TCG NEBS COMPLIANCE TEST REPORT FOR:

SCHROFF SAS
4 Rue du Marais, 67660 Betschdorf, France

Product: Varistar CP Seismic HL

PART: 23
EARTHQUAKE, OFFICE VIBRATION, AND TRANSPORTATION VIBRATION

Section 4.4, GR-63-CORE (Zone 4)
Telcordia Technologies GR-63, Issue 5, December 2017

Date: 03.08.22

Report: OP0611422

Signature:

Deniz Ezgi
NTS Program Manger

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TEST RESULTS SUMMARY

The **Varistar CP Seismic HL** was tested acc. to the requirements of GR 63 CORE, Issue 5, 2017 (Zone 4)

The **Varistar CP Seismic HL** complies with all tested requirements and objectives.

Column Heading Definitions for Summary of Test Results Table

The following Summary of Test Results table contains these columns of information:

- **Section** column gives the Section numbers from GR-63-CORE.
- **Section Name** column gives the Section name from GR-63-CORE.
- **Criteria** column gives the local number of the requirement (e.g., R3-1) from GR-63-CORE and the absolute number of the requirement (e.g., [2]).
- **Results** column gives the results of the evaluation (Compliant, Non-compliant, etc.).
  - Compliant: The Equipment Under Test met the requirements of the corresponding criteria
  - Non-compliant: The Equipment Under Test did not meet the requirements of the corresponding criteria
  - NA: The criteria were Not Applicable to the Equipment Under Test
  - ENR: An Evaluation, of these criteria, was Not Requested by the customer
  - For additional details, go to the page listed in this report.
- **Page** column gives the page number, in this report, for the corresponding criteria.

Table 23-1 Earthquake, Office- and Transportation-Vibration Summary of Test Results

Section	Section Name	Criteria	Results	Comments	Page
4.4	**Earthquake, Office Vibration, and Transportation Vibration**	-	-		-
4.4.1	Earthquake Environment and Criteria	-	-		-
4.4.1.2	Physical Performance Criteria	R4-65 [110]	Compliant	Zone 4	8
		R4-66 [111]	Compliant	Zone 4	8
		R4-67 [112]	Compliant	Zone 4	8
		O4-68 [113]	Compliant	Zone 4	8
4.4.1.3	Functional Performance	R4-69 [114]	NA	EUT is a passive cabinet	8
		O4-70 [115]	NA	EUT is a passive cabinet	8
4.4.2	Framework and Anchor Criteria	O4-71 [116]	Compliant	Structural frame is of welded construction. Cladding is applied with screws.	26
		R4-72 [117]	Compliant	Zone 4	26
		O4-73 [118]	Compliant	Zone 4	26
		R4-74 [119]	NA	Concrete expansion anchors are to be specified by end customer	26
		O4-75 [120]	NA	Concrete expansion anchors are to be specified by end customer	26
		O4-76 [121]	NA	Concrete expansion anchors are to be specified by end customer	26
4.4.3	Wall-Mounted Equipment Anchor Criterion	O4-76 [211]	NA	EUT is no wall mounted equipment	30
		R4-78 [175]	NA	EUT is no wall mounted equipment	30

Section	Section Name	Criteria	Results	Comments	Page
4.4.4	Office Vibration Environment and Criteria	-	-		-
	Physical Performance Criteria	R4-79 [122]	ENR	Evaluation not requested by customer	N/A
	Functional Performance Criteria	R4-80 [123]	ENR	Evaluation not requested by customer	N/A
4.4.5	Transportation Vibration Criteria	-	-		-
4.4.5.1	Transportation Environment	R4-81 [124]	ENR	Evaluation not requested by customer	N/A

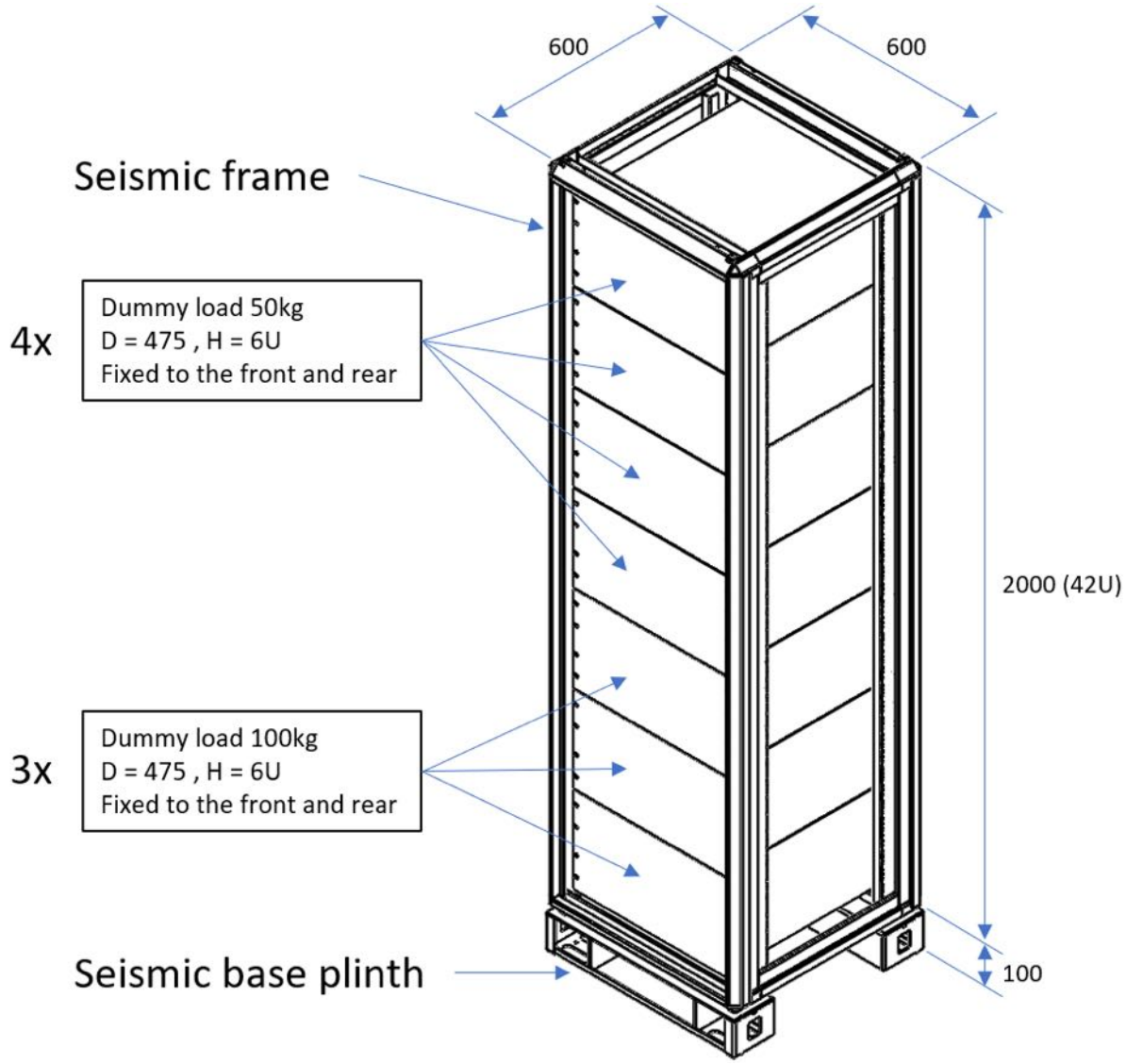
OVERVIEW

Project Objective

Testing was performed to determine if the **Varistar CP Seismic HL** met the requirements for Section 4.4, *Earthquake, Office Vibration, and Transportation Vibration*, of Telcordia Technologies GR-63-CORE, Issue 5, December 2017 (Zone 4).

The Equipment Configuration, Operating Conditions and Pass/Fail Criteria are described below:

Varistar CP HL seismic cabinet
Item number : 10630-048
Dimensions (including base plinth) : 2100H 600W 600D
Loaded with 500kg as described in below sketch :



Cabinet bill of material is detailed on attached drawing “10630-048_BET.pdf”


50 kg
50 kg
50 kg
50 kg
100 kg
100 kg
100 kg

EARTHQUAKE ENVIRONMENT AND CRITERIA (4.4.1)

Physical Performance Criteria (4.4.1.2)

Criteria:

During this test, only the equipment shelf's physical performance is considered. Permanent structural or mechanical damage of the framework or its fastening hardware would not constitute a failure, but may invalidate the test.

Permanent structural damage is defined as deformation of any load-bearing element of the equipment being tested, or any connection failure. Typical examples of permanent structural damage are bent or buckled uprights, deformed bases, cracks, and failed anchors or fastening hardware.

Mechanical damage is defined as any dislocation or separation of components. Examples of mechanical damage are disengaged cards and modules, and opened (ajar) doors, drawers, or covers.

R4-65 [110] All equipment shall be constructed to sustain the waveform testing of Section 5.4.1, "Earthquake Test Methods," without permanent structural or mechanical damage.

During frame-level testing, the physical performance of the equipment shelves, framework, and fastening hardware are considered. Permanent structural or mechanical damage of any of these elements constitutes a test failure. During shelf- level and wall-mounted testing, only the equipment shelf's physical performance is considered. (Permanent structural or mechanical damage of the framework or its fastening hardware would not constitute a failure, but may invalidate the test.) Hardware replacement during the earthquake testing is not permitted. Tightening of anchors or fasteners that can be performed without interrupting service is acceptable and is the only permissible repair.

R4-66 [111] Frame-level equipment shall be constructed so that during the waveform testing of Section 5.4.1, the maximum single-amplitude deflection at the top of the framework, relative to the base, does not exceed 75 mm *(3 in)*.

R4-67 [112] Frame-level equipment shall have a natural mechanical frequency greater than 2.0 Hz as determined by the swept sine survey of Section 5.4.1

O4-68 [113] Frame-level equipment should have a natural mechanical frequency greater than 6.0 Hz as determined by the swept sine survey of Section 5.4.1

Functional Performance (4.4.1.3)

Criteria:

The criterion for assessing functionality depends on the service provided by the equipment being tested. The criteria are determined by applying appropriate Telcordia generic requirements or, if none exist, by reviewing the supplier's or purchaser's own performance specifications.

R4-69 [114] All equipment shall be constructed to meet applicable functionality requirements **immediately before and after** each axis of waveform testing of Section 5.4.1. The equipment shall sustain operation without replacement of components, manual rebooting, or human intervention.

O4-70 [115] All equipment should be constructed to meet applicable functionality requirements continuously during waveform testing of Section 5.4.1. These functionality criteria shall demonstrate that the equipment has sustained operation without loss of service during the testing.

Test Method

Test Configuration - Frame-Level

The frame-level configuration shall be used for network equipment supplied with a framework.

1. Mount the equipment to its supporting framework.
2. Mount the equipment frame to the shaker table similar to how it will be installed in service. This may include using a concrete slab and anchors to simulate equipment installed on concrete building floors. In all cases use recommended fastener size, quantities, torque values, hold-down plates, shims, isolation devices, etc. Where concrete expansion anchors are normally used to fasten the framework base to the building floor, the mounting to the shaker table may be substituted by welded studs, bolts, or cap-screws of equal quantities and diameter as the concrete expansion anchors.
3. The equipment shall be fastened to the shaker table (or concrete slab) using typical anchor locations. If the framework base allows for a variety of anchor locations, locate one fastener in the inner most location.
4. Record the torque value of each anchor or fastener.
5. Frames intended to support overhead cable shall be loaded with a weight of 23 kg (50.0 lb) on top of the framework. Less weight may be used if it can be demonstrated that the above value is excessive. Where less weight is used, the computations for such weight shall be provided as part of the test plan.

Frame-Level Instrumentation Configuration

1. Locate the accelerometers so they record the acceleration of the shaker table, acceleration at the top of the framework, and acceleration at the mid-height level.
2. Install anchor load measurement equipment to record the peak anchor loads if the concrete slab and concrete expansion anchors are omitted from the framelevel test. It can be assumed that the inner-most anchor position is the worstcase and will have the highest load.
3. Install deflection measurement equipment to measure the deflection at the top of the framework relative to its base.

Test Sequence

1. Perform a swept sine survey with an acceleration amplitude of 0.2 g from 1 to 50 Hz at a sweep rate of 1.0 octave per minute. (Higher sweep rates are permitted to reduce equipment stress.)
2. Verify equipment functionality and physical condition.
3. Subject the equipment to the VERTEQII waveform. Verify the TRS meets or exceeds the RRS in the frequency range from 1.0 to 50 Hz. If the TRS is below the RRS at any point, use the last drive signal and table acceleration to update the transfer function. Apply it to the Telcordia waveform to generate a new drive signal, and retest the equipment. Repeat this step as necessary.
   The TRS should not exceed the RRS by more than 30% in the frequency range of 1 to 7 Hz. A test may be invalid if an equipment failure occurs when the TRS exceeds the RRS by more than 30% in this frequency range.
4. Record the displacement and acceleration data during the shaking.
5. Thoroughly inspect the equipment and note all changes to its physical condition.
6. Record any reductions in anchor or fastener torques.
7. Reverify equipment functionality.

The test severity corresponds to Zone 4, the time history signal applied was Verteq II.
The rack used for the test was an earthquake-approved 7 ft. Hendry rack.
The rack itself was fixed with screws (M12) to an aluminum plate of 40mm thickness.

Definition of axes:
x : horizontally side to side
y : horizontally front to back
z : vertical

Acceleration values in the mutually perpendicular axis of the EuT were measured at the following measurement points:

MP:	IABG-measuring chain identification:	Range	Component	position:	cross reference:
A	13-01579	±500 m/s²	at top of Pipe	top	Fig. 23-3
B	13-01580	±500 m/s²	at top of rack	top	Fig. 23-4
C	13-01581	±500 m/s²	at middle of rack	side	Fig. 23-5

The seismic table acceleration sensors for recorded time histories, mounted directly below the surface of the table, are used as input for the calculation of the transfer functions and as reference sensors for the sine sweeps, earthquake loads.

Measurement-point:	IABG-measuring chain identification	Range / m/s²
STS_X/Y/Z	15-17431	±100

Deviations from prescribed Test Sequence

Resonance Search

The resonance search was performed on an electrodynamic shaker. Due to its performance, the following deviations from GR-63-CORE occurred:

1. Start of sine sweep was 1,25 Hz (instead of 1 Hz)
2. Amplitude was 0,13 g (instead of 0,2 g)
3. 3 axes; 1 sweep cycle per axis

Frequency Range (Hz)	Acceleration	Sweep Rate (oct. / min)
1 – 60 *	0.1 g in x and z direction 0.05 g in y direction	1

Resonance Search

Fig. 23-1 Entire built-up for resonance search (front)

Fig. 23-2 The EUT with dummy weights

Fig. 23-3 Load washer application

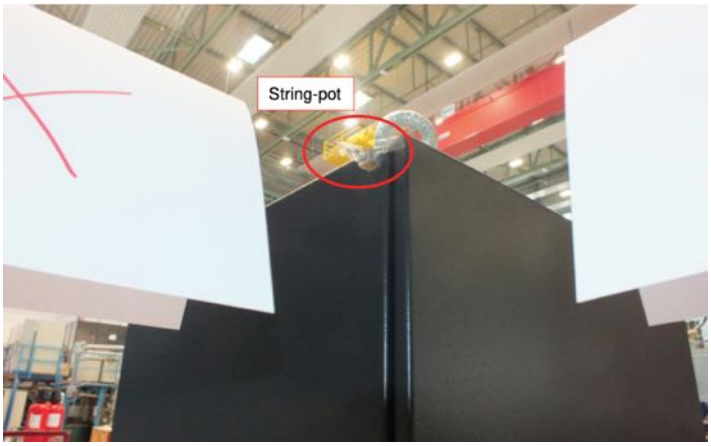


Fig. 23-4 String-Pot in X-Y directions to measure displacement

Waveform Testing

The waveform testing was performed on a MTS seismic table. The entire built-up is shown in Fig. 23-6 to Fig. 23-8.
For the y-axis test, the EUT is rotated about 90 °. For z-axis test, a vertically oriented piston underneath the table is used.
For the z-axis test, no LVDT is applied.

All earthquake tests are documented by video.

Fig. 23-5 Entire built-up for waveform testing (front)

Fig. 23-6 The EUT with dummy weights

Fig. 23-7 Measuring point at top of EUT

Fig. 23-8 Measuring point at middle of EUT

Test Results

Resonance Search

The resonance search was performed in three axes with the following results (figs. 23-9 to 23-23):

lowest natural gross frequency for excitation in x-direction: 9.5 Hz

lowest natural gross frequency for excitation in y-direction: 8.9 Hz

lowest natural gross frequency for excitation in z-direction: out of range

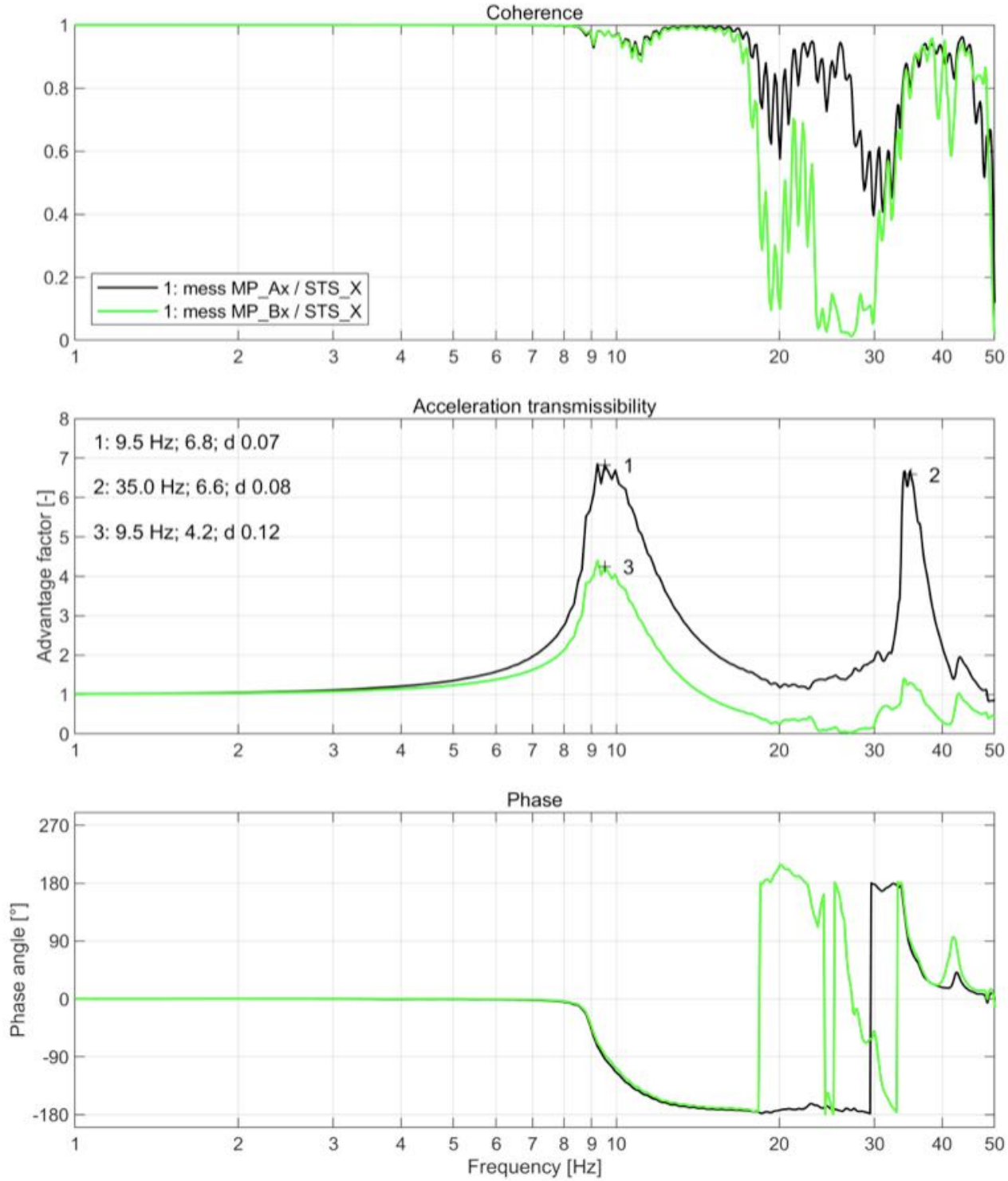


Fig. 23-9 Resonance search: excitation in x-dir.

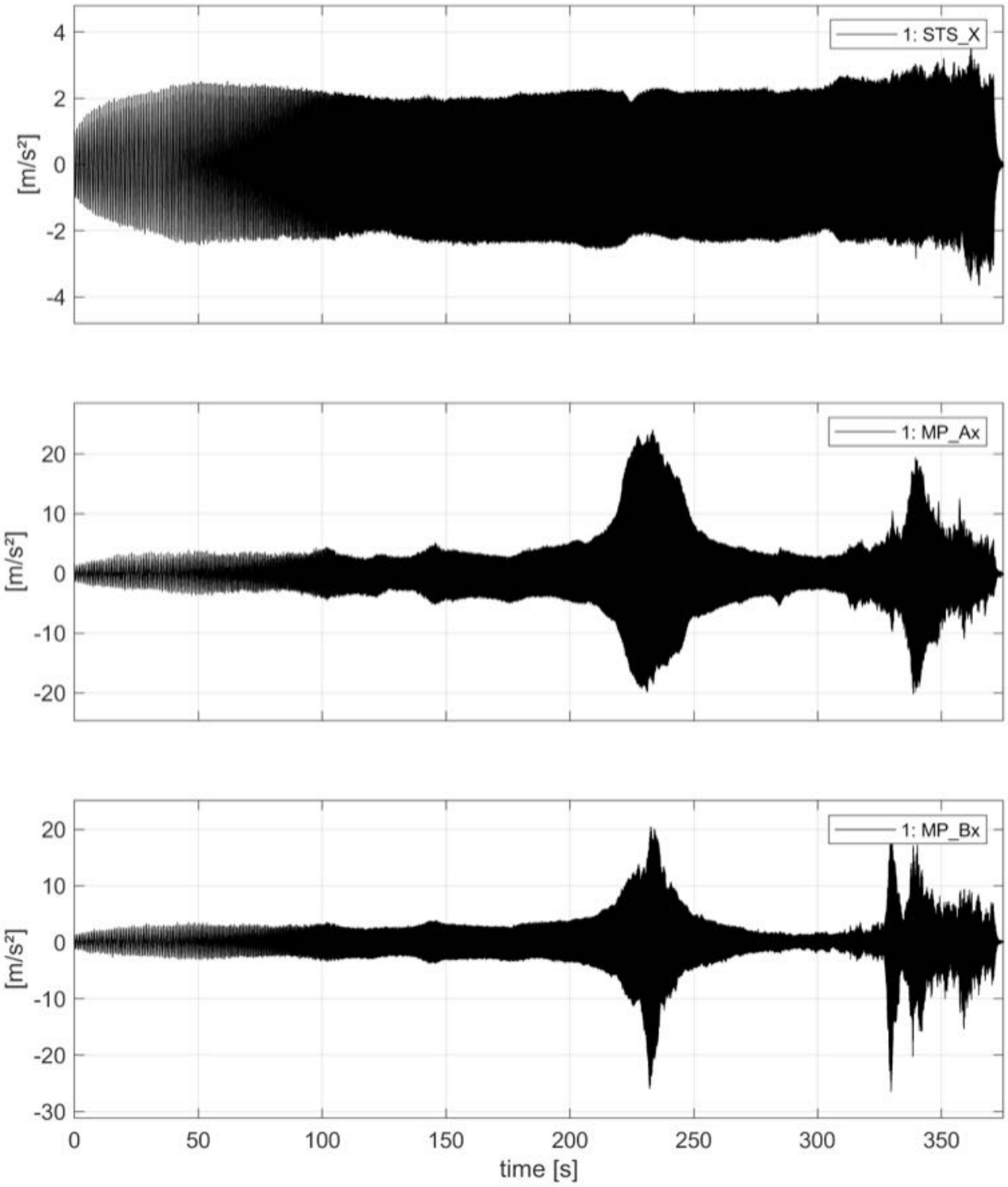


Fig. 23-10 Resonance search: excitation in x-dir.; MP-A, MP-B, STS

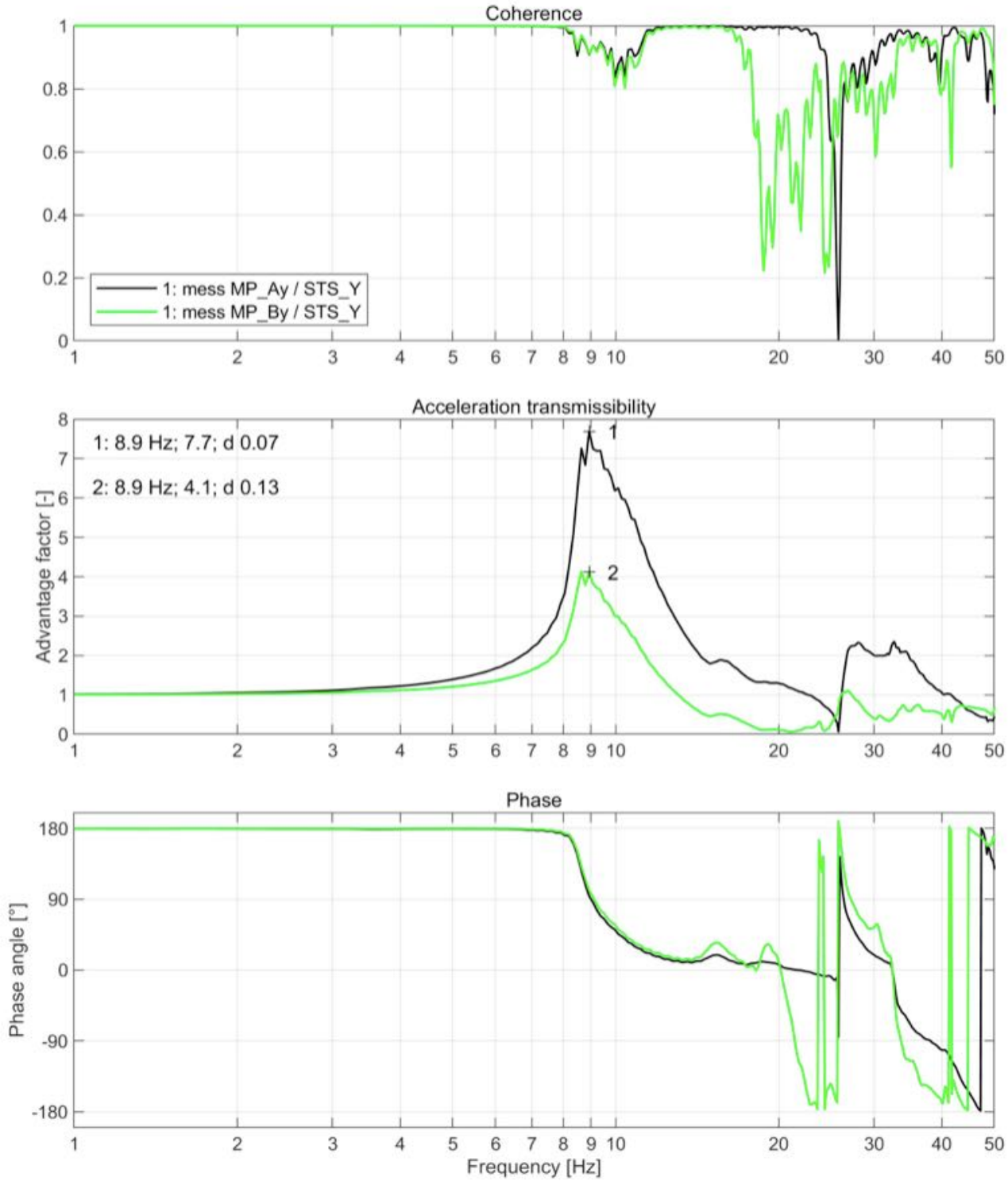


Fig. 23-11 Resonance search: excitation in y-dir.

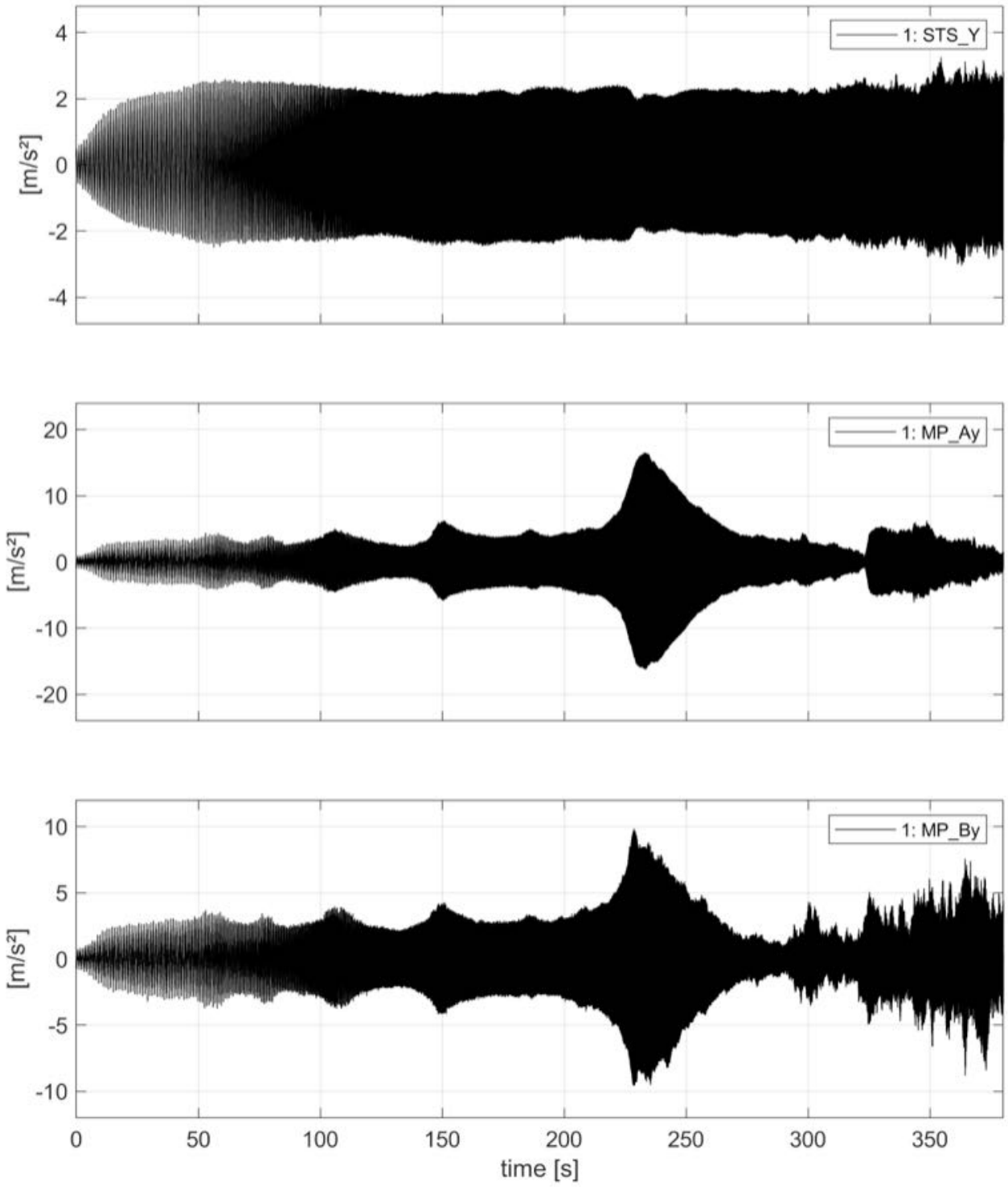


Fig. 23-12 Resonance search: excitation in y-dir.; MP-A, MP-B, STS

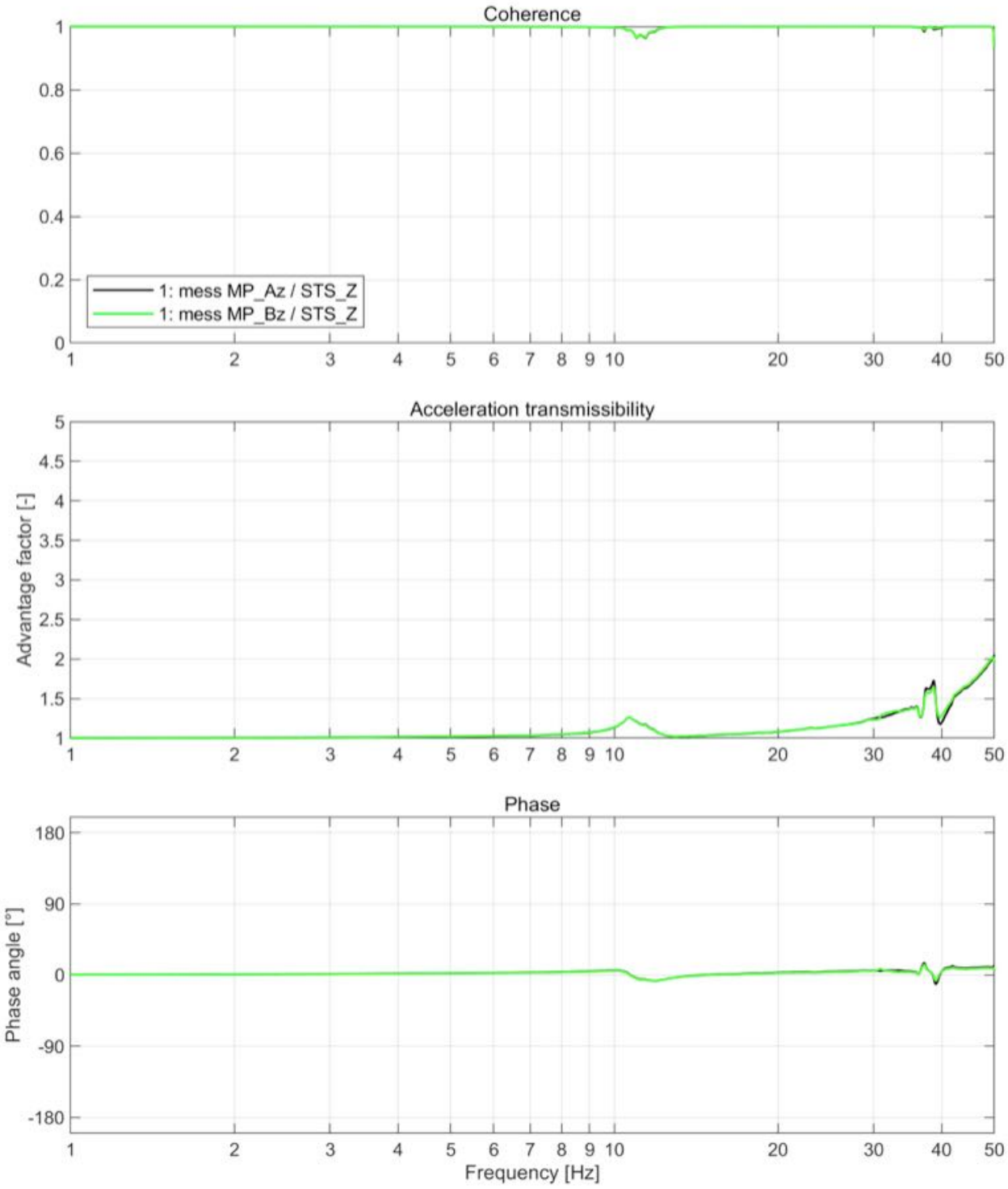


Fig. 23-13 Resonance search: excitation in z-dir.

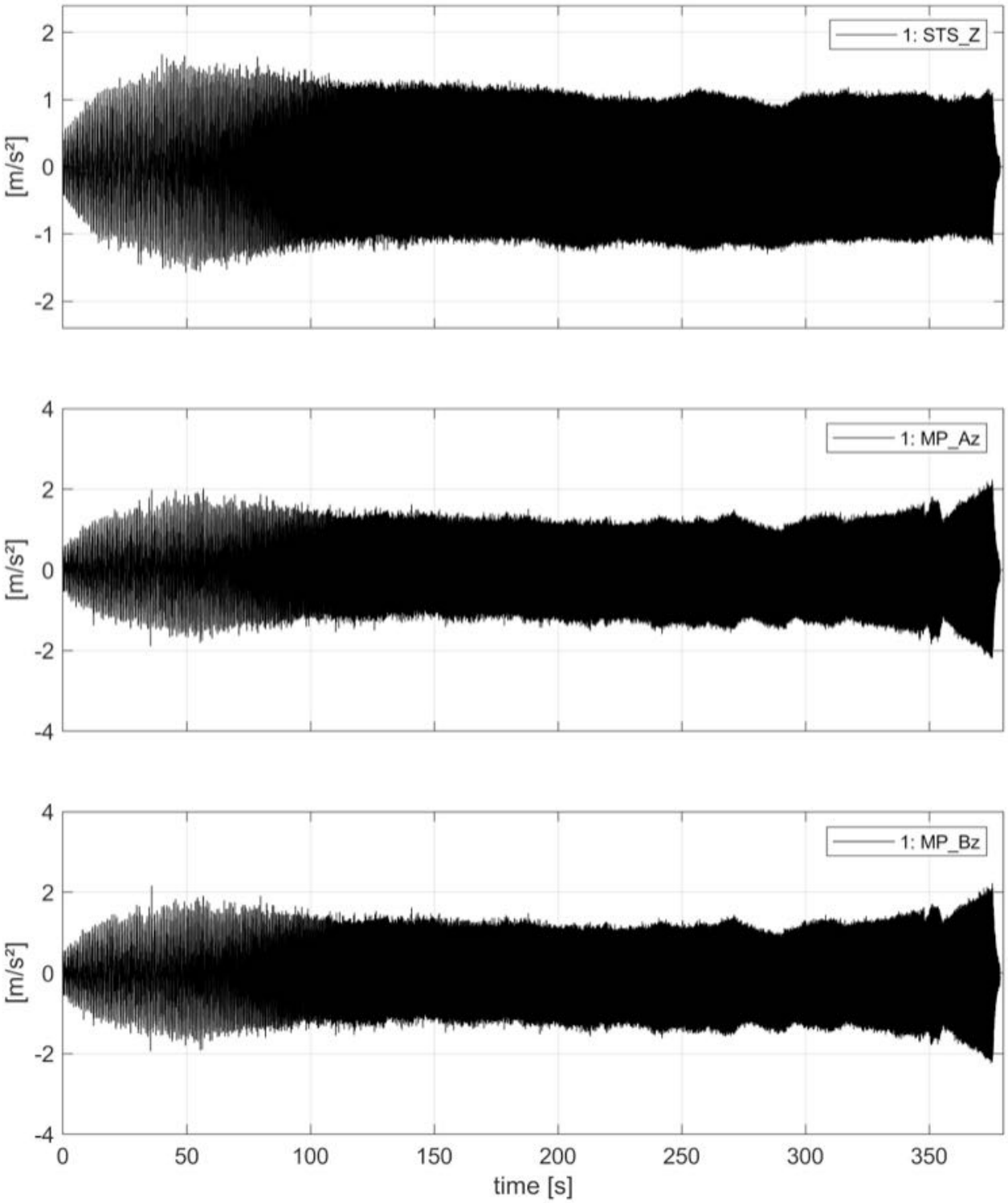
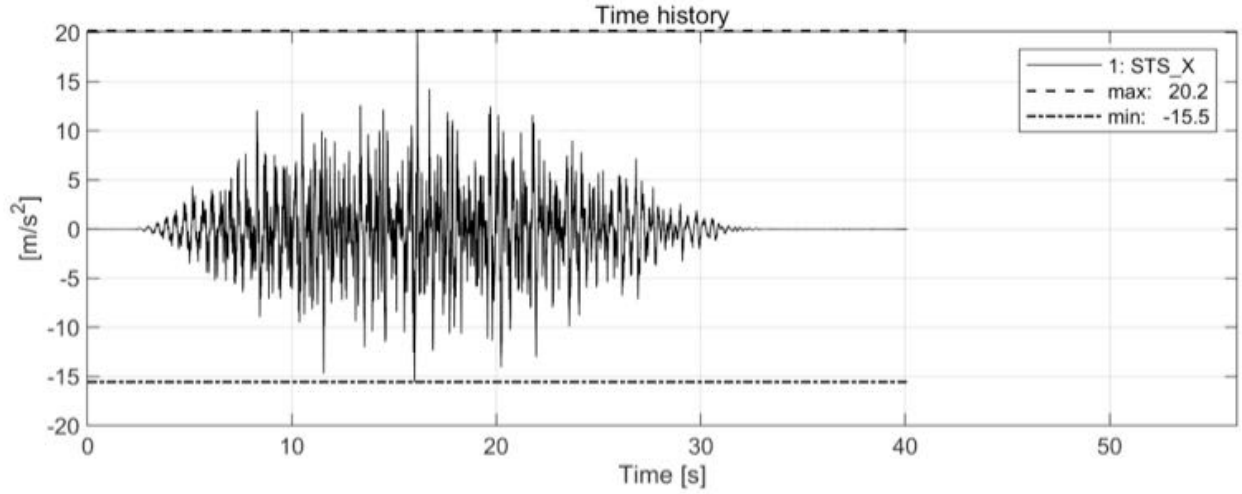


Fig. 23-14 Resonance search: excitation in z-dir.; MP-A, MP-B, STS

Waveform Testing

Excitation in direction of x-axis



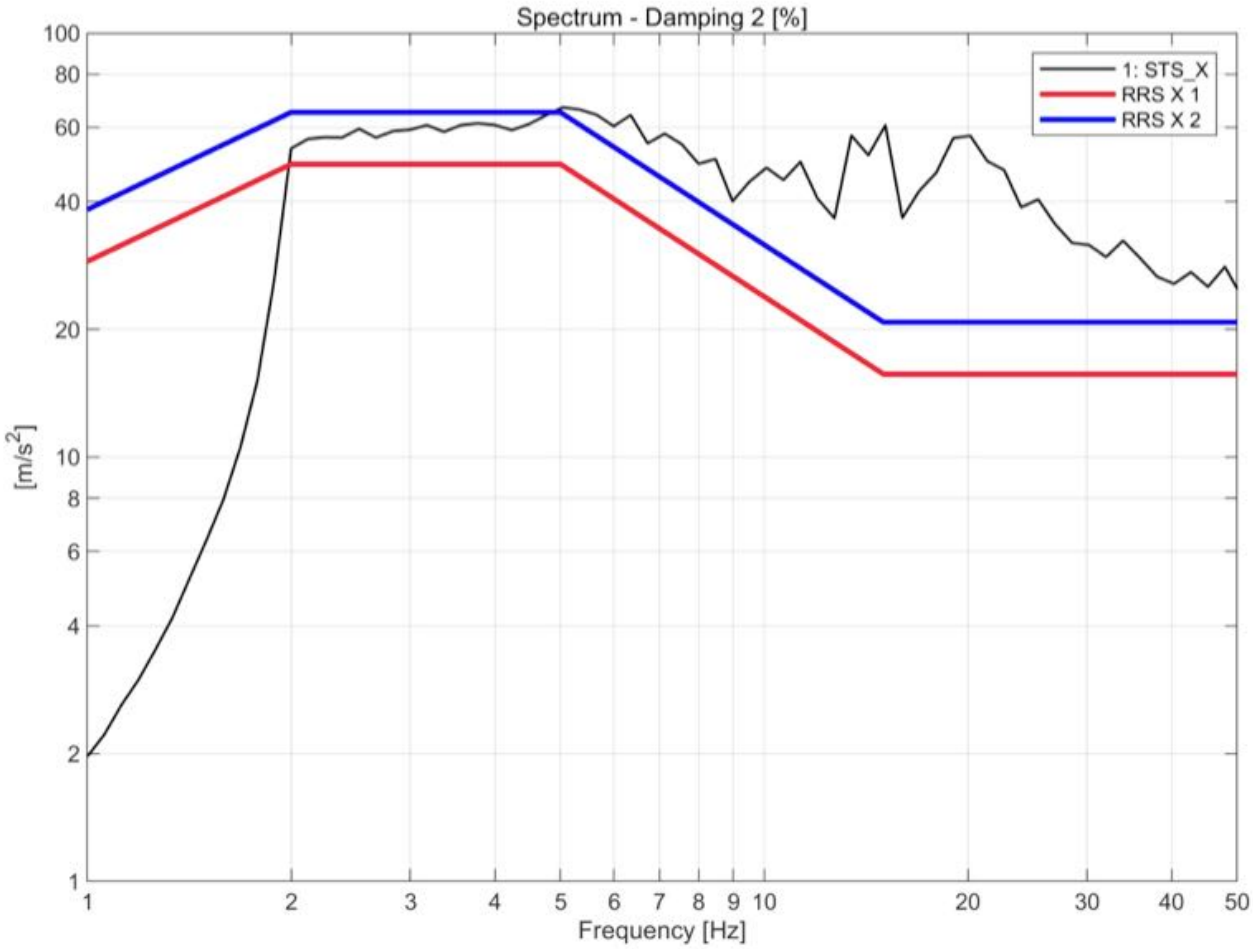


Fig. 23-15 Time history signal and RRS1 (index value) vs. STS (measured value) at the table. RRS2 is for indication only and denotes 130% of the index value.

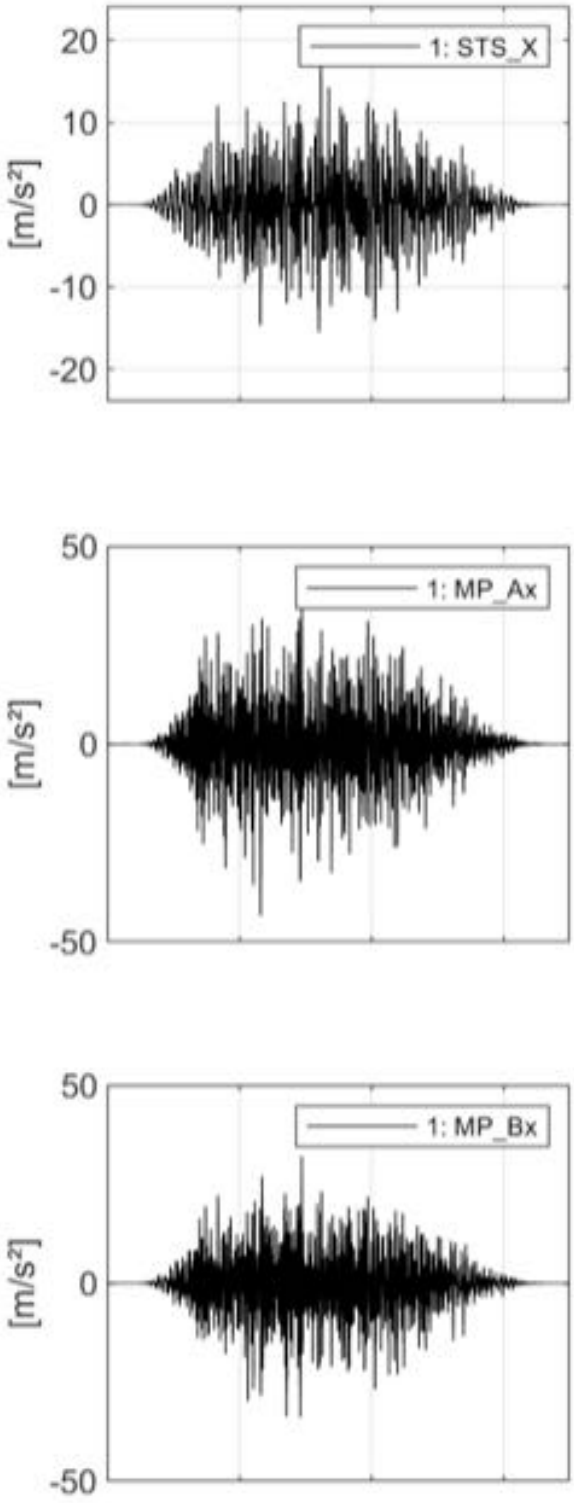
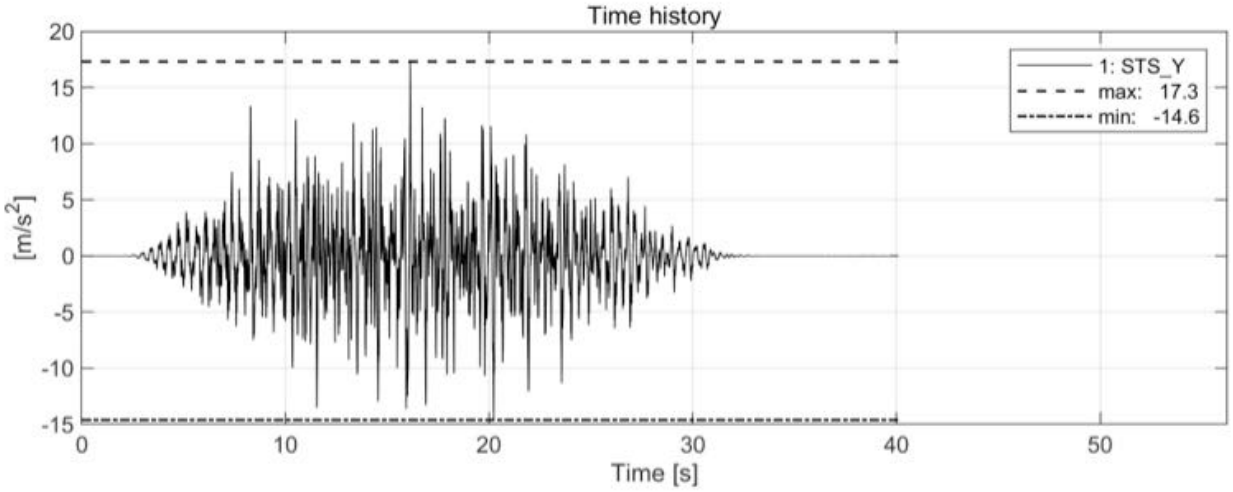


Fig. 23-16 Time history signal at all the measurement points

Excitation in direction of y-axis



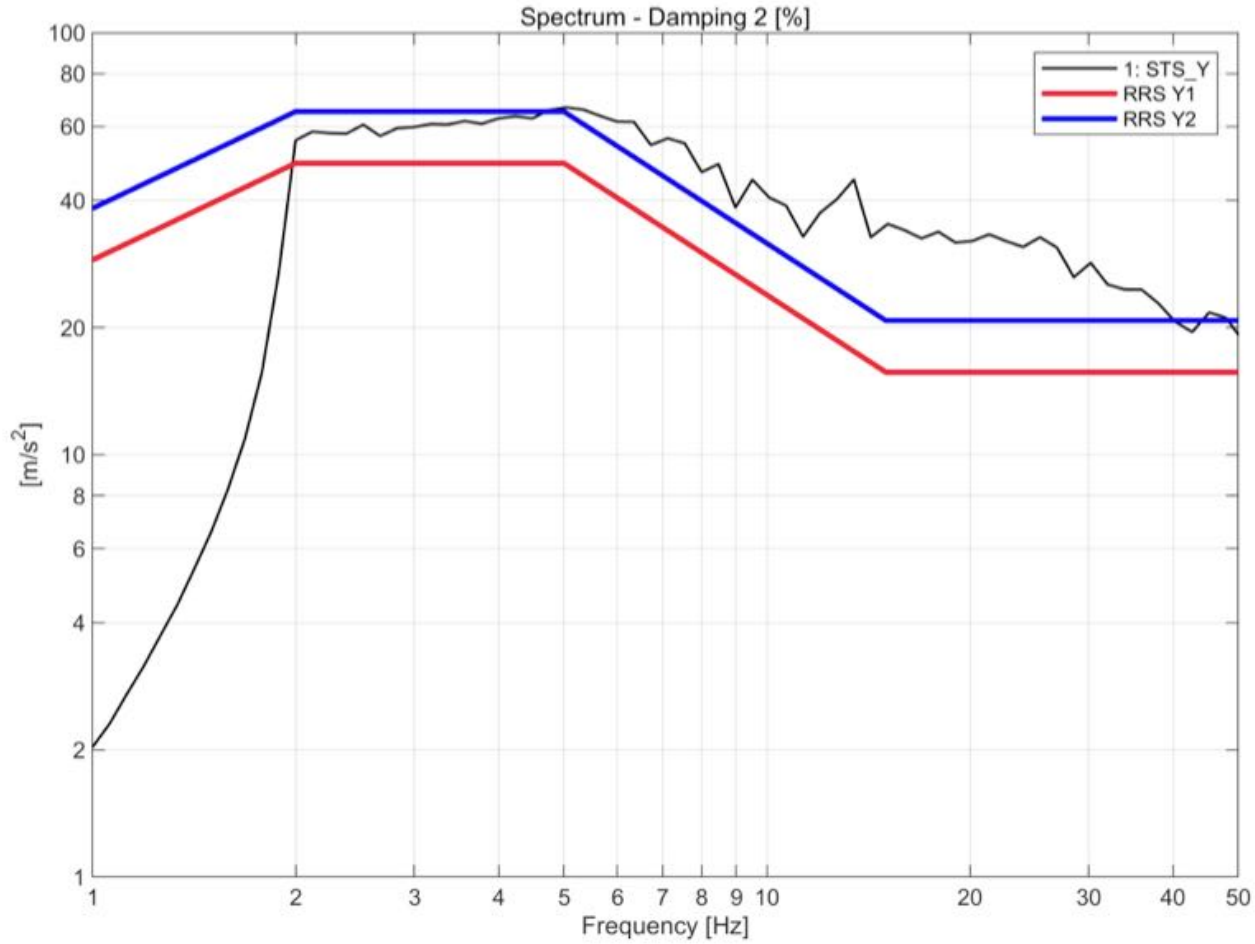


Fig. 23-17 Time history signal and RRS1 (index value) vs. STS (measured value) at the table. RRS2 is for indication only and denotes 130% of the index value.

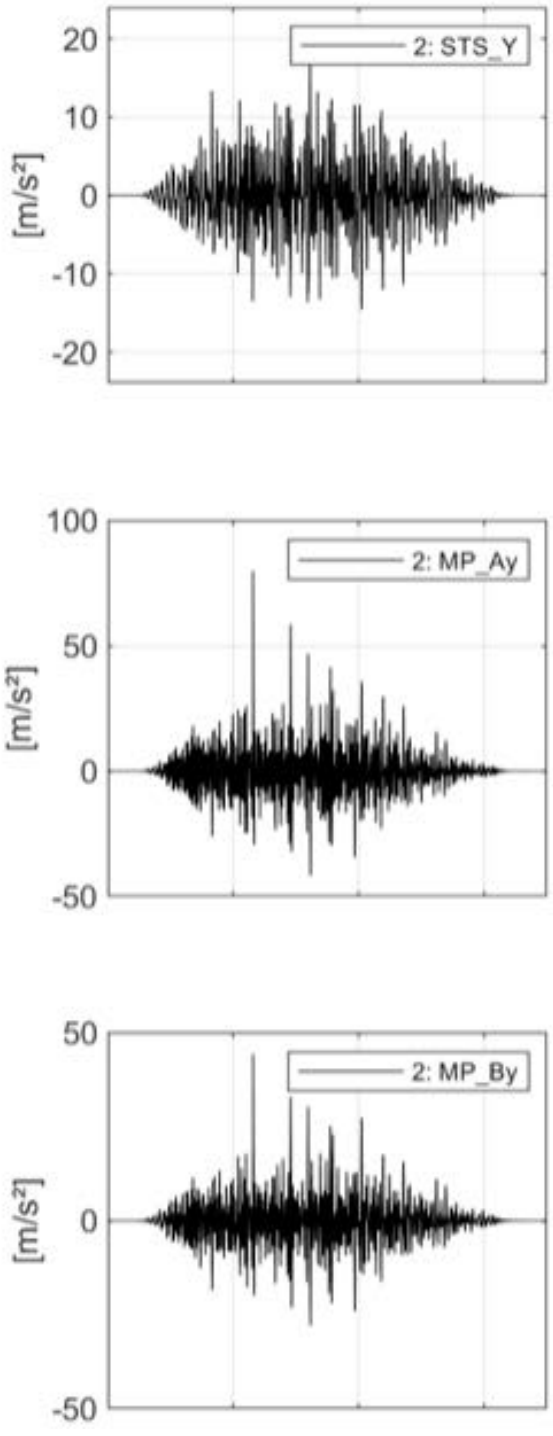
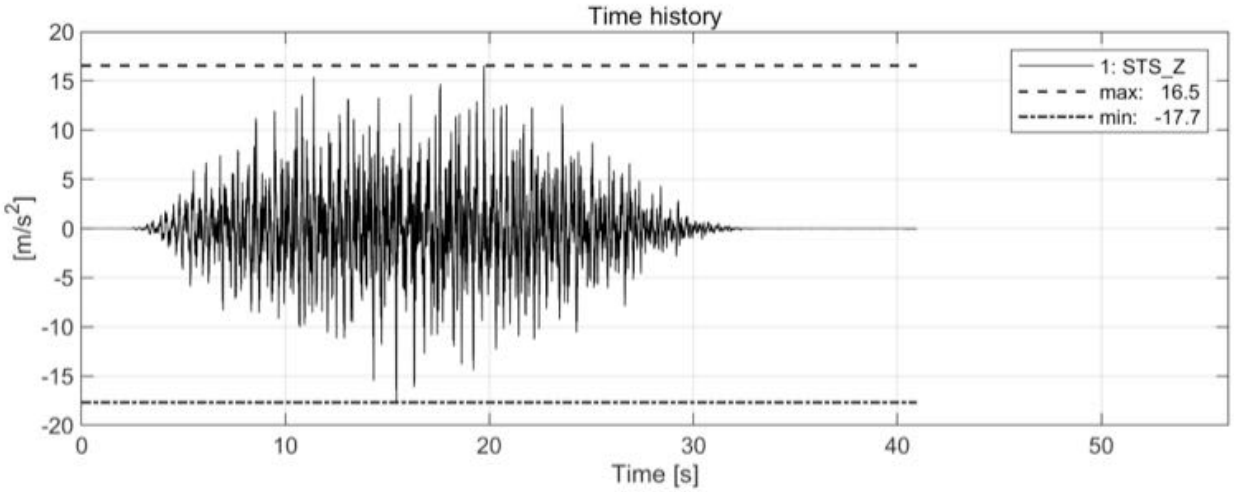


Fig. 23-18 Time history signal at all the measurement points

Excitation in direction of z-axis



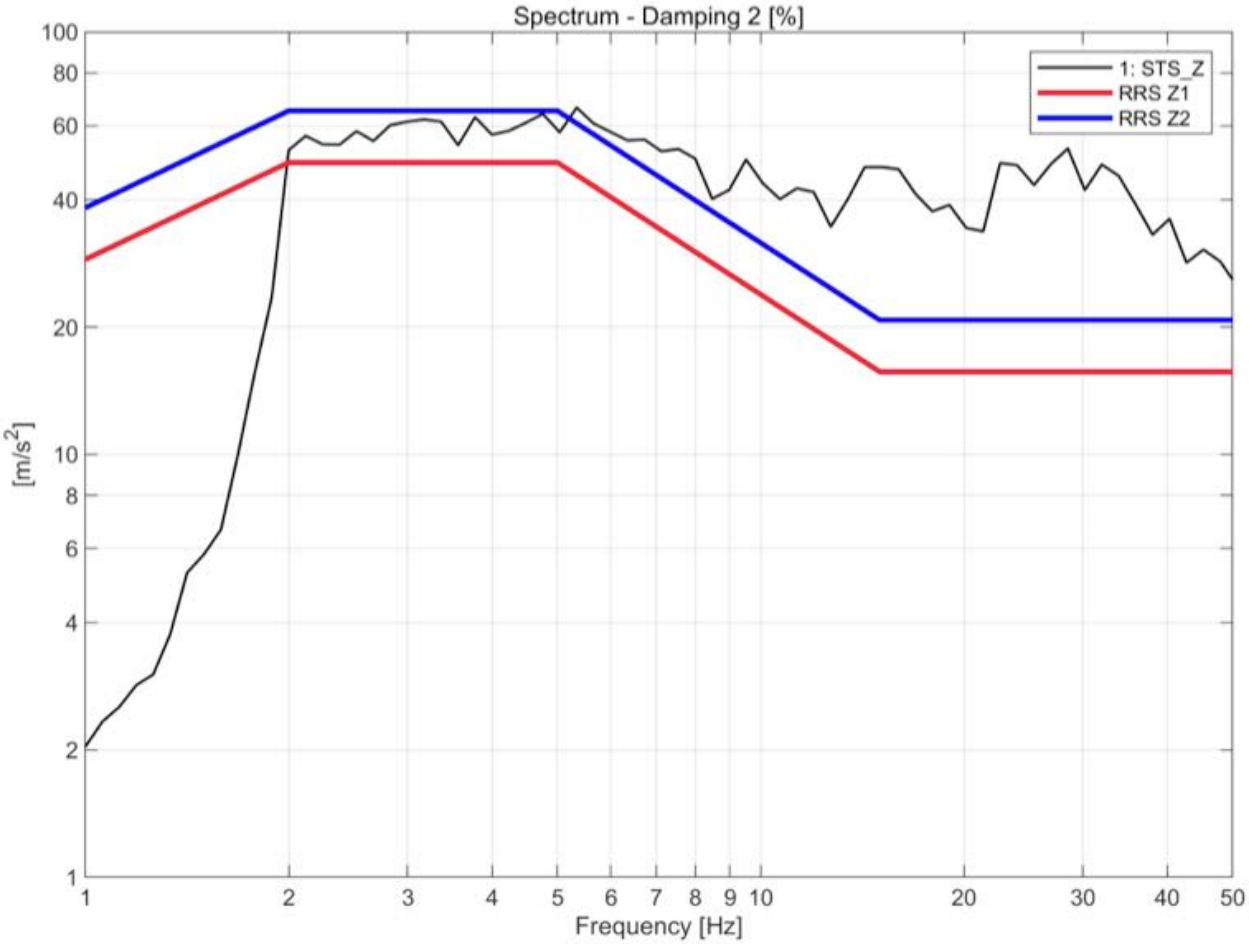


Fig. 23-19 Time history signal and RRS1 (index value) vs. STS (measured value) at the table. RRS2 is for indication only and denotes 130% of the index value.

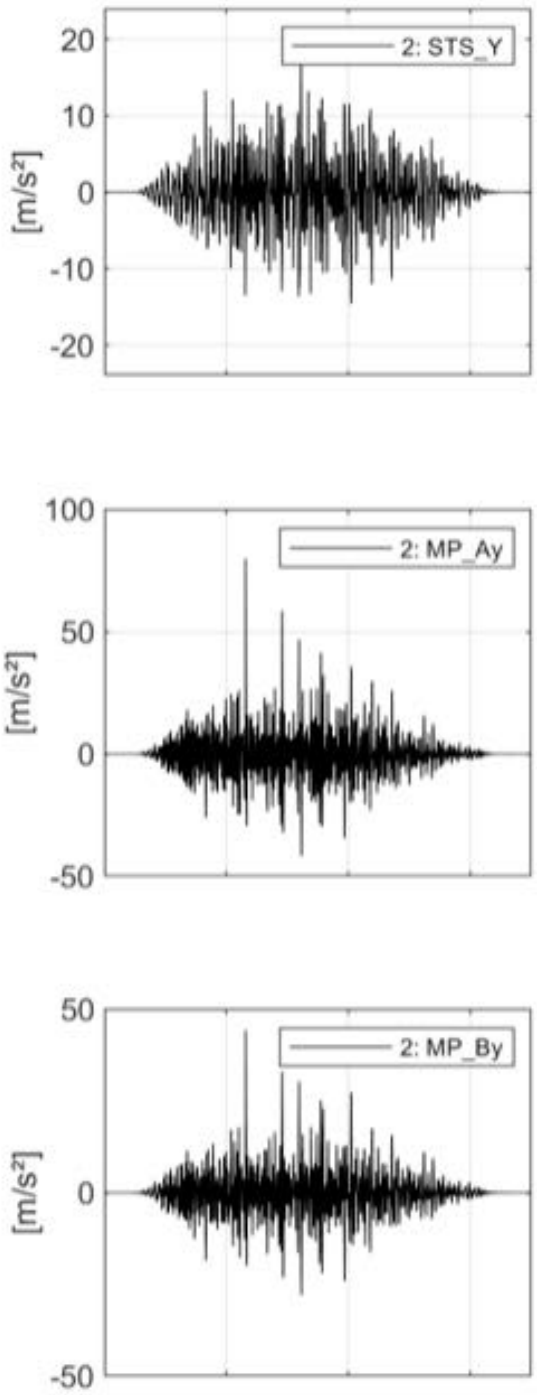


Fig. 23-20 Time history signal at all the measurement points

FRAMEWORK AND ANCHOR CRITERIA (4.4.2)

Criteria:

The following criteria apply to all framework and concrete expansion anchors used in network facilities. They are intended to ensure minimum limits for structural performance in earthquake environments are met.

O4-71 [116] It is an objective that framework should be of welded construction.

R4-72 [117] Framework shall be constructed for base mounting to the floor without auxiliary support or bracing from the building walls or ceilings.

O4-73 [118] For framework used in earthquake risk zones, it is an objective that the static pull testing procedures of Section 5.4.1.4, "Static Test Procedure," should be followed, meeting these objectives:

- The maximum single amplitude deflection at the top of the framework should not exceed 75 mm(3 in).
- The top of the framework should return to its original position, within 6 mm (0.24 in) when the load is removed.
- The framework should sustain no permanent structural damage during static framework testing.

R4-74 [119] Concrete expansion anchors used to base mount framework to the floor shall meet the following requirements:

- • Maximum embedment depth of 90 mm (3.5 in)
- • Maximum bolt diameter of 13 mm (0.5 in).

O4-75 [120] It is an objective that concrete expansion anchors used to base mount the framework to the floor should be suitable for earthquake (dynamic) applications, as specified by the manufacturer.

NOTE*: Typical concrete anchors are not designed for dynamic loads, such as earthquakes. The above criterion specifies that the selected anchors should be designed to meet the dynamic loads specified in this document.*

O4-76 [121] It is an objective that concrete expansion anchors should use steel construction to minimize creep.

Concrete expansion anchors used for frame-level waveform testing must conform to the physical performance requirements of Section 4.4.1, "Earthquake Environment and Criteria." If substitute fasteners are used in place of concrete expansion anchors during frame-level testing, the peak increase in fastener load above its preload as calculated or measured during the tests should not exceed the safe working load specified for the concrete expansion anchors by the manufacturer in 3000 psi concrete.

Test Location

The following evaluation was performed by Mr. Deniz Ezgi on June 02, 2022 at

NTS Europe GmbH
Hofmannstr. 50
81379 Munich
Germany

Test Method

The Varistar CP Seismic Rack was evaluated acc. To GR-63-CORE, issue 5 chapter 5.4.1

The mounting on the floor and anchors are not specified by the manufacturer and therefore marked as NA in this report. Therefore acc. To GR-63-CORE the dynamic load during waveform testing was recorded using a load-cell washer positioned underneath the bolt head of one of the screws attaching the EUT to the aluminum plate mounted on the shaker table

The highest displacement in the x-direction: 7.7mm

The highest displacement in the y-direction: 23.4mm

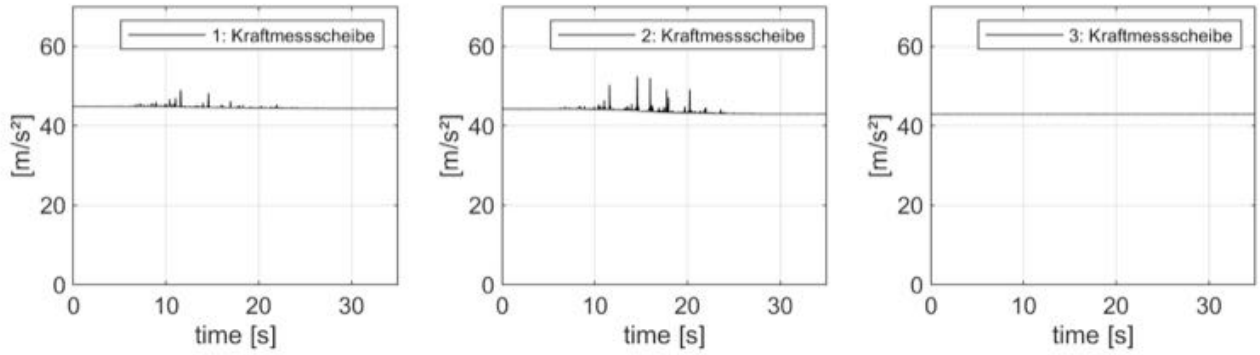


Fig. 23-21 Dynamic load during waveform testing recorded by load-cell washer in X-, Y-, and Z-directions

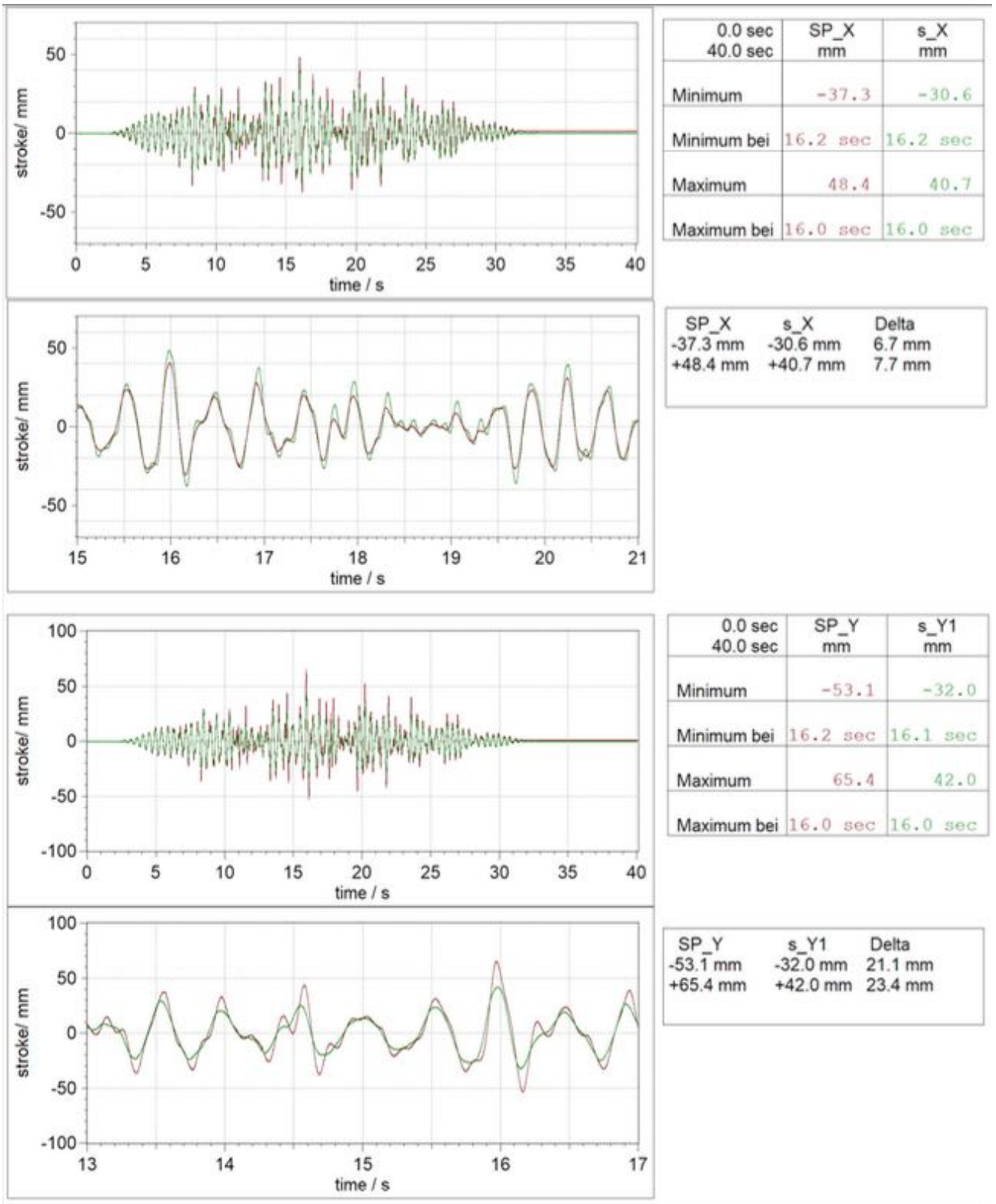


Fig. 23-22 Displacement data X- and Y-directions

The Varistar CP Seismic Rack is **compliant** with **R4-72 [117]** and Objectives **O4-71 [116]** and **O4-73 [118]**. **R4-74 [119] O4-75 [120]**, as well as **O4-76 [121] are not applicable**.

Test Equipment Used

The "Heavy-Multi-Axis-Shaker" (HyMAS) is a computer-controlled servo-hydraulic vibration test facility manufactured by Moog, designed to simulate dynamic loads in all six degrees of freedom under environmental conditions.

The movement of the shaker-table in its six degrees of freedom (translational X, Y, Z and rotation Rx, Ry, Rz) is controlled by a four-variable system (sactuators/Δpfeedback of the actuators/a3STS /v4).
When large equipment (high mass and high center of gravity) is tested on a multi-axial shake table, coupled table/ equipment modes may exist.
The reliability of all measuring pickups are guaranteed by the quality management system of IABG as governed by DIN ISO 10 012. In addition, the accelerometers are calibrated annually.
When large equipment (high mass and high center of gravity) is tested on a multi-axial shake table, coupled table/ equipment modes may exist.
The following Table 23-3 contains a list of the measuring, recording and control equipment frequently used during the tests, together with the most important characteristic data. This equipment is required on one hand to operate the test facility and on the other hand to collect the vibration characteristics of the test sample. The use of the above-mentioned equipment depends on the particular test to be carried out; if necessary, other equipment shall also be used.

Serial Number	Definition	Range	Measuring Point	Next calibration
15-17431 X/Y/Z	Shake table sensor	± 100 m/s^2	Below table surface	01.2023
X/Y/Z-81023	Acc. Sensor "A"	± 500 m/s^2	Top left back frame	01.2023
X/Y/Z-81024	Acc. Sensor "B"	± 500 m/s^2	Mid-left back frame	01.2023
20015190303	String pot SP_X	± 250 mm	Top of frame	06.2024
20015090297	String pot SP_Y	± 250 mm	Top of frame	06.2024
252610863	Load washer KMR/100 kN	0-100 kN	M12 screw between adapter plate and frame	11.2022

WALL-MOUNTED EQUIPMENT ANCHOR CRITERION (4.4.3)

Criteria:

O4-77 [211] It is an objective that framework used for securing wall-mounted equipment should be of welded construction.

R4-78 [175] Fastening systems used for wall-mounted equipment shall withstand a force of 3 times the weight of the equipment applied to the equipment in any direction.

Wall-mounted equipment listed to the latest edition of **ANSI / UL 60950-1:2005**, *Information Trchnology Equipment – Safety, Part 1: General Requirements, plus revisions, or UL62368-1, Audio/video, information and communication technology equipment – Part 1: Safety requirements,* conforms to this requirement.

NA: The criteria were Not Applicable to the Equipment Under Test - EUT is not designed to be wall-mounted.

Test Location

The following evaluation was performed by Mr. Deniz Ezgi on June 02, 2022 at

NTS Europe GmbH
Hofmannstr. 50
81379 Munich
Germany

Test Method

No test performed.

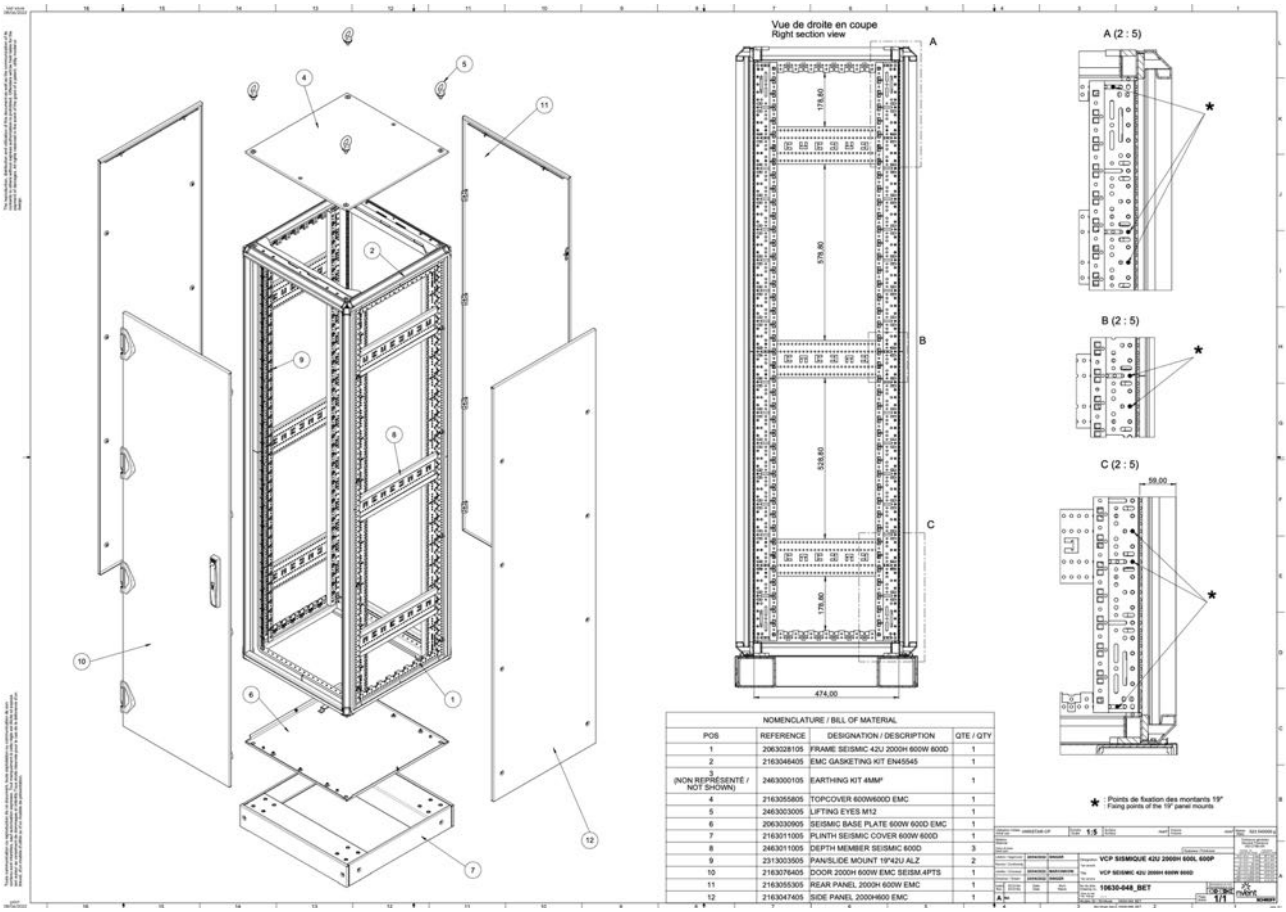
Test Results

The Varistar CP Seismic Rack is **ENR** with **R4-78 [175]** and **O4-77 [211]**.

Test Equipment Used

Table 23-2 Earthquake Environment List of Test Equipment

APPENDIX A



NOMENCLATURE / BILL OF MATERIAL

POS	REFERENCE	DESIGNATION / DESCRIPTION	QTE / QTY
1	2063028105	FRAME SEISMIC 42U 2000H 600W 600D	1
2	2163046405	EMC GASKETING KIT EN45545	1
3 (NON REPRESENTE / NOT SHOWN)	2463000105	EARTHING KIT 4MM²	1
4	2163055805	TOPCOVER 600W600D EMC	1
5	2463003005	LIFTING EYES M12	1
6	2063030905	SEISMIC BASE PLATE 600W 600D EMC	1
7	2163011005	PLINTH SEISMIC COVER 600W 600D	1
8	2463011005	DEPTH MEMBER SEISMIC 600D	3
9	2313003505	PAN/SLIDE MOUNT 19"42U ALZ	2
10	2163076405	DOOR 2000H 600W EMC SEISM.4PTS	1
11	2163055305	REAR PANEL 2000H 600W EMC	1
12	2163047405	SIDE PANEL 2000H600 EMC	1