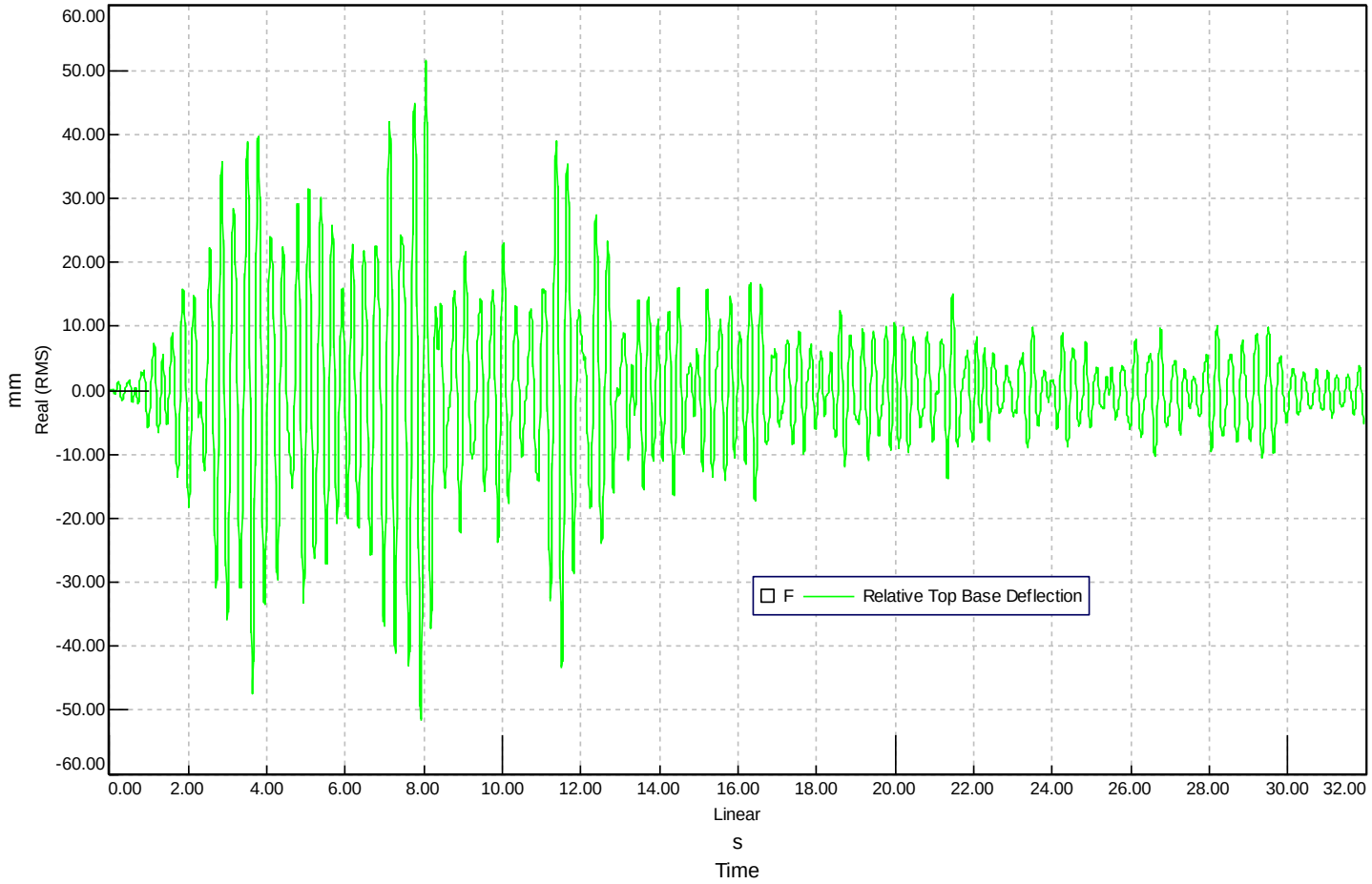

Figure 50 – Y Axis – MP2-MP3: Diagram of Seismic Test – Time-history of the relative displacement between the frame top and base of the EUT

Project: PRO-MTL-ELE24-029_seismic
Section: Y_AXIS
Run: RUN09_Sine_1
Date: Fri Aug 09 2024 11:06:08
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Number of control channels: 1
Point id: AvgCtrl
Control strategy: Average

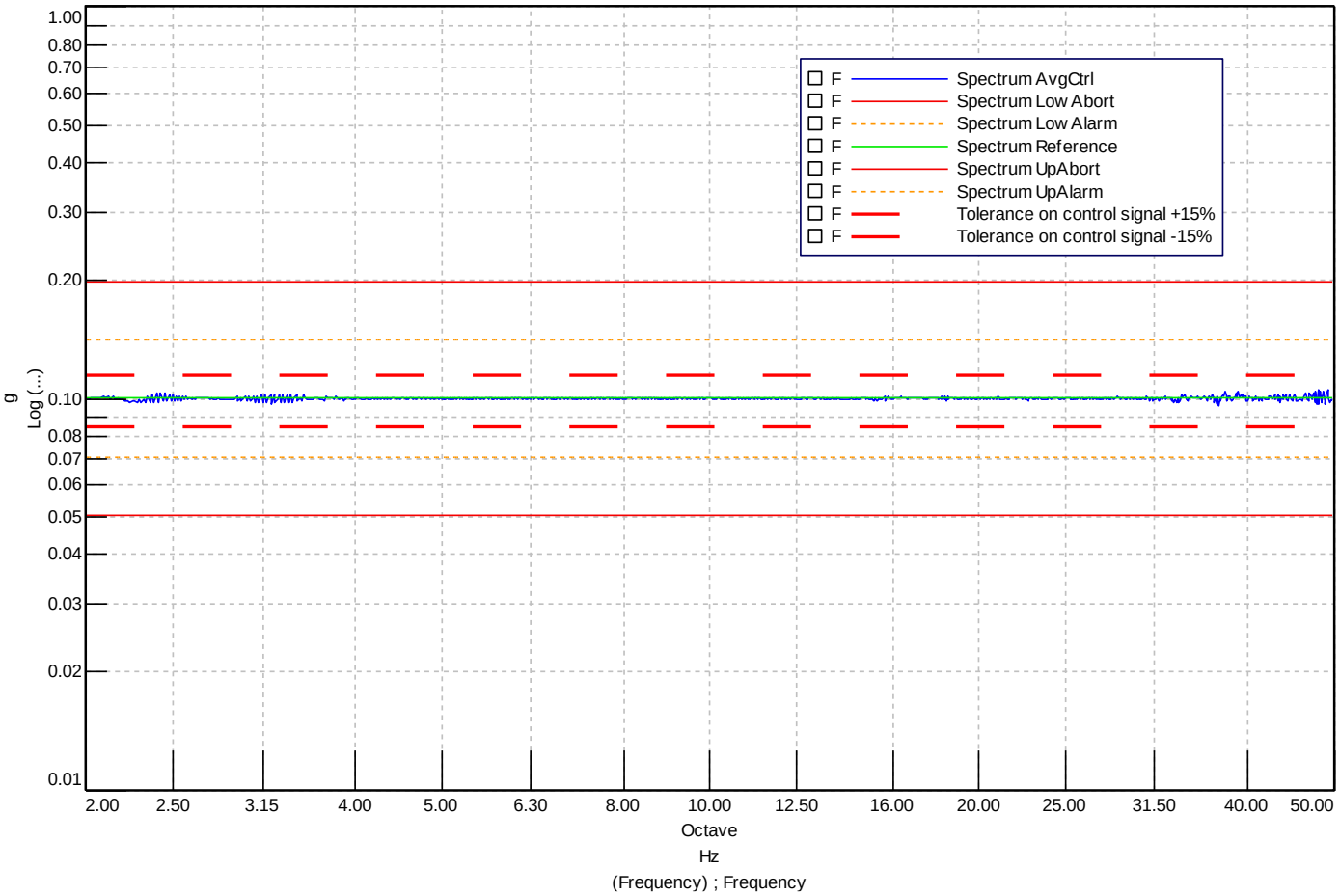

Figure 51 – Y Axis – AvgCtrl: Diagram of final vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Y_AXIS
Run: RUN09_Sine_1
Date: Fri Aug 09 2024 11:06:08
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP1B
Control strategy: Average

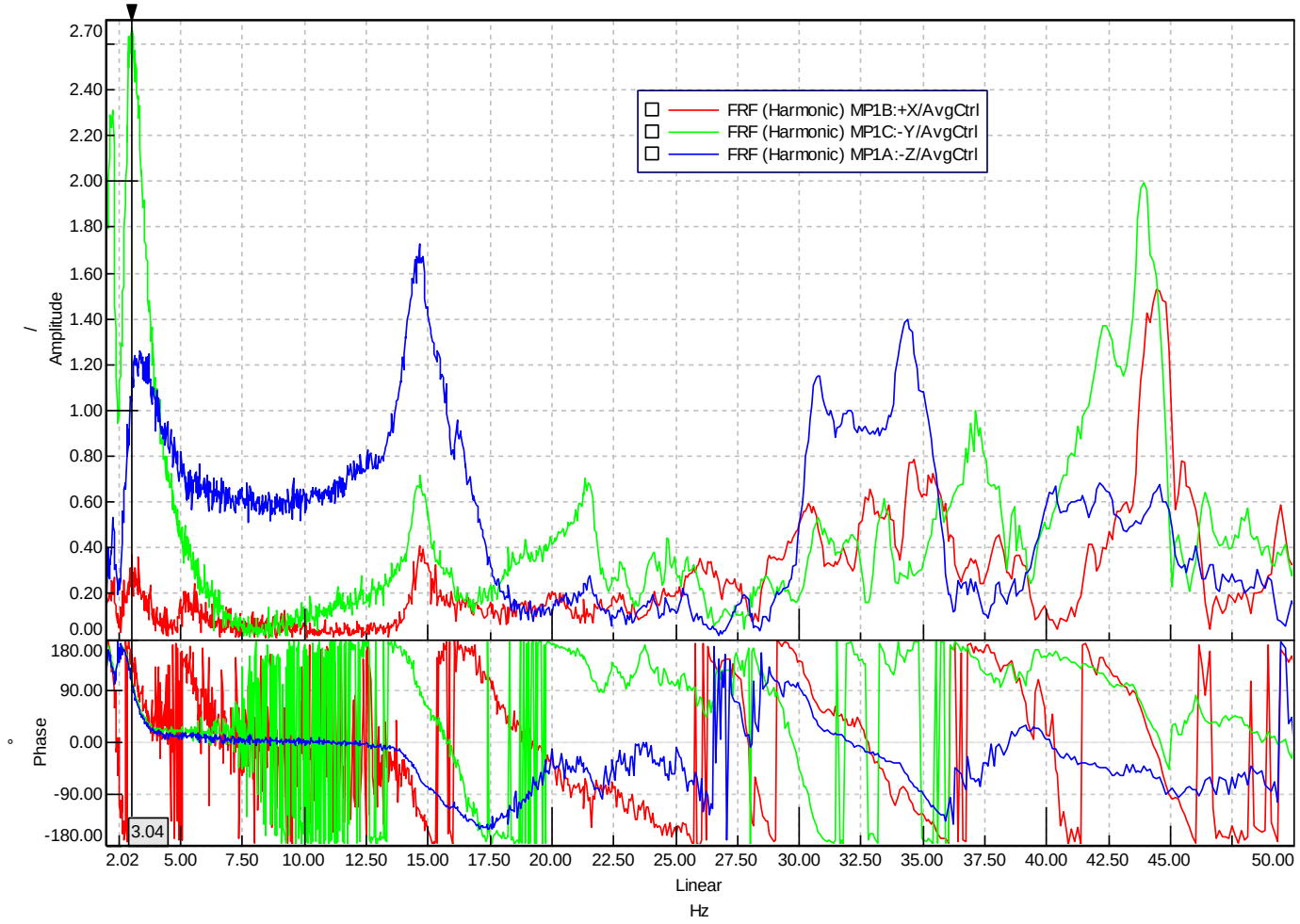

Figure 52 – Y Axis – MP1: Diagram of final vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Y_AXIS
Run: RUN09_Sine_1
Date: Fri Aug 09 2024 11:06:08
Sweep direction: Up
Sweep rate: 1 Oct/min
Sweep done: 2
Reference point id: AvgCtrl
Point id: MP2C
Control strategy: Average

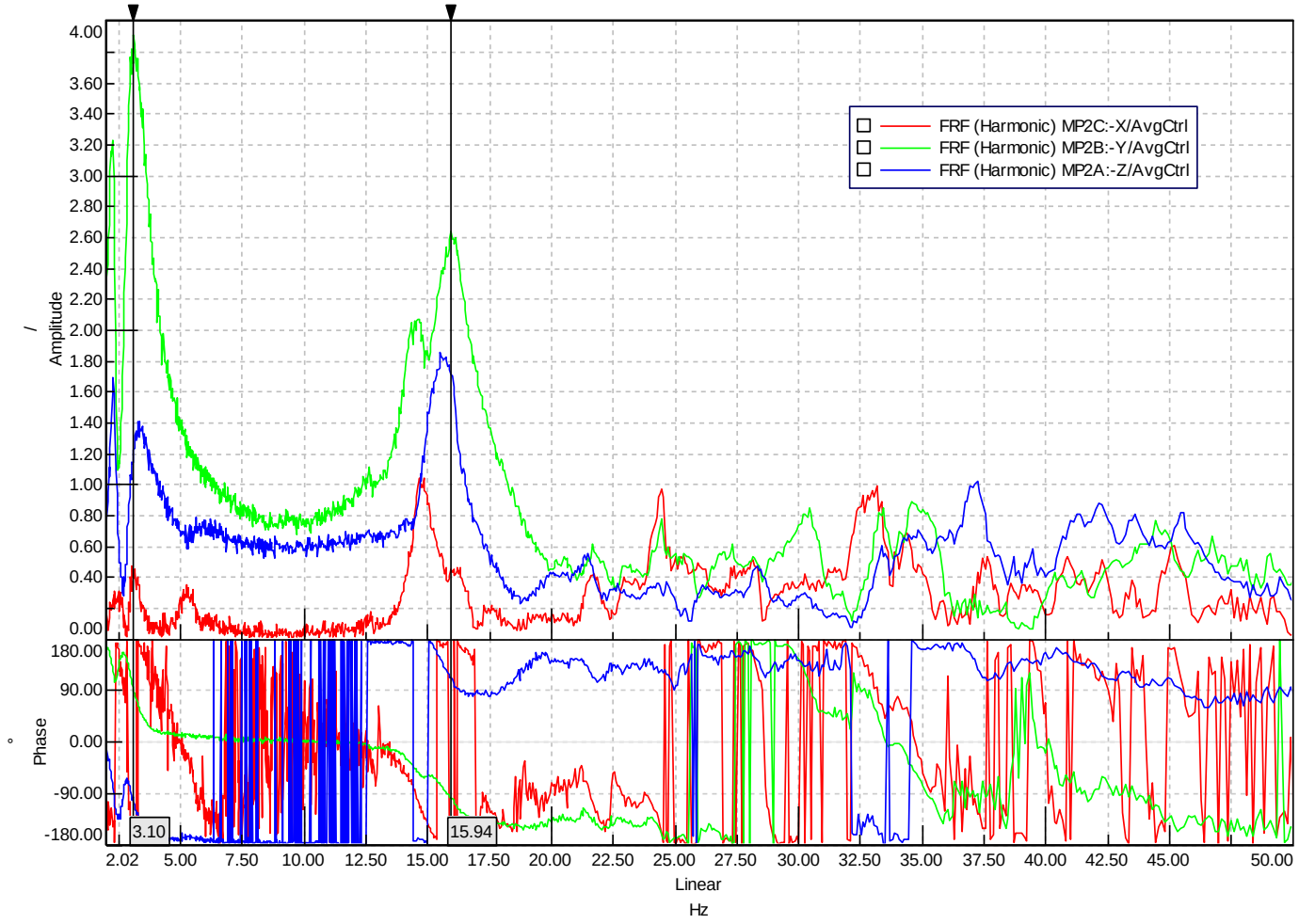

Figure 53 – Y Axis – MP2: Diagram of final vibration response investigation test – Sweep Up

Project: PRO-MTL-ELE24-029_seismic
Section: Y_AXIS
Run: RUN09_Sine_1
Date: Fri Aug 09 2024 11:06:08
Sweep Direction: Up
Sweep Rate: 1 Oct/min
Sweep done: 2
Point id: MP3A
Control strategy: Average

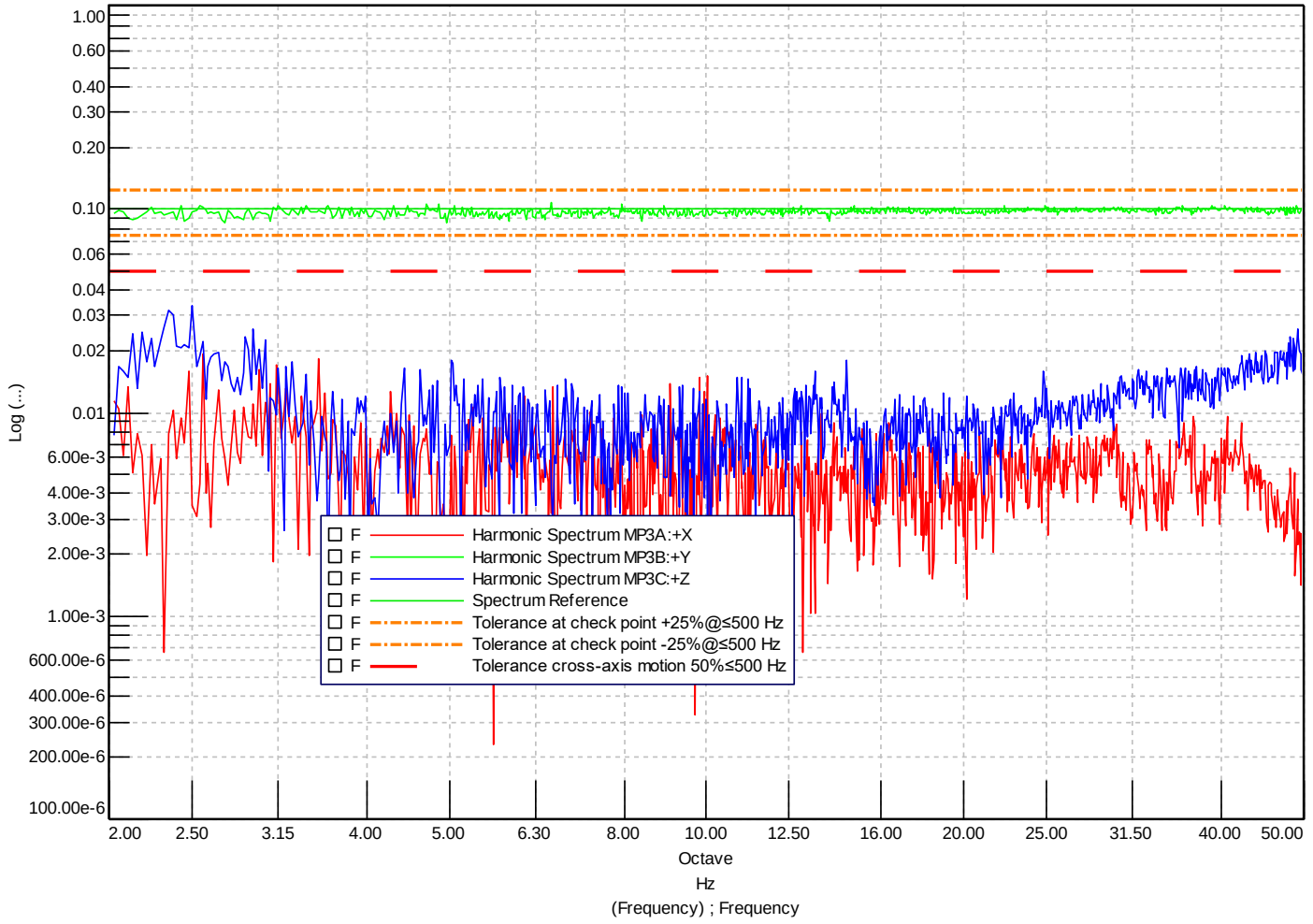

Figure 54 – Y Axis – MP3: Diagram of final vibration response investigation test – Tolerances – Sweep Up

| End of test report |