SNAS
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KONŠTRUKTA - Defence, a.s.
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Prevádzka špeciálneho skúšobníctva Lieskovec
Skúšobné laboratórium SKTC-112, 018 41 Dubnica nad Váhom

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Testing P R O T O C O L No. 112/00910/2016

Applicant:

Ardic Elektrik San. Ve Tic. Ltd. STI.
Evren Mah.Bahar cad. No.2
Polat Is Markezi Kat.: 3 DR. 8
34192 Günesli Bagcilar–ISTANBUL
TURKEY

Subject of Testing:

- cable ladder type A 20–FM–100–15;
- cable trays type A 05–05A–15;
- wire mesh cable channel type ATK–10–15.

Objective of Testing:

Verification of seismic eligibility.

Type of test:

- assessment of resonant frequencies;
- seismic eligibility.

Means of receiving and handing-over the test sample:

Delivery note No. TNT GD 397 429 425 WW.

Test done on the basis of:

- Quotation No. 71/2015–1 and e–mail dated Feb. 2, 2016;
- RfQ 08-09-2015.

Test methods used:

STN EN 60068-3-3

Digitally signed by Bolgarin Mihail
Date: 2021.03.09 08:20:21 EET
Reason: MoldSign Signature
Location: Moldova

Test apparatus used:

- vibration device DERRITRON VP 400, SZ–204;
- horizontal sliding stand HKS 001, SZ–262;
- control system PUMA 2401, MZ–100;
- control sensor PSB 353B33, MZ–99;
- operational sensor Endevco 213E, výr. č. LA 19, MZ–29;
- hygro–thermo–barometer GFTB 100, MZ–161.

Test staff:

- Ing. Miloš Feja;
- Jaroslav Gavlas.

Date of the test:

09. 03. 2016 ÷ 16. 03. 2016

Temperature, humidity and air pressure in the laboratory:

Air temperature during the test ranged between 16,5 °C ÷ 18,0 °C, humidity between 76 % ÷ 56 % and air pressure round 978 hPa ÷ 980 hPa.

Testing procedure:

The below items were delivered for the test course:

- cable ladder type A 20–FM–100–15;
- cable trays type A 05–05A–15;
- wire mesh cable channel type ATK–10–15.

The cable ladder type A 20–FM–100–15 was designated as sample No.1.

This ladder consisted from:

- cable ladder type A 20–FM–100–15;
- carrier channel type A–5–4–20;
- clamp AMD;
- screws M8x20 (type CV–1) + nuts M8 (type ASF–1);
- rod M10 (type AT–2) + nut M10 (type ASF–2).

The cable trays type A 05–05A–15 was designated as sample No. 2.

This channel consisted from:

- cable trays, type A 05–05A–15;
- carrier channel type A–5–4–10
- screws M8x20 (type CV–1) + nuts M8 (type ASF–1);
- rod M10 (type AT–2) + nut M10 (type ASF–2).

Wire mesh cable channel type ATK–10–15.

This channel consisted from:

- wire mesh cable channel type ATK–10–15;
- carrier channel type ATK–11;
- rod M10 (type AT–2) + nuts M10 (type ASF–2).

The applicant for the testing course submitted catalogue and assembly sheets related particular items (products) to be tested.

Particular items were mounted into testing assemblies composed from above listed design elements. Length of rod M10 (type AT–2), from carriers up to the attachment to testing apparatus was set to 450 mm and distance of carriers between each other was 580 mm.
Individual testing assemblies are shown in Annex 1 to this Protocol.

These testing assemblies were gradually fixed onto testing apparatus and gradually attached in three axis to the either firm or sliding stand of vibration device.

Attachments of particular testing assemblies and axis directions there on vibration stands are shown in Annex 2 to this Protocol.

Particular testing assemblies were provoked by vibrations of vibrating device in one axis while subsequently applied in three preferential orthogonal axis in respect to testing assembly.

Control sensor of vibrating device was being attached to the base plate of fixture in "y" axis.

Control sensor of vibrating device was being attached in "x" and "z" axis there on a stand of vibrating device.

On testing assemblies there was a sensor attached to which recorded responses on vibrations.

Layout of mentioned sensors is shown there in Annex 3 to this Protocol.

The below tests were carried out with those testing assemblies:

1 Assessment of resonant frequencies (explorative vibration test)
2 Seismic eligibility – simulation of earthquake impacts:

a) Level S1 Test;
b) Level S2 Test.

1 Assessment of resonant frequencies (explorative vibration test).

After arrangement with Applicant the explorative vibration test was performed in accordance with points 10.1 and 14.2 of respective standard in frequency band range 5 Hz ÷ 35 Hz and acceleration of 1 m/s^2.

2 Seismic eligibility – simulation of earthquake impacts.

After arrangement with Applicant the explorative vibration test was performed in accordance with points 13.1.2 a 14.5 of respective standard.

a) Level S1 Test was carried out by value equal to 50 % of that value of S2, i.e. by acceleration of 6 m/s^2, in frequency band range 5 Hz ÷ 35 Hz, with five S1 earthquakes.

b) Level S2 Test was carried out in accordance with points 7.2 and 9.2 of respective standard. Level S1 Test was carried out by acceleration of 12 m/s^2, in frequency band range 5 Hz ÷ 35 Hz, with one S2 earthquake.

Speed of frequency shifting in the course of testing was 1 octave/minute.
Recordings of signals from control sensor and sensor recording the vibration responses are shown there in Annex No.4, No.5 and No.6 of this Protocol.

After testing courses performed the testing assemblies were checked out.

Signal of control sensor is black-shaded there in diagrams.
Signal of sensor recording the vibration responses is red-shaded thereto.

Test results:

Based on diagrams of individual provoking levels and responses the results of resonance and critical frequencies were evaluated in accordance with points 3.5 and 3.21 of respective standard. Resonance frequency determination was stated when response transfer was greater than 3.

1 Assessment of resonant frequencies (explorative vibration test).

Cable ladder, type A 20–FM–100–15: there was no resonance neither critical frequency observed there in "y" axis.

Cable ladder, type A 20–FM–100–15: there was resonance frequency observed in frequency band range 5,0 Hz ÷ 7,2 Hz there in „x" axis.
Critical frequency was observed there at 6,8 Hz.

Cable ladder, type A 20–FM–100–15: there was resonance frequency observed in frequency band range 8,0 Hz ÷ 13,0 Hz there in „z" axis.
Critical frequency was observed there at 10,5 Hz.

Cable trays, type A 05–05A–15: there was no resonance neither critical frequency observed there in "y" axis.

Cable trays, type A 05–05A–15: there was resonance frequency observed in frequency band range 10,0 Hz ÷ 15,0 Hz there in „x" axis.
Critical frequency was observed there at 13,0 Hz.

Cable trays, type A 05–05A–15: there were resonance frequencies observed in frequency band ranges 12,0 Hz ÷ 16,5 Hz and 17,5 Hz ÷ 21,0 Hz there in „z" axis.
Critical frequencies were observed there at 16,0 Hz and 18,0 Hz.

Wire mesh cable channel type ATK–10–15: there was no resonance neither critical frequency observed there in "y" axis.

Wire mesh cable channel type ATK–10–15: there was resonance frequency observed in frequency band range 9,0 Hz ÷ 13,7 Hz there in „x" axis.
Critical frequency was observed there at 11,5 Hz.

Wire mesh cable channel type ATK–10–15: there were resonance frequencies observed in frequency band ranges 5,7 Hz ÷ 9,3 Hz and 10,8 Hz ÷ 12,0 Hz there in „z" axis.
Critical frequencies were observed there at 7,3 Hz a 11,3 Hz.

2 Seismic eligibility – simulation of earthquake impacts:

a) Level S1 Test

Cable ladder, type A 20–FM–100–15: there was no resonance neither critical frequency observed there in "y" axis.

Cable ladder, type A 20–FM–100–15: there was resonance frequency observed in frequency band range 5,0 Hz ÷ 7,5 Hz there in „x" axis..
Critical frequency was observed there at 7,2 Hz.

Cable ladder, type A 20–FM–100–15: there was resonance frequency observed in frequency band range 8,0 Hz ÷ 12,0 Hz there in „z" axis..
Critical frequency was observed there at 9,8 Hz.

Cable trays, type A 05–05A–15: there was no resonance neither critical frequency observed there in "y" axis.

Cable trays, type A 05–05A–15: there was resonance frequency observed in frequency band range 9,7 Hz ÷ 13,7 Hz there in „x" axis.
Critical frequency was observed there at 12,7 Hz.

Cable trays, type A 05–05A–15: there were resonance frequencies observed in frequency band ranges 12,6 Hz ÷ 16,7 Hz and 17,0 Hz ÷ 19,0 Hz there in „z" axis.
Critical frequencies were observed there at 15,6 Hz and 17,6 Hz.

Wire mesh cable channel type ATK–10–15: there was no resonance neither critical frequency observed there in "y" axis.

Wire mesh cable channel type ATK–10–15: there was resonance frequency observed in frequency band range 9,0 Hz ÷ 13,0 Hz there in „x" axis.
Critical frequency was observed there at 10,7 Hz.

Wire mesh cable channel type ATK–10–15: there were resonance frequencies observed in frequency band ranges 5,8 Hz ÷ 8,6 Hz and 10,8 Hz ÷ 11,5 Hz there in „z" axis.
Critical frequencies were observed there at 7,3 Hz a 11,3 Hz.

b) Level S2 Test

Cable ladder, type A 20–FM–100–15: there was no resonance neither critical frequency observed there in "y" axis.

Cable ladder, type A 20–FM–100–15: there was resonance frequency observed in frequency band range 6,6 Hz ÷ 7,7 Hz there in „x" axis.
Critical frequency was observed there at 7,4 Hz.

Cable ladder, type A 20–FM–100–15: there was resonance frequency observed in frequency band range 7,6 Hz ÷ 12,0 Hz there in „z" axis.
Critical frequency was observed there at 9,4 Hz.

Cable trays, type A 05–05A–15: there was no resonance neither critical frequency observed there in "y" axis.

Cable trays, type A 05–05A–15: there was resonance frequency observed in frequency band range 8,8 Hz ÷ 12,8 Hz there in „x" axis.
Critical frequency was observed there at 11,8 Hz.

Cable trays, type A 05–05A–15: there were resonance frequencies observed in frequency band ranges 12,3 Hz ÷ 16,5 Hz and 16,8 Hz ÷ 19,0 Hz there in „z" axis.
Critical frequencies were observed there at 15,0 Hz and 17,4 Hz.

Wire mesh cable channel type ATK–10–15: there was no resonance neither critical frequency observed there in "y" axis.

Wire mesh cable channel type ATK–10–15: there was resonance frequency observed in frequency band range 7,7 Hz ÷ 10,5 Hz there in "x" axis.
Critical frequency was observed there at 9,8 Hz.

Wire mesh cable channel type ATK–10–15: there was resonance frequency observed in frequency band range 5,7 Hz ÷ 8,6 Hz a 10,8 Hz ÷ 11,2 Hz there in "z" axis.
Critical frequency was observed there at 6,9 Hz a 11,1 Hz.

Assessment of Testing:

Based on the course of resonances and their frequency bands it is considered they represent the resonance burst that might influence the construction of items (products) in subject during their real exploitation.

In spite of above findings and observations the presented testing assemblies have met requirements as per points 3.23 of respective standard when imposed under vibration level S1 and 3.24 under vibration level S2.

Cable ladder, type A 20–FM–100–15 features the critical resonance < 12 Hz.
Cable trays, type A 05–05A–15 features the critical resonance > 12 Hz.
Wire mesh cable channel type ATK–10–15 features the critical resonance < 12 Hz.

Based on above mentioned the Applicant is recommended to take into account these facts during real exploitation of products in subject. It might impact the product reliability and integrity at multiple seismic actions.

Similarly the Applicant is recommended to assign the products in subject to faulty criteria I in accordance with 4.3 of respective standard.

The overall assessment of seismic resistance test shall be finally executed be Applicant himself.

Annexes:

No 1 Particular testing assemblies
No 2 Fixing the testing assemblies and axis orientation thereto on vibrating stands
No 3 Sensor arrangements
No 4 Recordings of signals from control sensor and sensor recording the vibration responses
No 5 Recordings of signals from control sensor and sensor recording the vibration responses
No 6 Recordings of signals from control sensor and sensor recording the vibration responses

Amendments:

Results of testing represent the subject of test performed only.
Testing Protocol duplicated otherwise than as a whole may only be done on the base of written consent of SKTC – 112 Testing Laboratory.

Protocol executed by Jaroslav Gavlas.
In Dubnica nad Váhom, on March17, 2016.

AKREDITOVANÉ SKÚŠOBNÉ LABORATÓRIUM S-077 SKTC-112 KONŠTRUKTA-Defence, a.s. PŠS Lieskovec Dubnica n/V.

Ing. Miroslav Marikovič
Head of SKTC–112 Testing Laboratory

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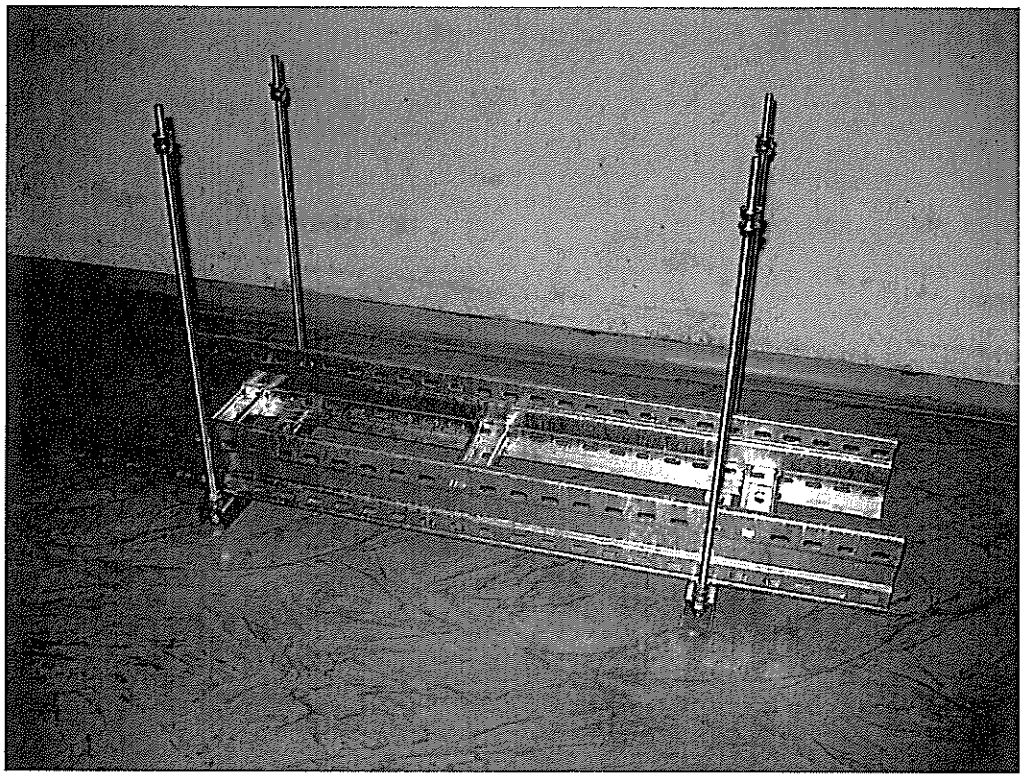
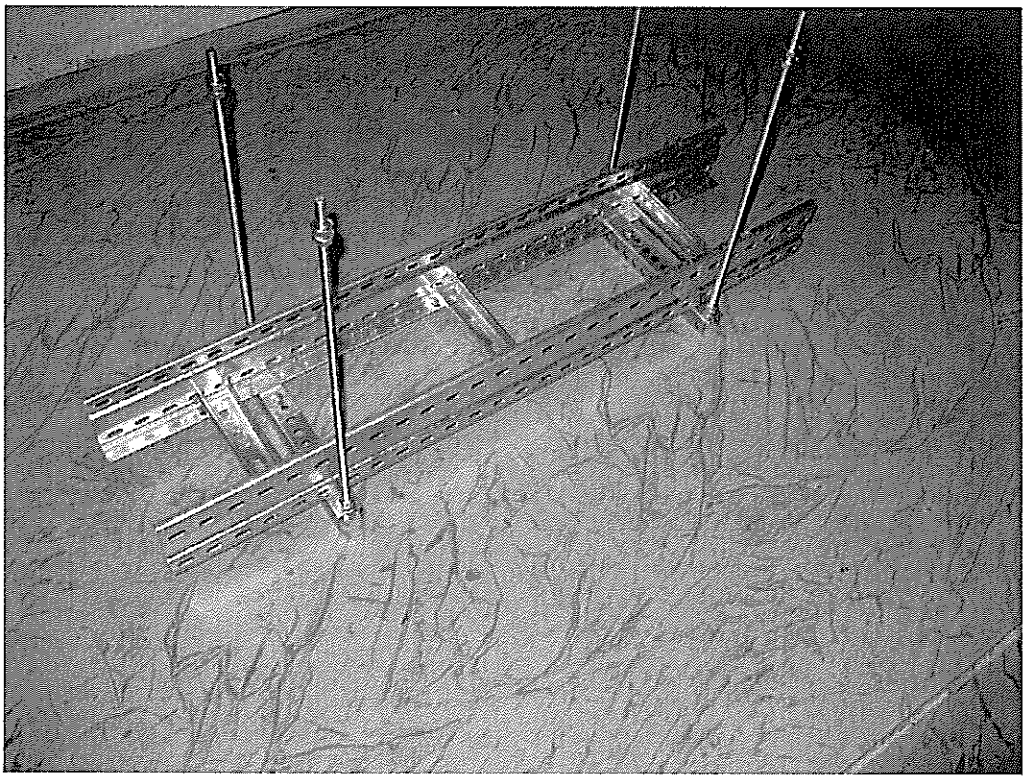
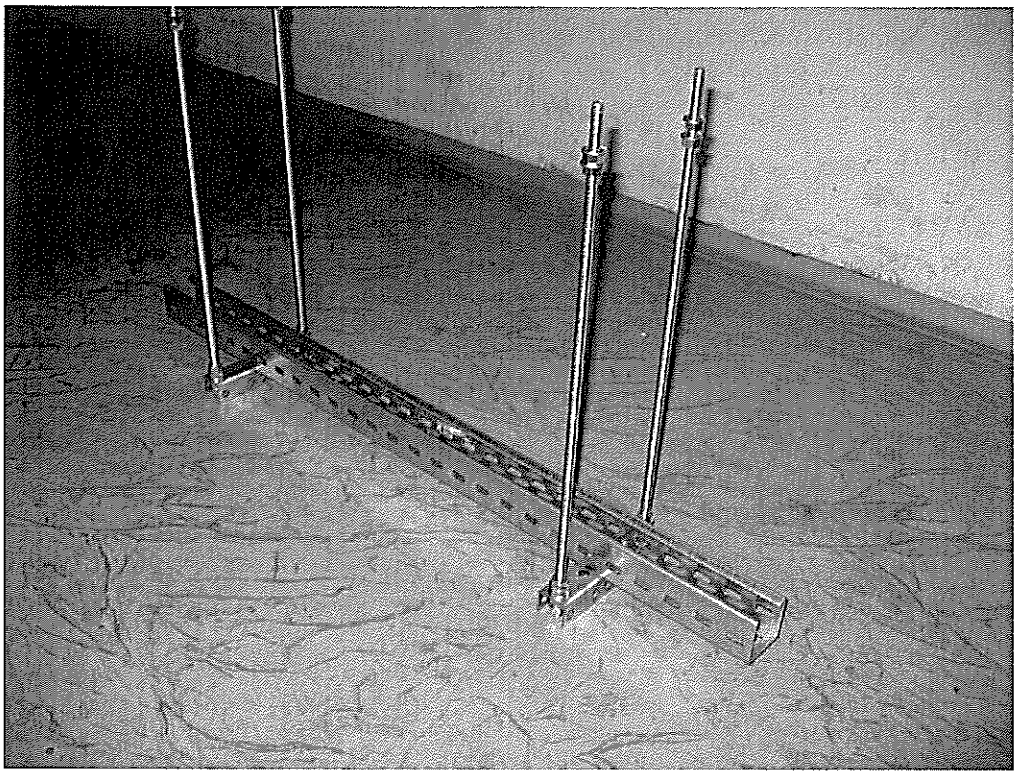
Printout No. 2 PŠS Lieskovec, SKTC–112
01841 Dubnica nad Váhom

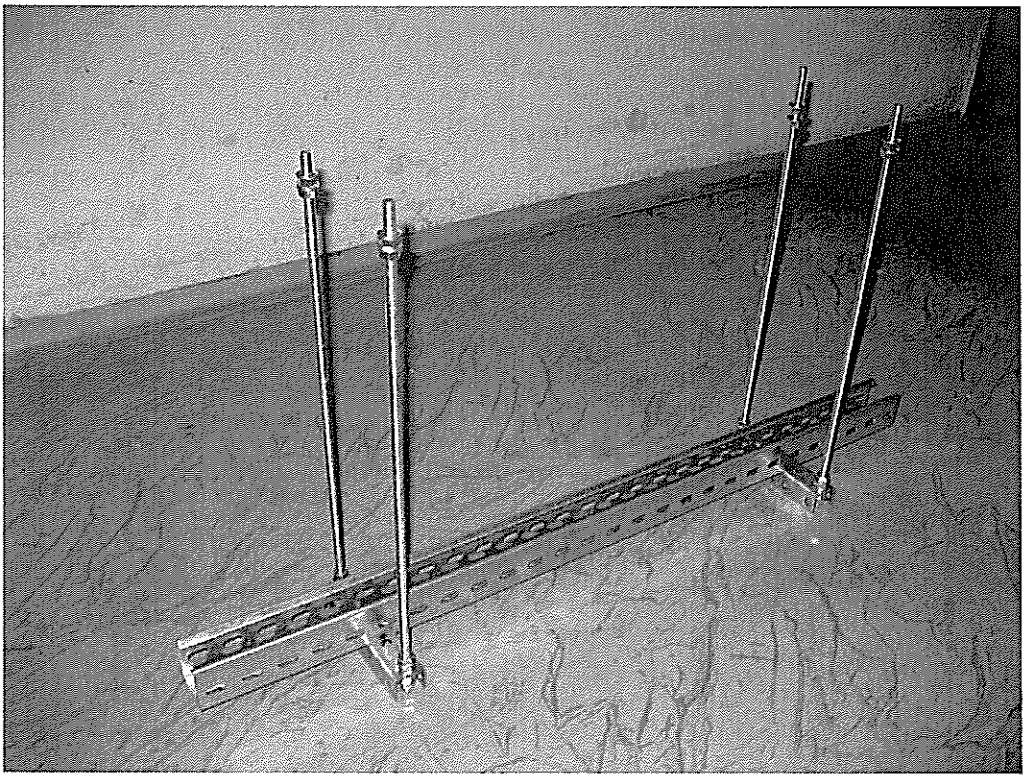
Testing assembly of cable ladder type A 20–FM–100–15



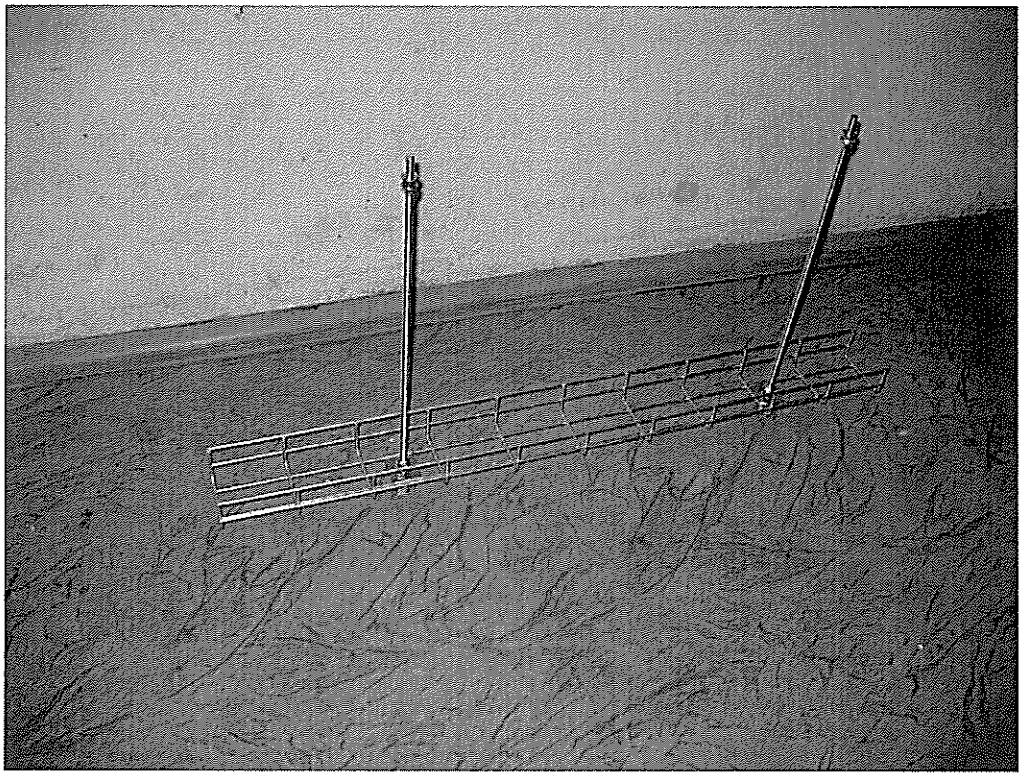


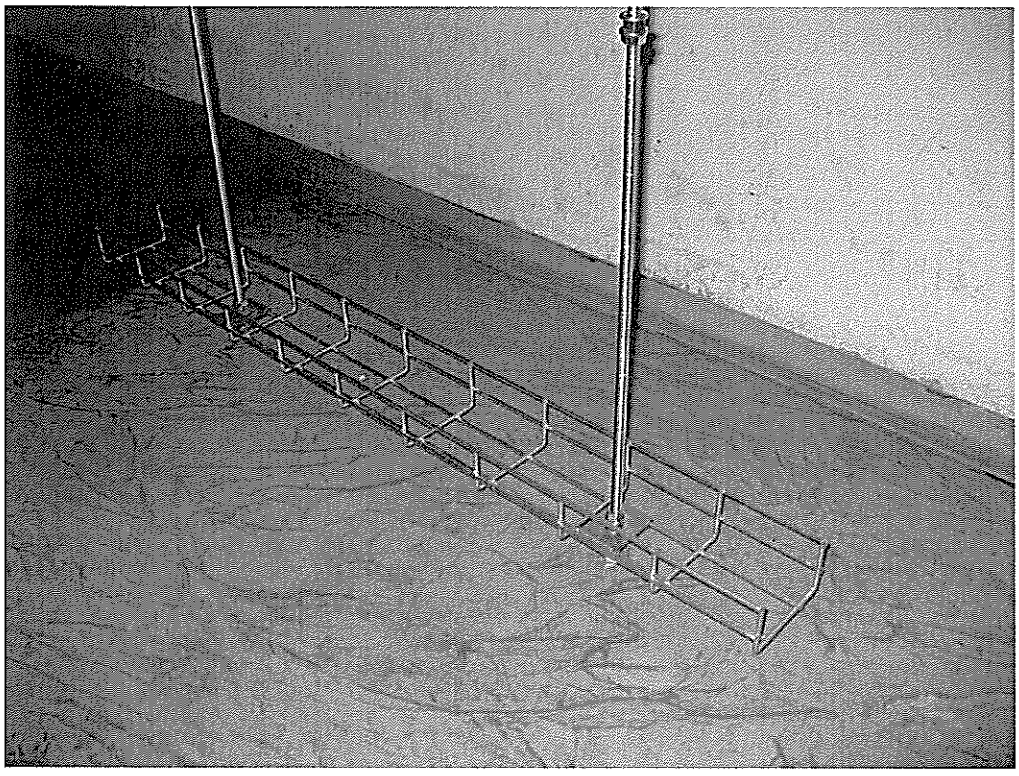
Testing assembly of cable trays type A 05–05A–15



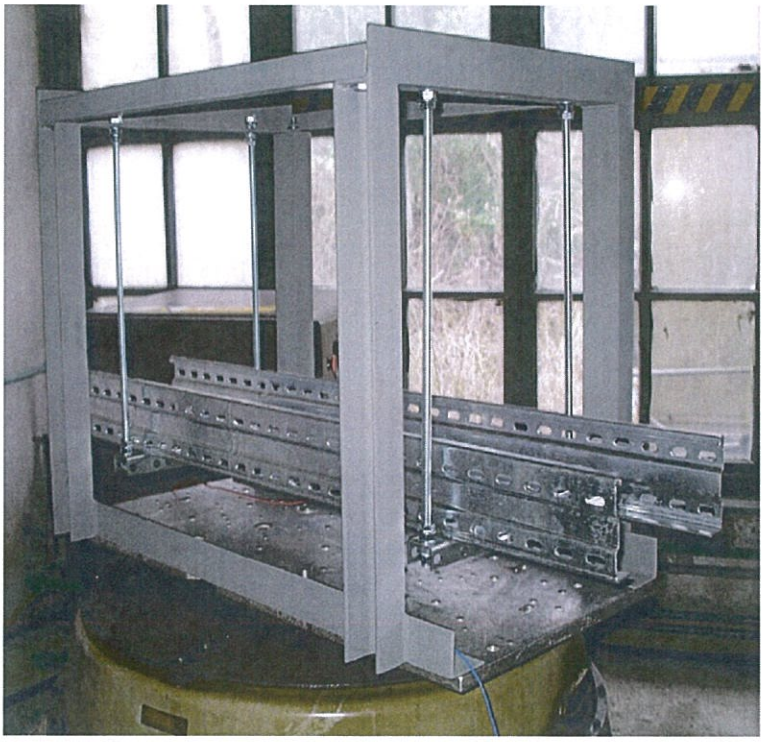


Testing assembly of cable channel type ATK–10–15



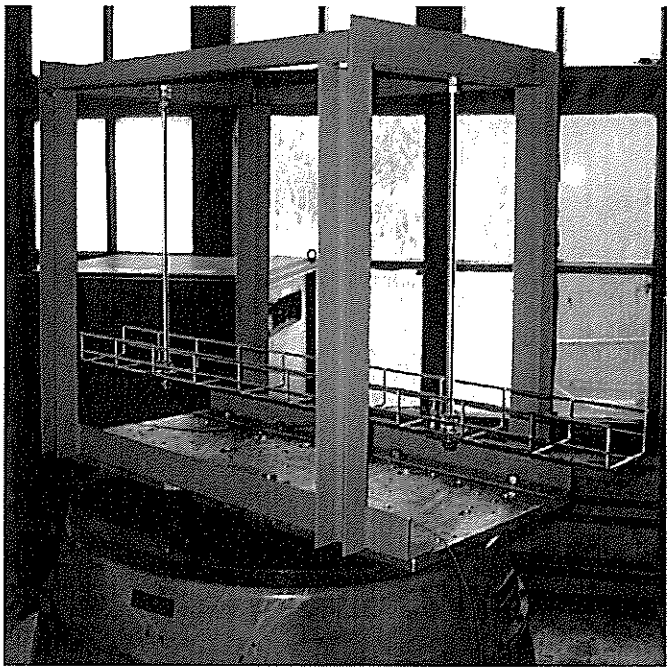


Fixing the testing assembly of cable ladder type A 20–FM–100–15 in testing apparatus and its "y" axis orientation thereto on vibrating stand

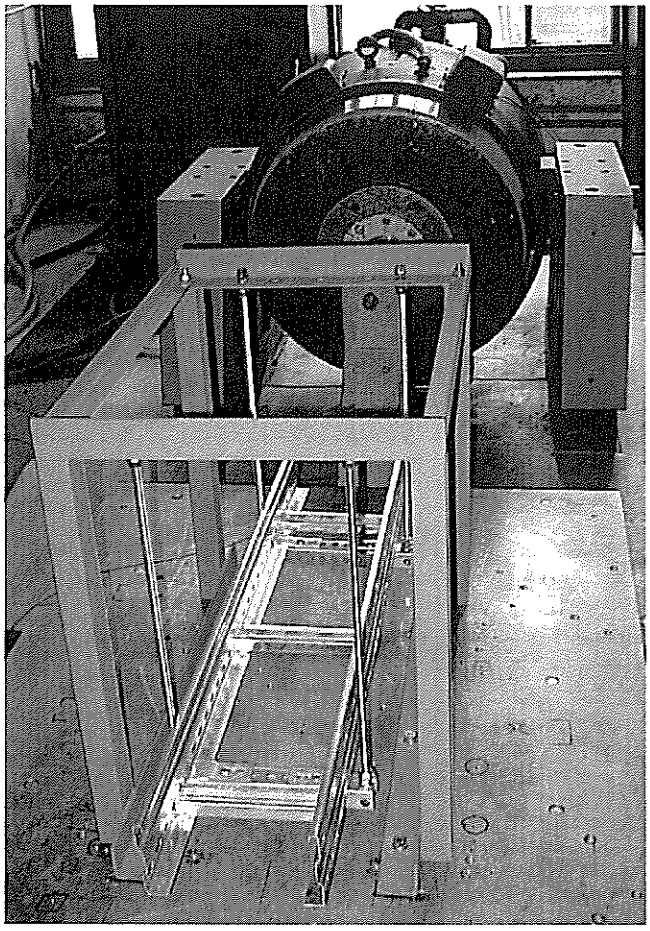


Fixing the testing assembly of cable trays type A 05–05A–15 in testing apparatus and its "y" axis orientation thereto on vibrating stand

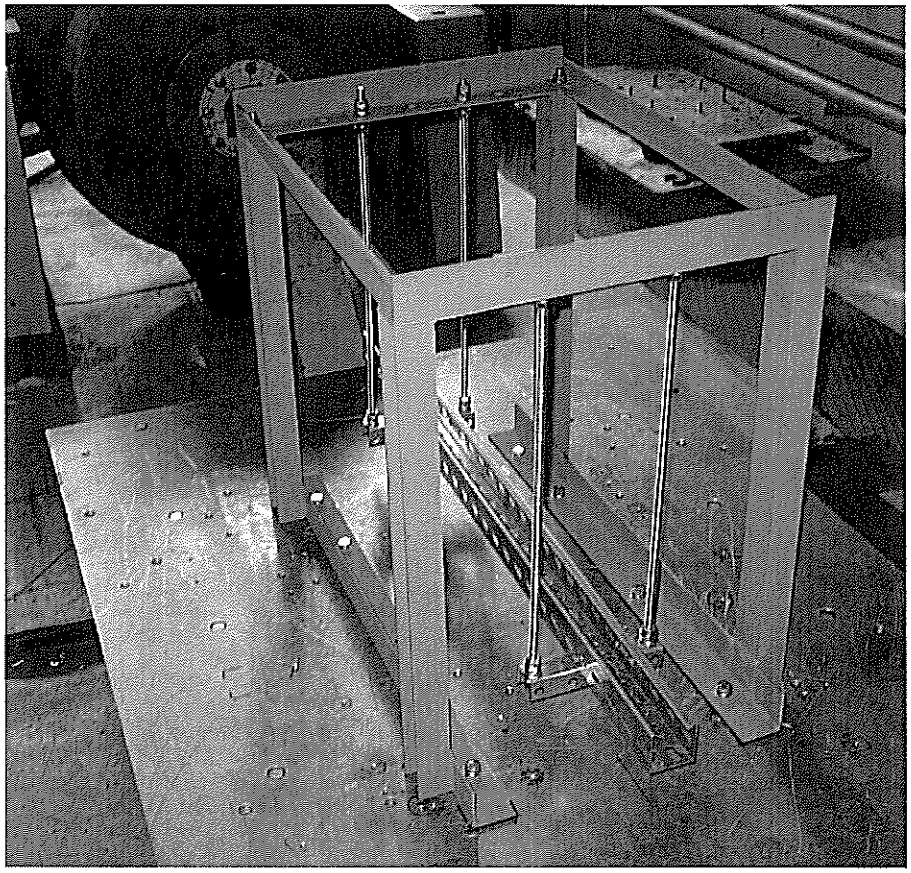
Fixing the testing assembly of cable channel type ATK–10–15 in testing apparatus and its "y" axis orientation thereto on vibrating stand



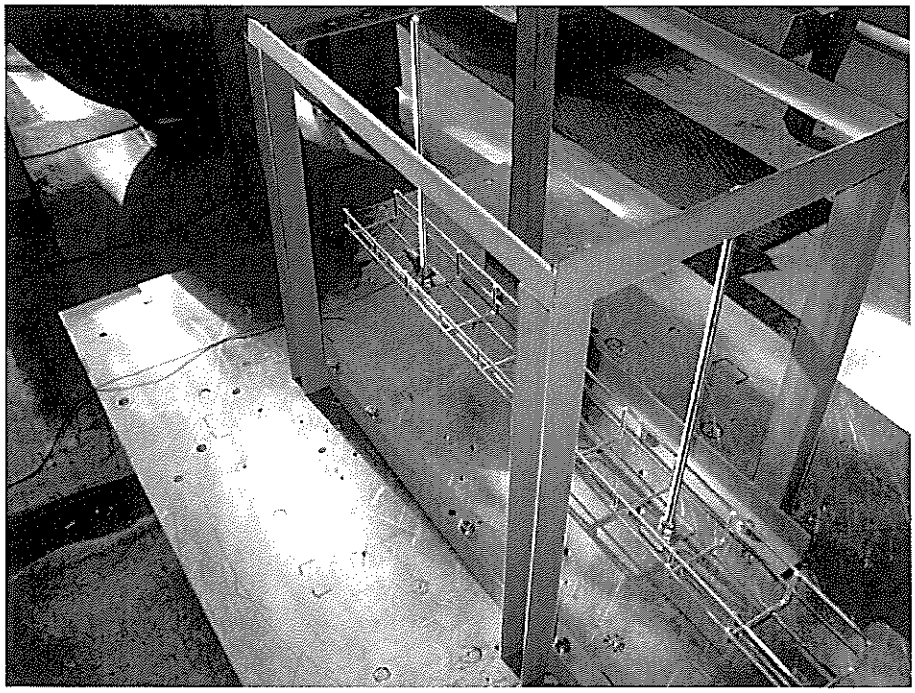
Fixing the testing assembly of cable ladder type A 20–FM–100–15 in testing apparatus and its "x" axis orientation thereto on vibrating stand



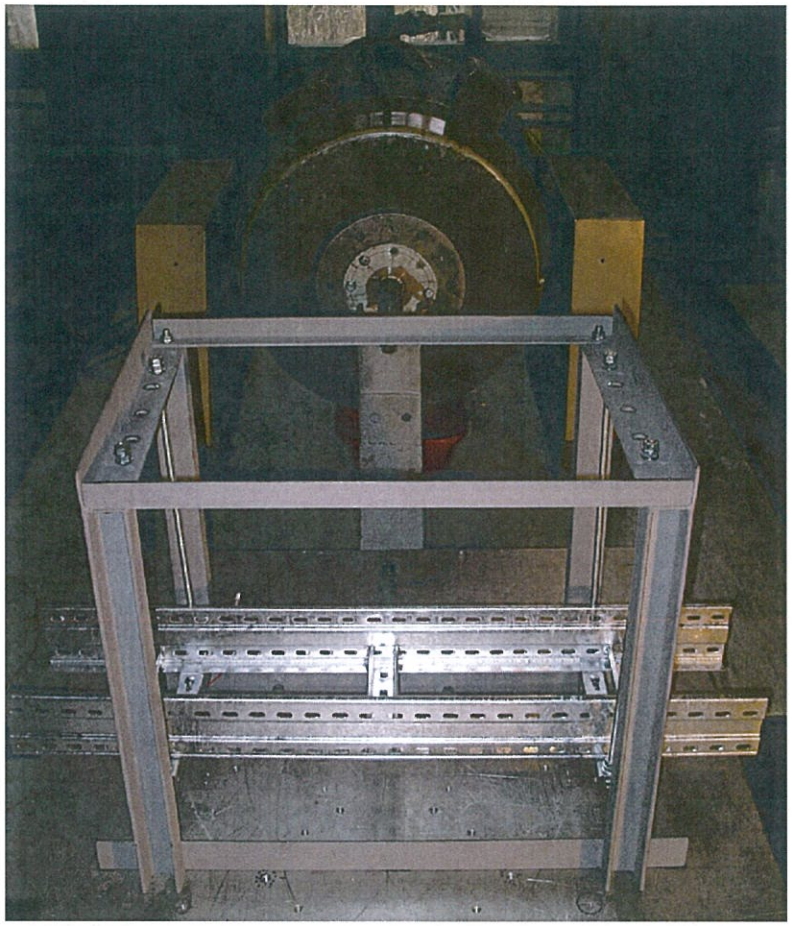
Fixing the testing assembly of cable trays type A 05–05A–15 in testing apparatus and its "x" axis orientation thereto on vibrating stand



Fixing the testing assembly of cable channel type ATK–10–15 in testing apparatus and its "x" axis orientation thereto on vibrating stand

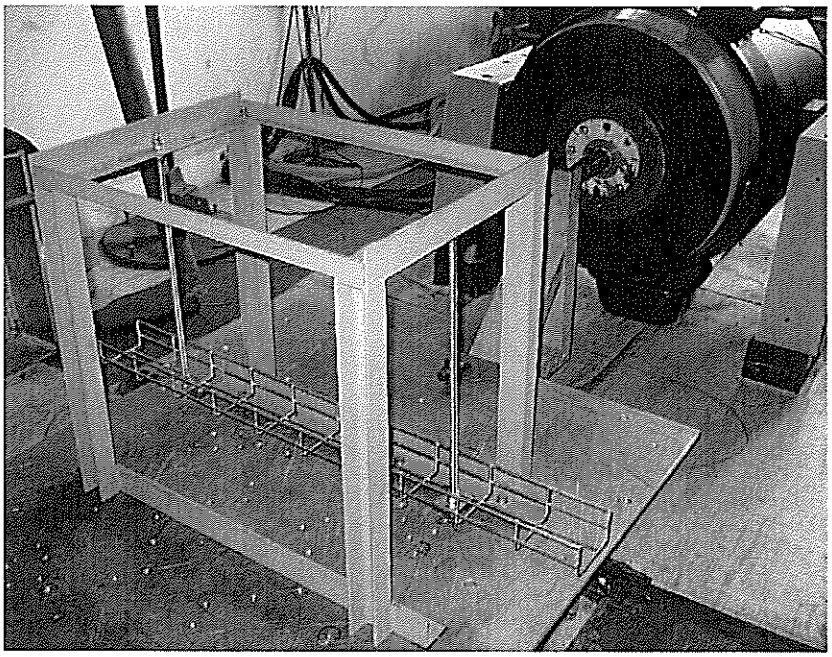


Fixing the testing assembly of cable ladder type A 20–FM–100–15 in testing apparatus and its "z" axis orientation thereto on vibrating stand

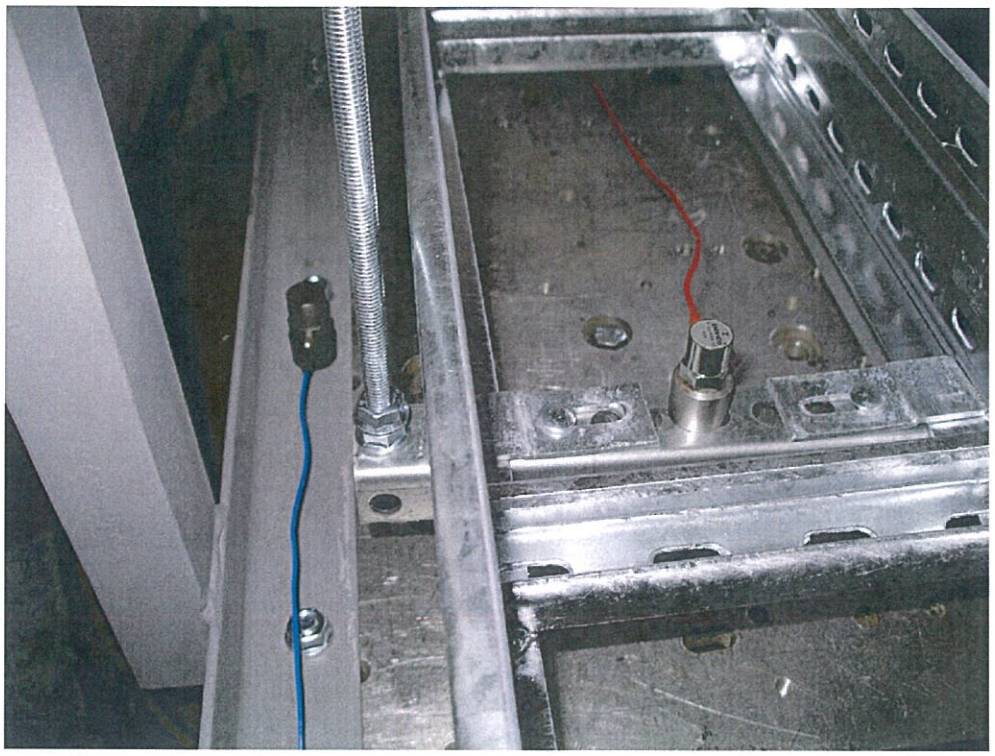


Fixing the testing assembly of cable trays type A 05–05A–15 in testing apparatus and its "z" axis orientation thereto on vibrating stand

Fixing the testing assembly of cable channel type ATK–10–15 in testing apparatus and its "z" axis orientation thereto on vibrating stand



Location of both the control sensor and sensor recording the vibration responses while testing the cable ladder type A 20–FM–100–15 there in "y" axis.



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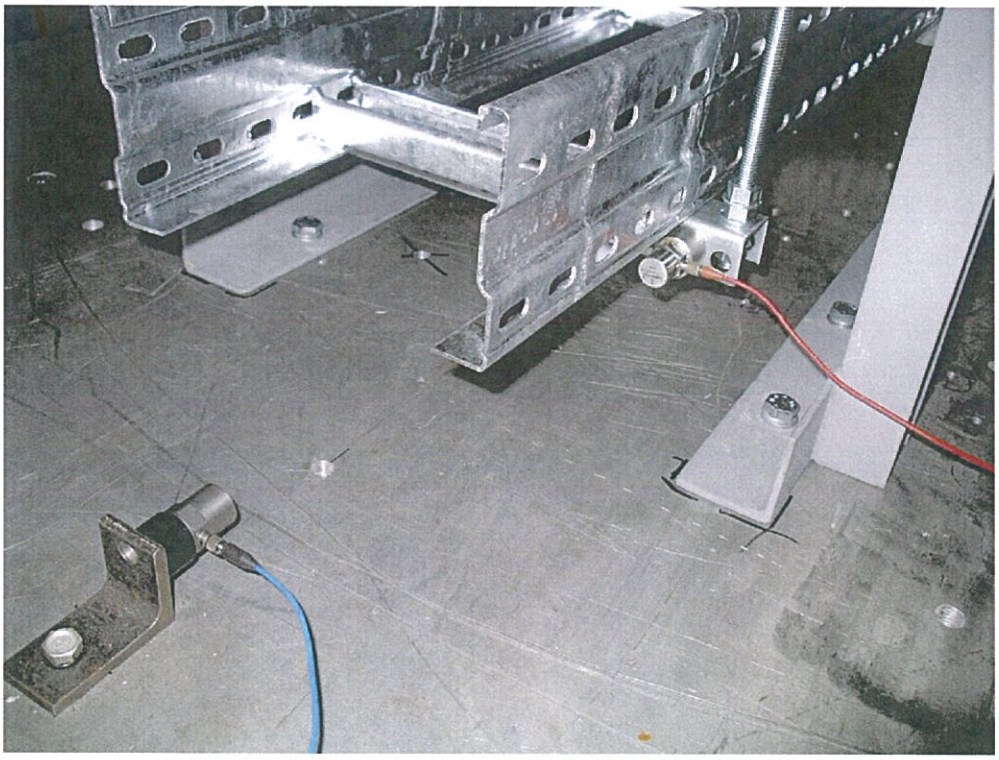
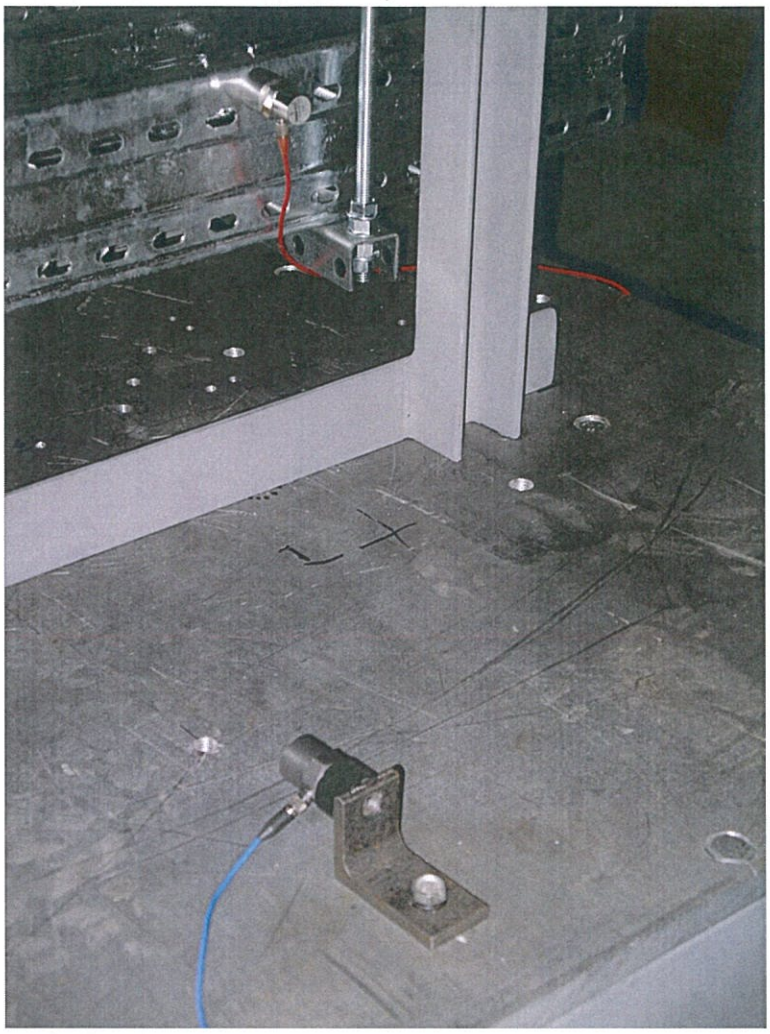
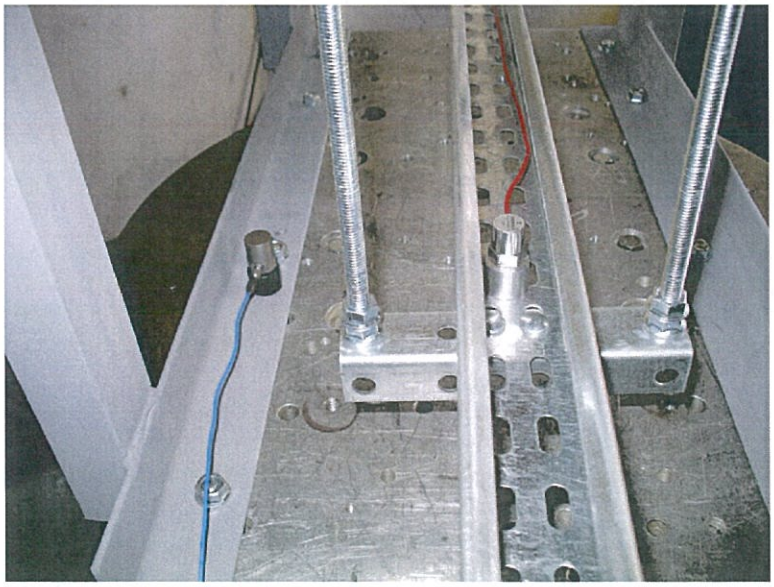


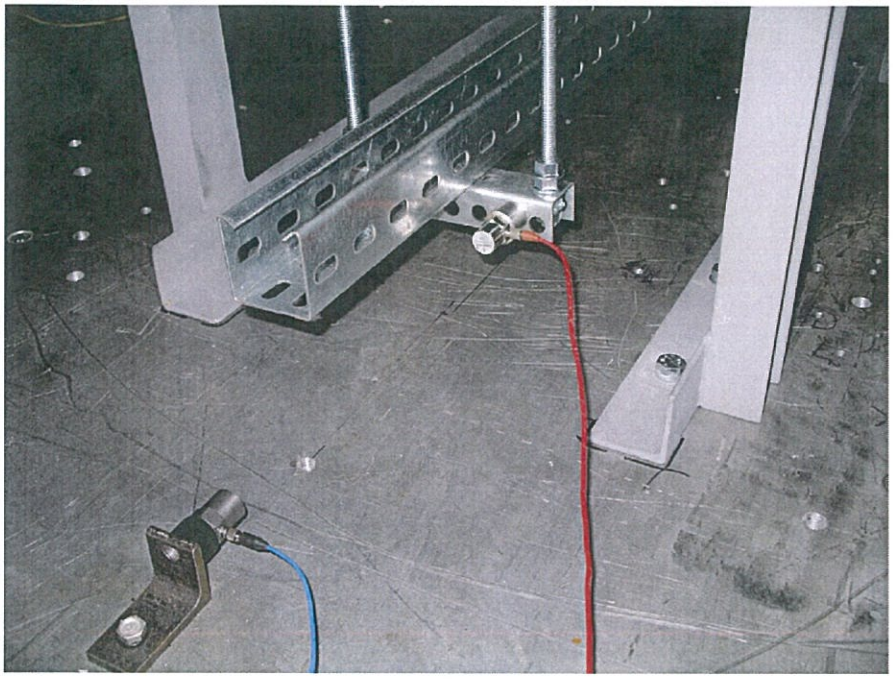
Location of both the control sensor and sensor recording the vibration responses while testing the cable ladder type A 20–FM–100–15 there in "z" axis.



Location of both the control sensor and sensor recording the vibration responses while testing the cable trays type A 05–05A–15 there in "y" axis.

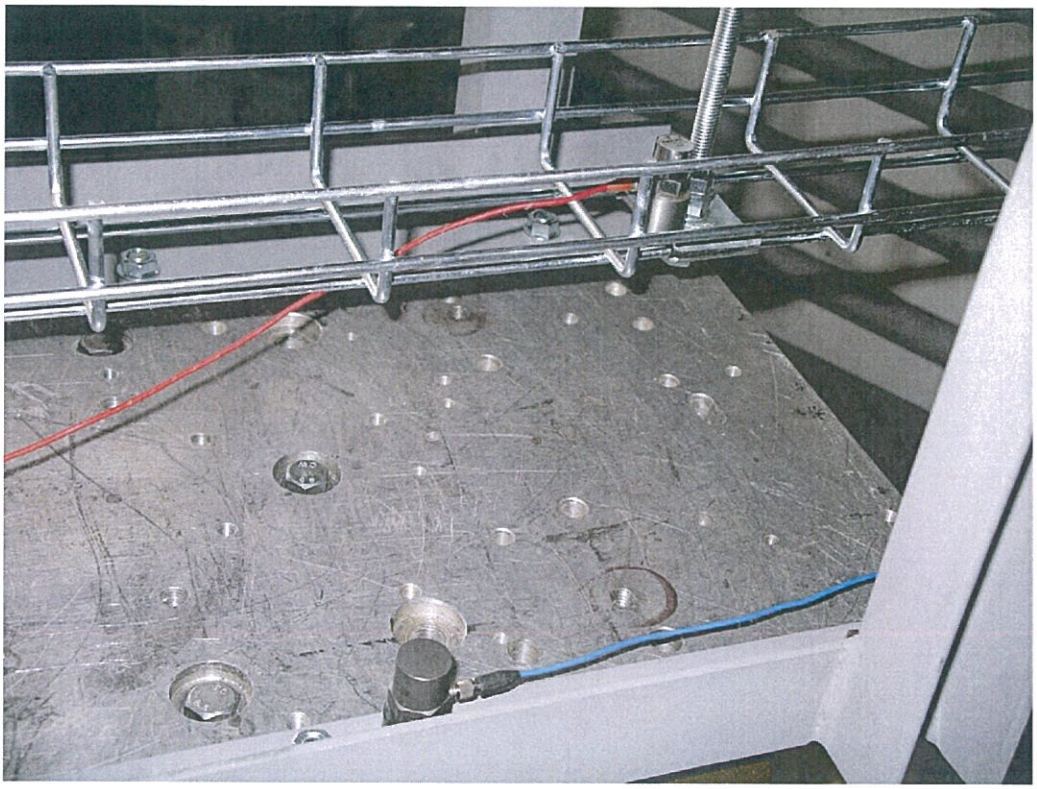


Location of both the control sensor and sensor recording the vibration responses while testing the cable trays type A 05–05A–15 there in "x" axis.

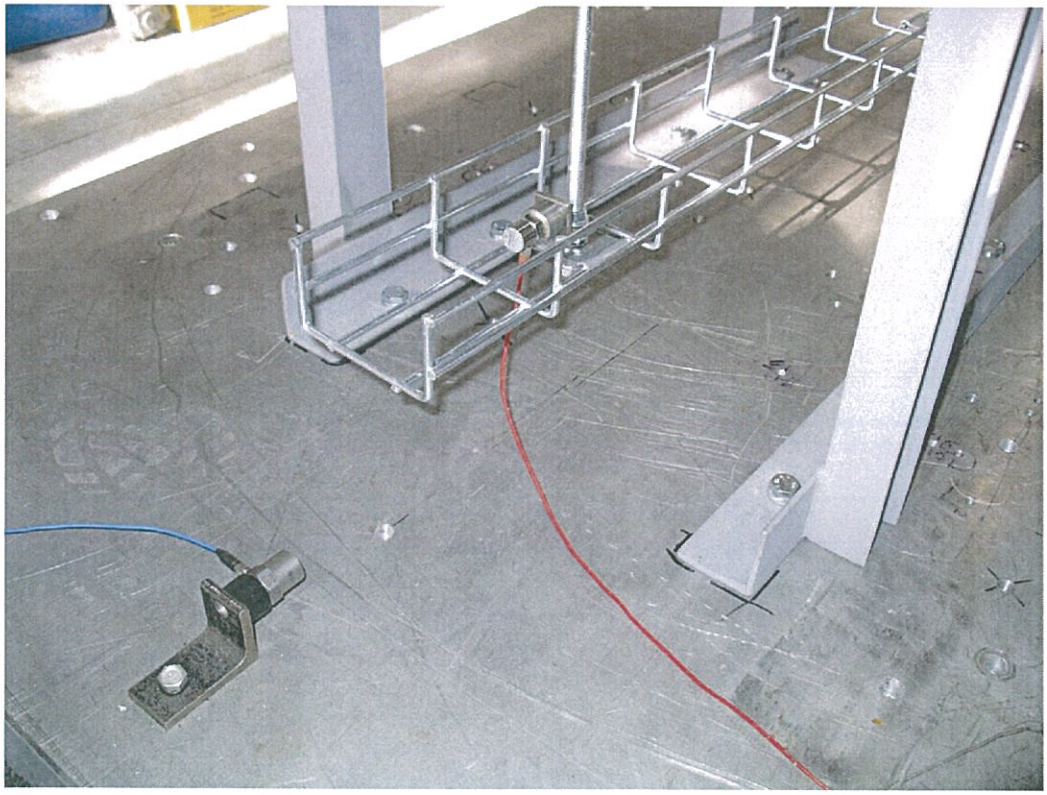


Location of both the control sensor and sensor recording the vibration responses while testing the cable trays type A 05–05A–15 there in "z" axis.

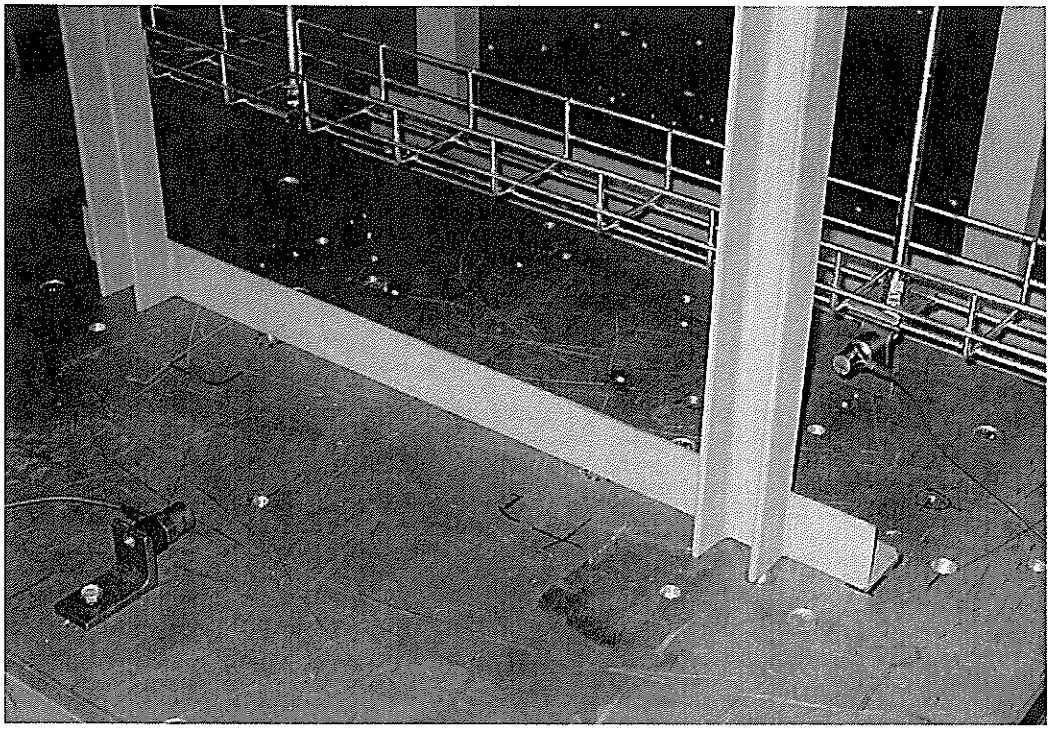
Location of both the control sensor and sensor recording the vibration responses while testing the cable channel type ATK–10–15 there in "y" axis.



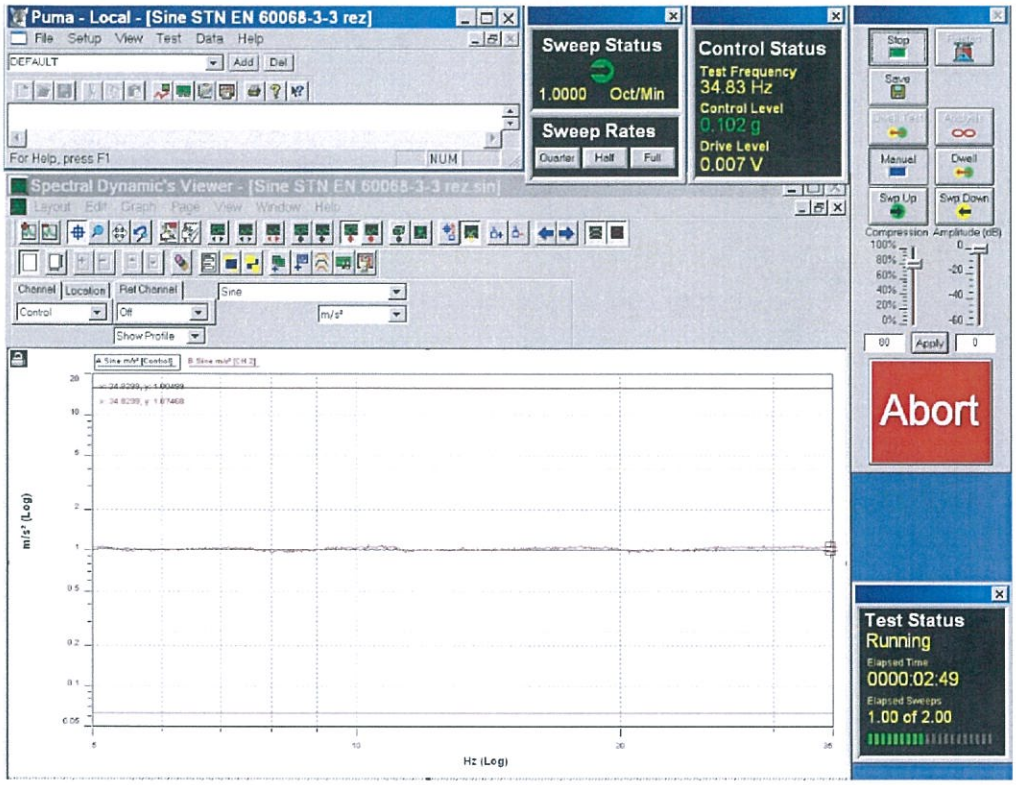
Location of both the control sensor and sensor recording the vibration responses while testing the cable channel type ATK–10–15 there in "x" axis.



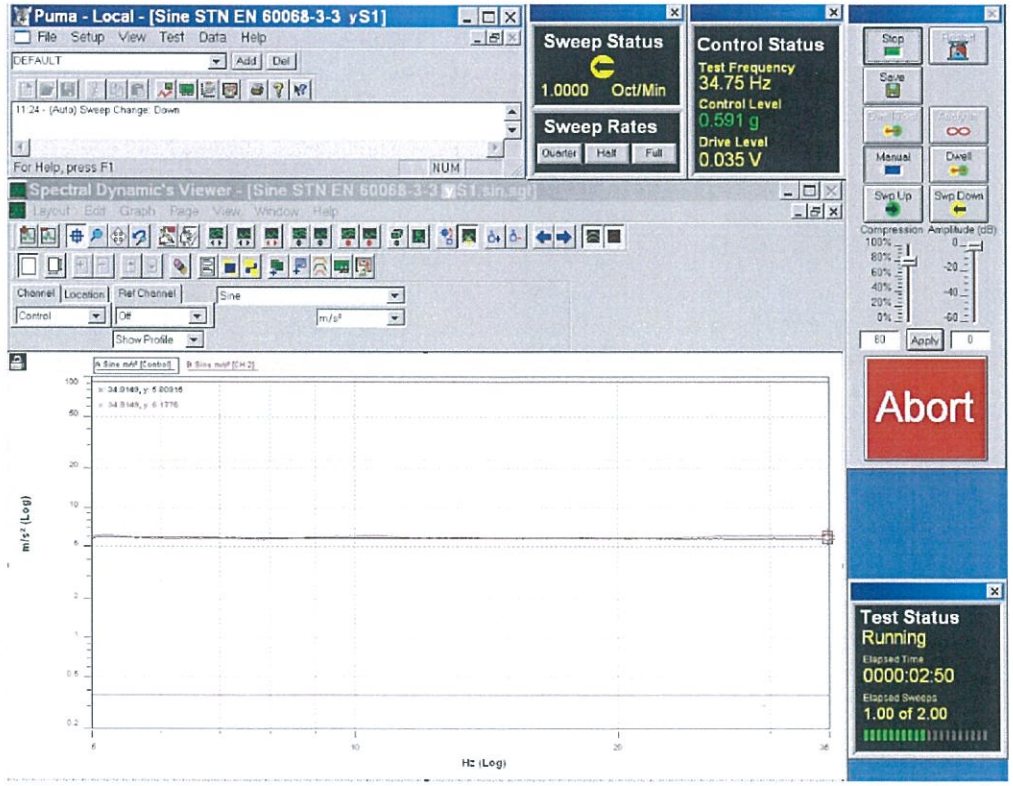
Location of both the control sensor and sensor recording the vibration responses while testing the cable channel type ATK–10–15 there in "z" axis.



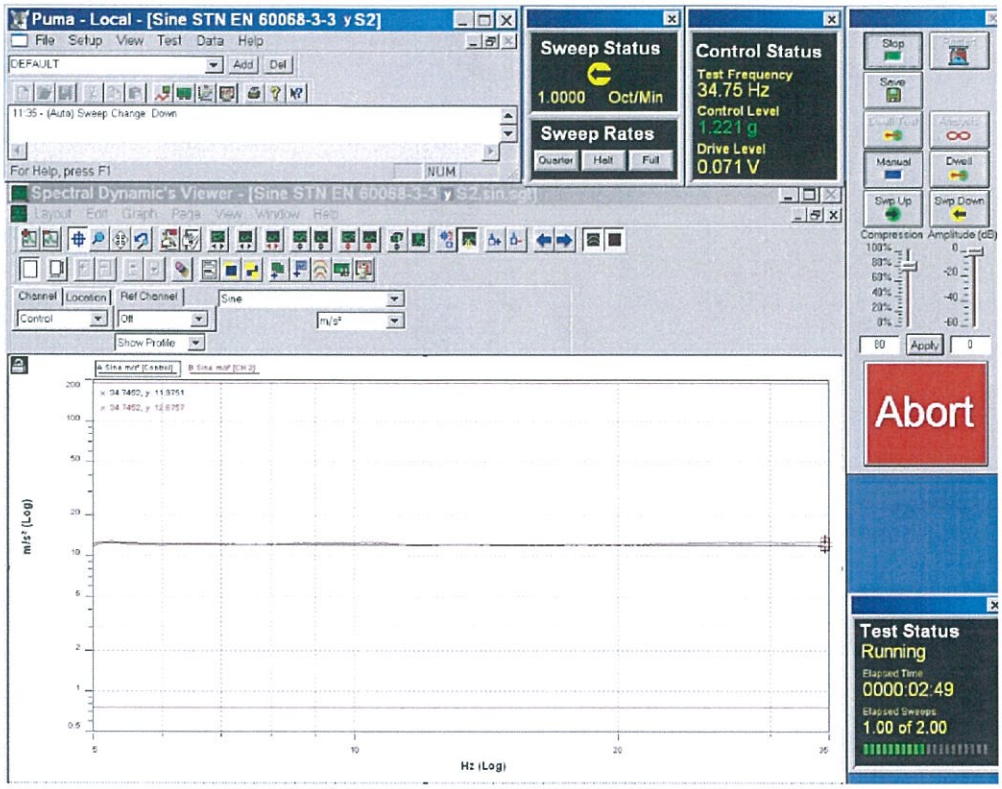
Recordings of signals from control sensor and sensor recording the vibration responses, cable ladder type A 20–FM–100–15, at test of resonant frequency assessment there in “y” axis.



Recordings of signals from control sensor and sensor recording the vibration responses, cable ladder type A 20–FM–100–15, at test of seismic eligibility Level S1 there in “y” axis.

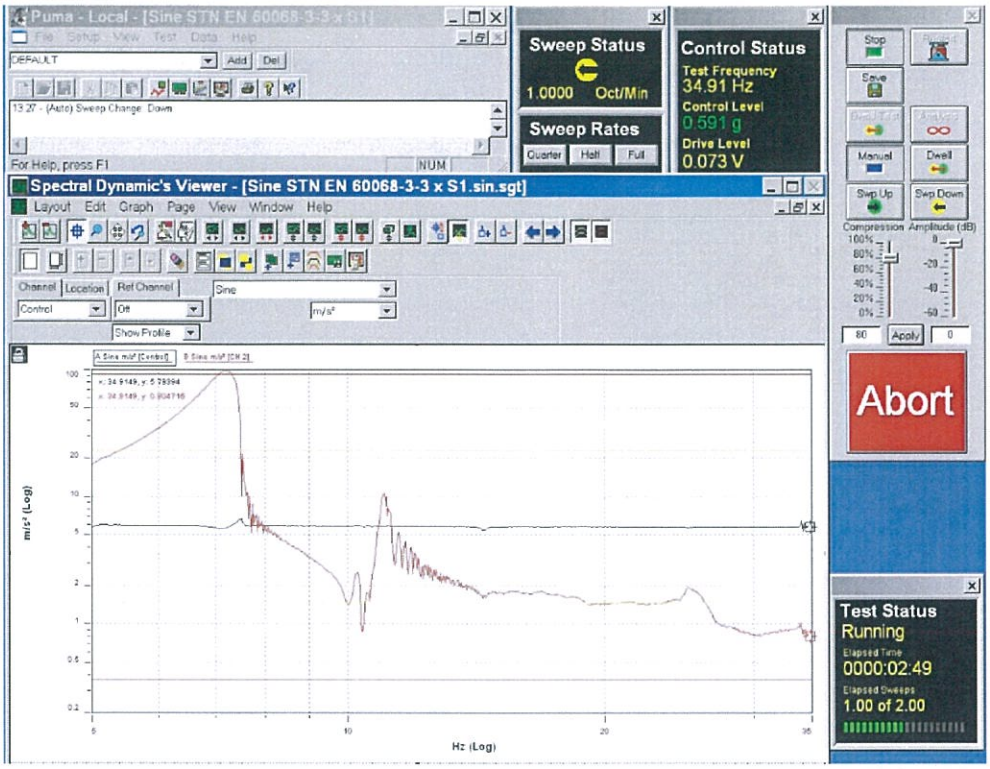


Recordings of signals from control sensor and sensor recording the vibration responses, cable ladder type A 20–FM–100–15, at test of seismic eligibility Level S2 there in “y” axis.

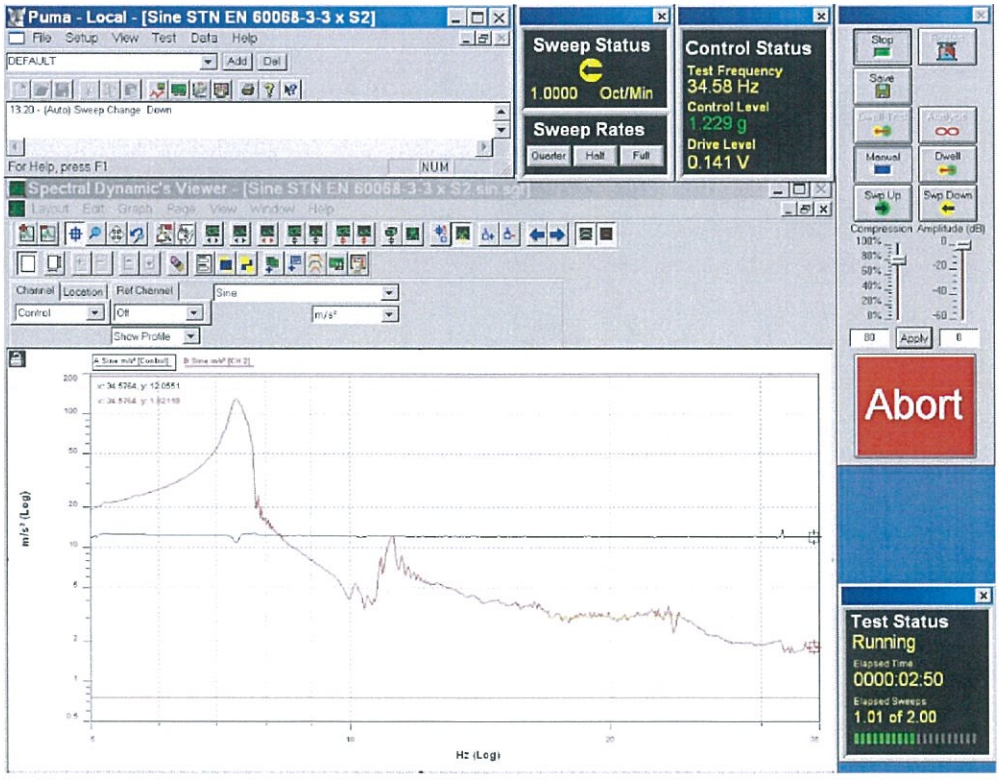


Recordings of signals from control sensor and sensor recording the vibration responses, cable ladder type A 20–FM–100–15, at test of resonant frequency assessment there in “x” axis.

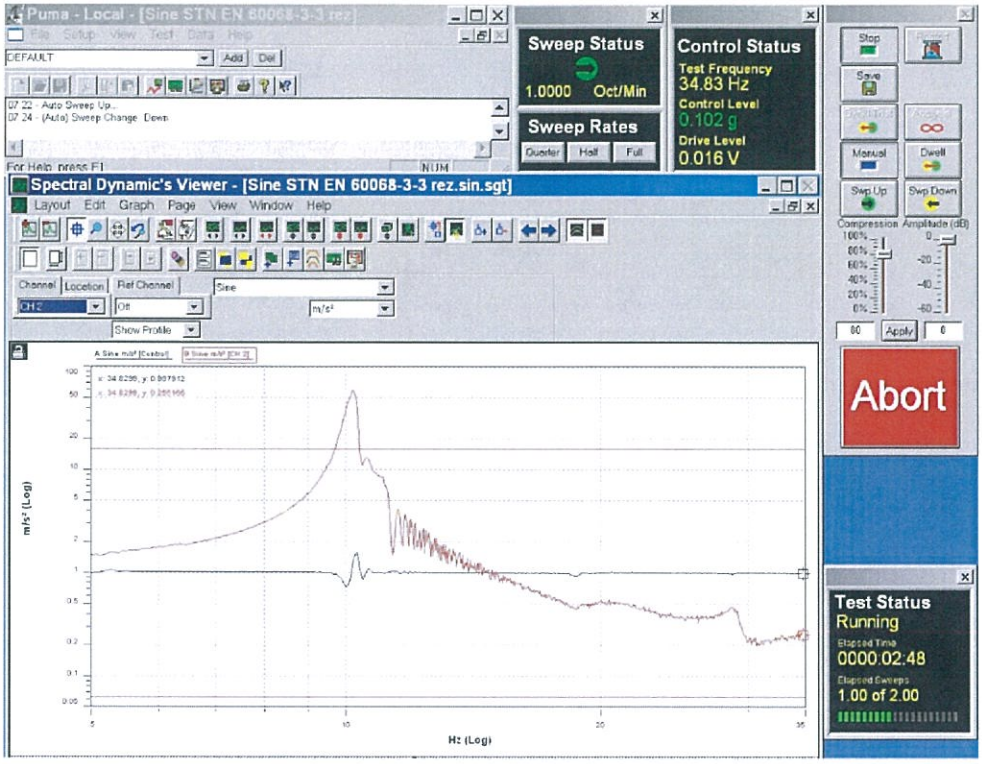
Recordings of signals from control sensor and sensor recording the vibration responses, cable ladder type A 20–FM–100–15, at test of seismic eligibility Level S1 there in "x" axis.



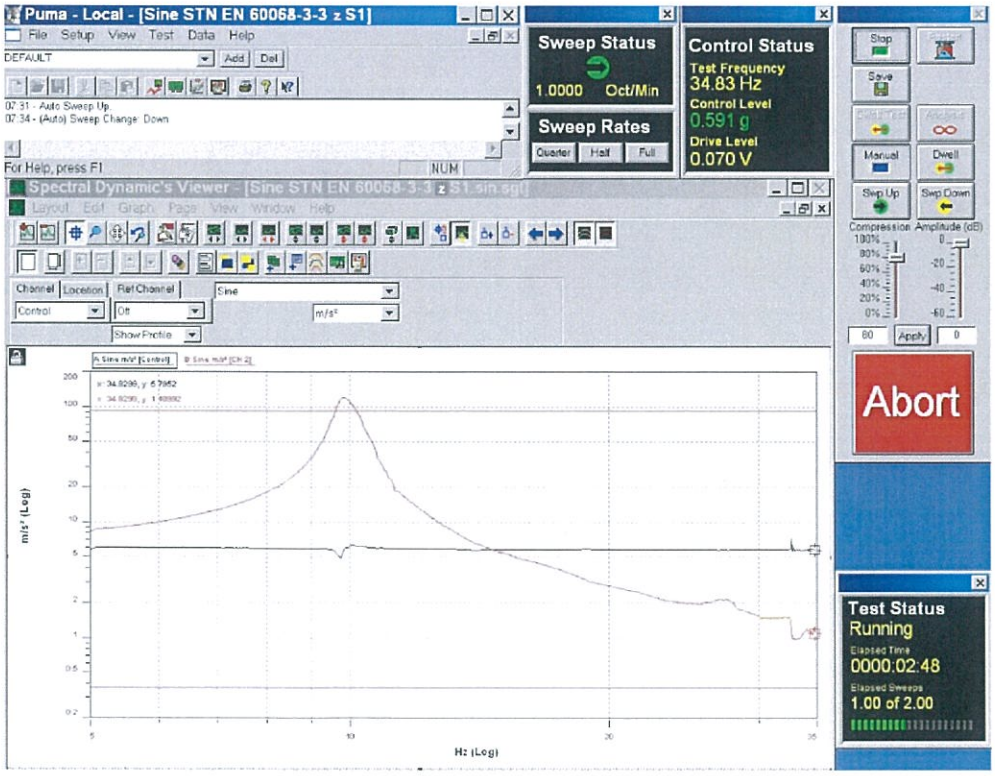
Recordings of signals from control sensor and sensor recording the vibration responses, cable ladder type A 20–FM–100–15, at test of seismic eligibility Level S2 there in "x" axis.



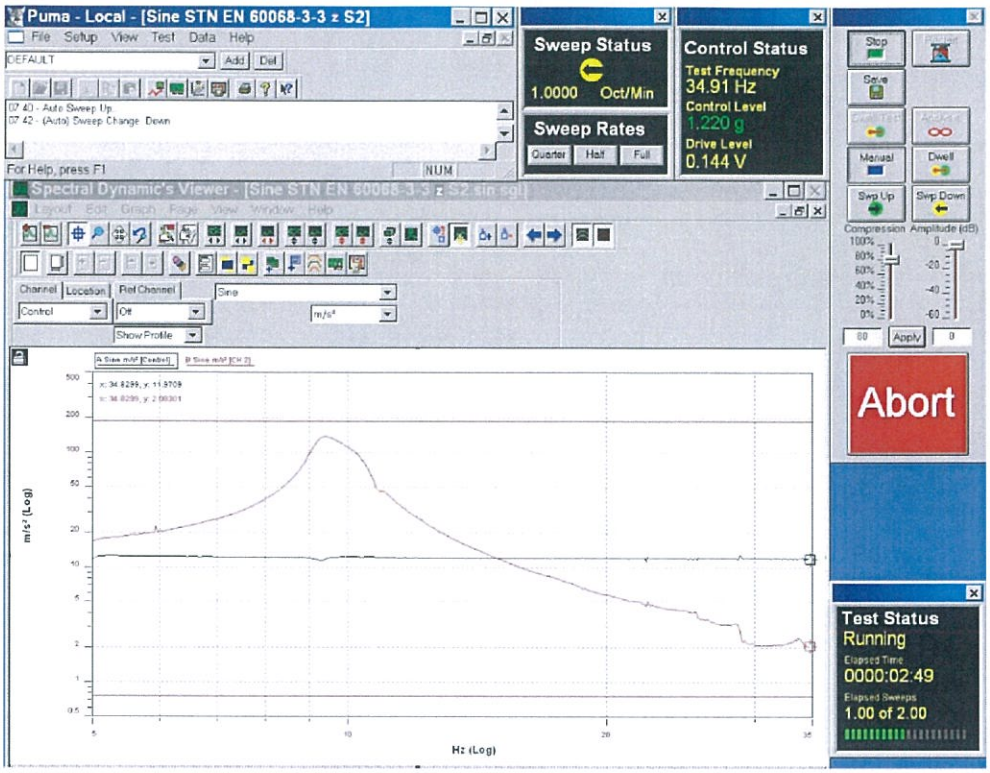
Recordings of signals from control sensor and sensor recording the vibration responses, cable ladder type A 20–FM–100–15, at test of resonant frequency assessment there in "z" axis.



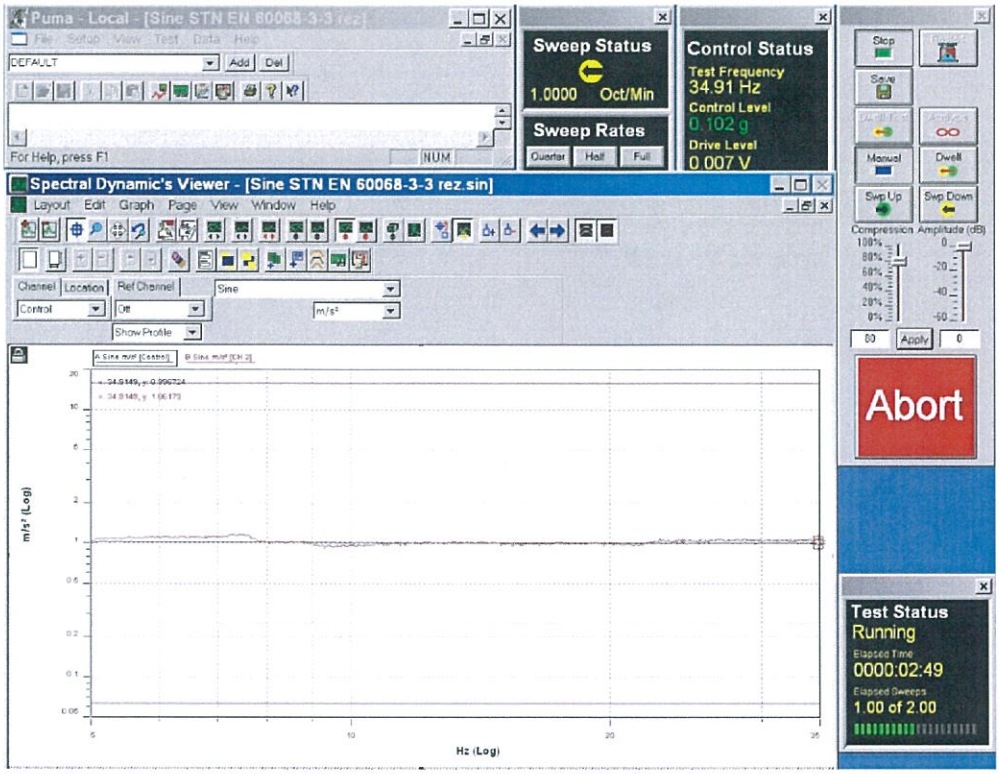
Recordings of signals from control sensor and sensor recording the vibration responses, cable ladder type A 20–FM–100–15, at test of seismic eligibility Level S1 there in "z" axis.



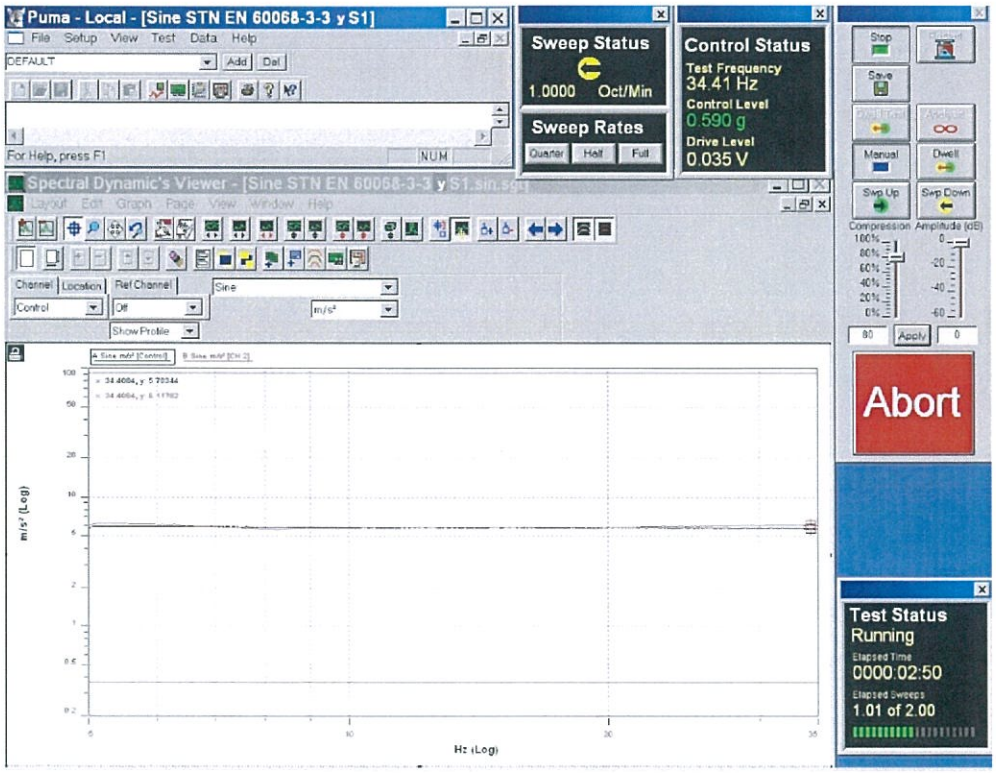
Recordings of signals from control sensor and sensor recording the vibration responses, cable ladder type A 20–FM–100–15, at test of seismic eligibility Level S2 there in "z" axis.



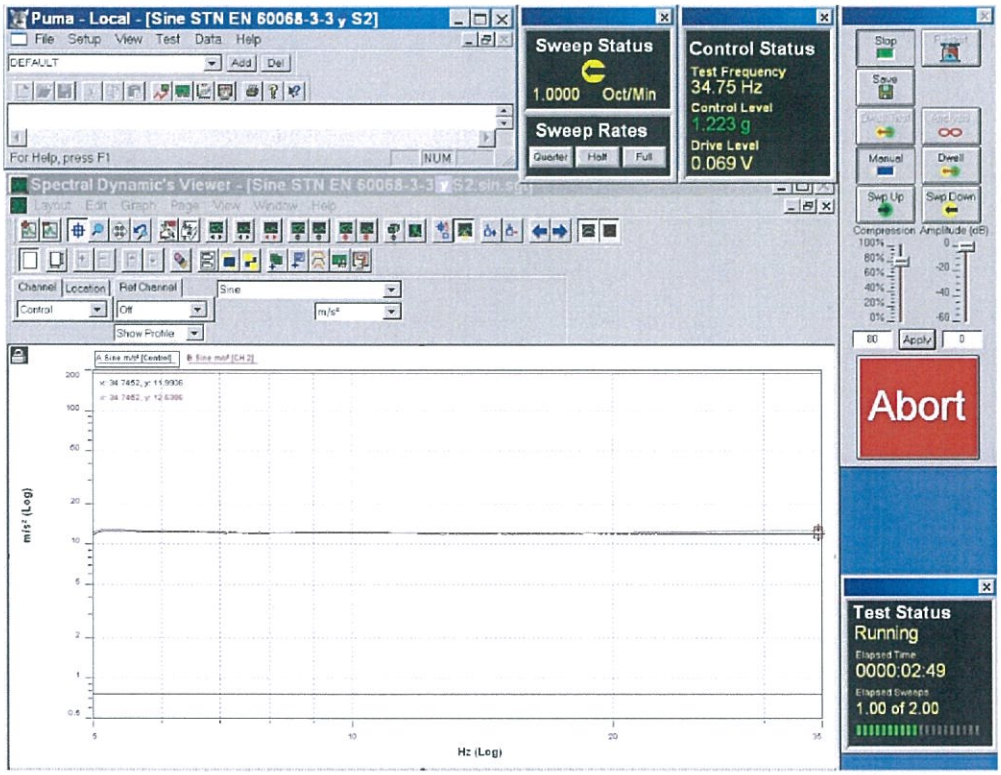
Recordings of signals from control sensor and sensor recording the vibration responses, cable trays type A 05–05A–15, at test of resonant frequency assessment there in "y" axis.



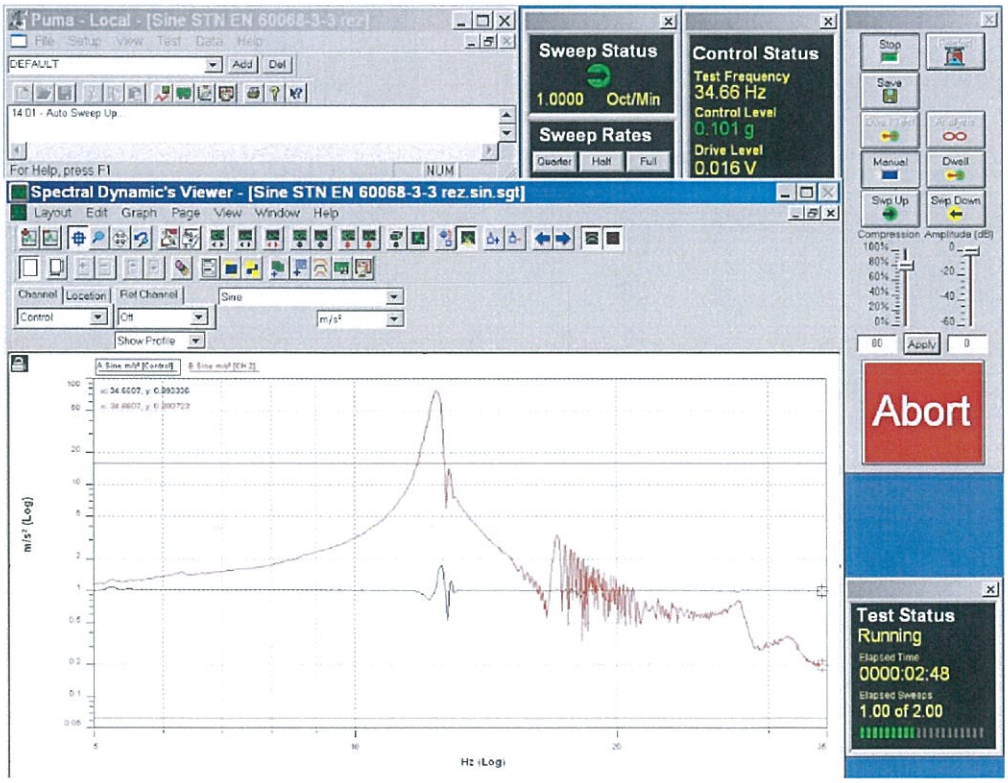
Recordings of signals from control sensor and sensor recording the vibration responses, cable trays type A 05–05A–15, at test of seismic eligibility Level S1 there in "y" axis.



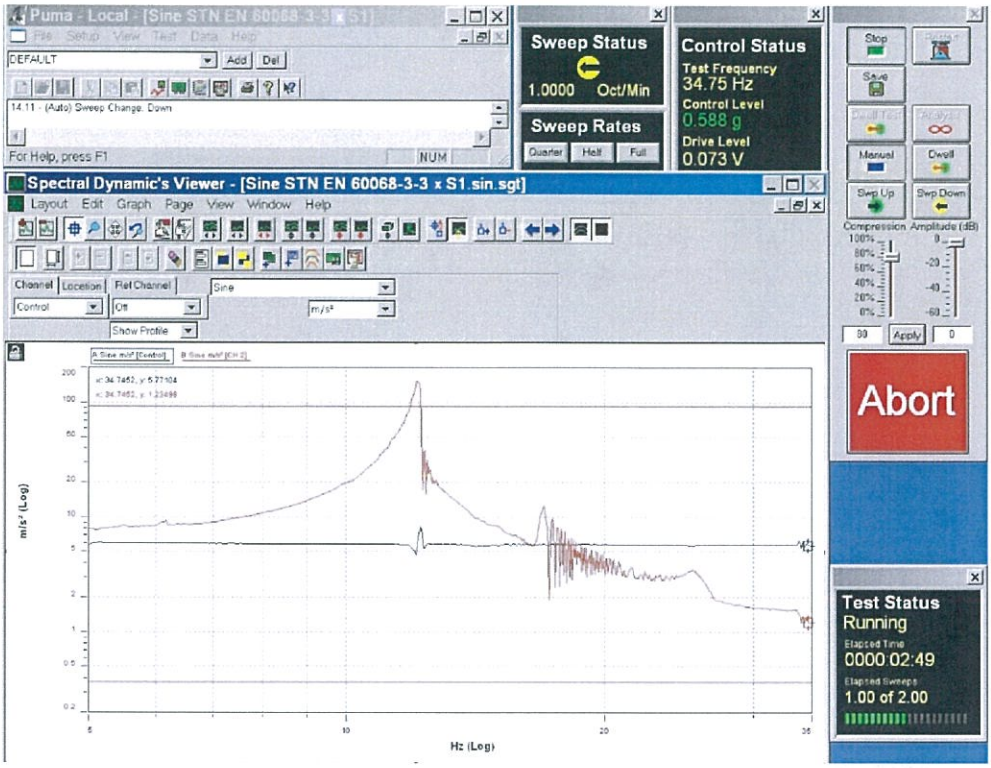
Recordings of signals from control sensor and sensor recording the vibration responses, cable trays type A 05–05A–15, at test of seismic eligibility Level S2 there in “y” axis.



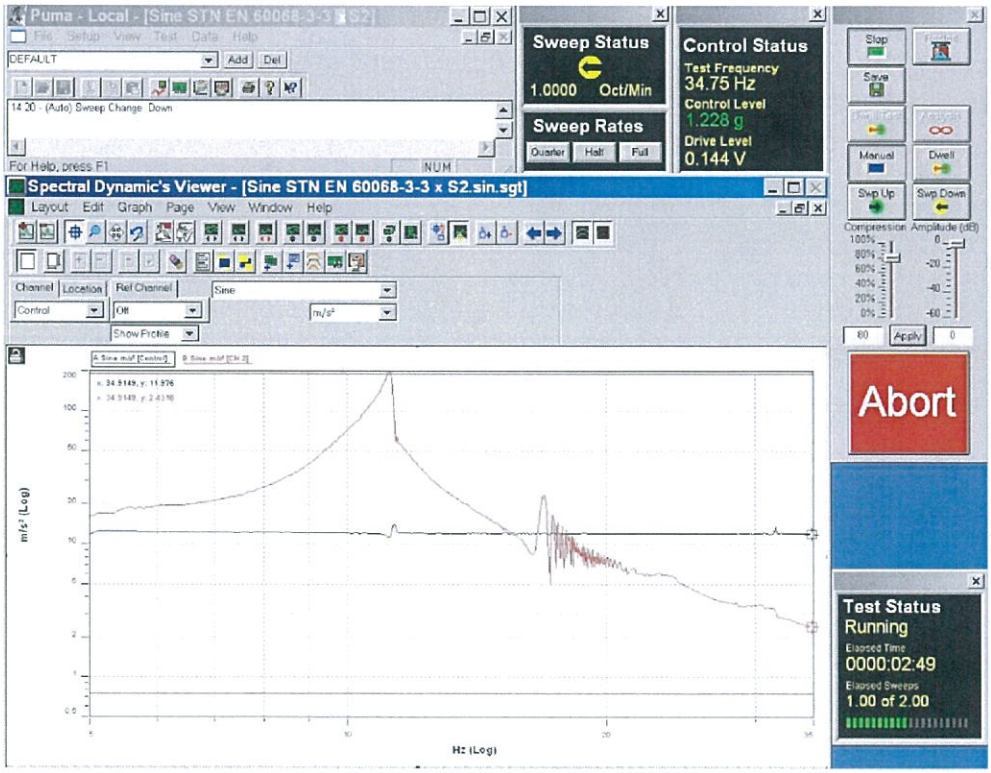
Recordings of signals from control sensor and sensor recording the vibration responses, cable trays type A 05–05A–15, at test of resonant frequency assessment there in “x” axis.



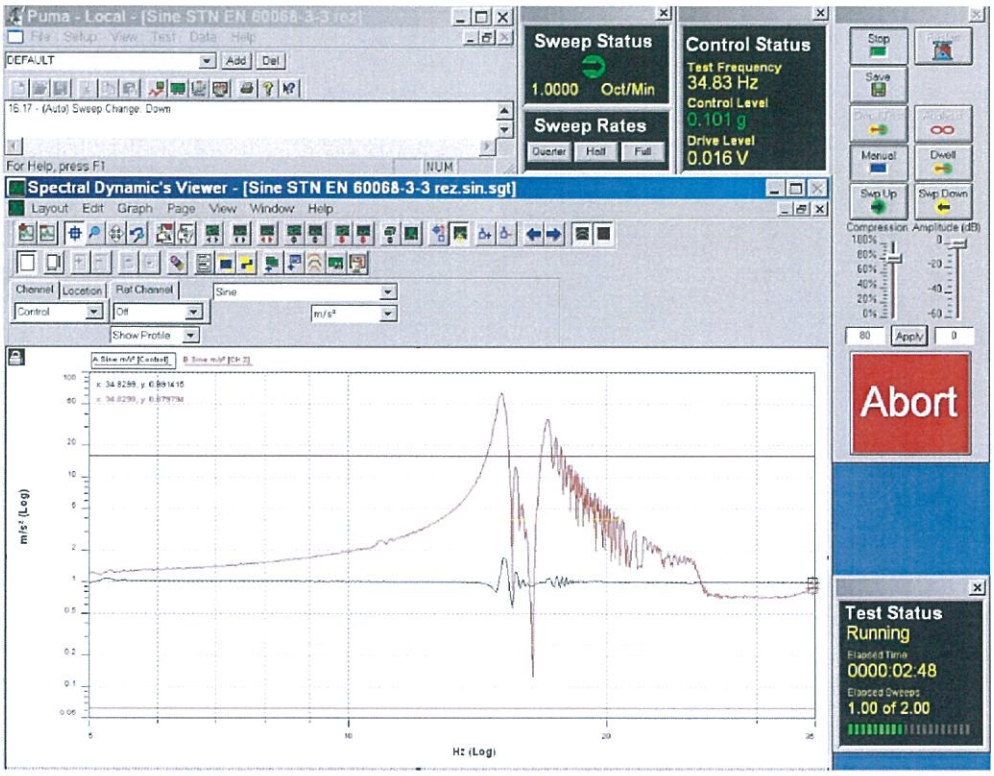
Recordings of signals from control sensor and sensor recording the vibration responses, cable trays type A 05–05A–15, at test of seismic eligibility Level S1 there in "x" axis.



Recordings of signals from control sensor and sensor recording the vibration responses, cable trays type A 05–05A–15, at test of seismic eligibility Level S2 there in "x" axis.



Recordings of signals from control sensor and sensor recording the vibration responses, cable trays type A 05–05A–15, at test of resonant frequency assessment there in "z" axis.



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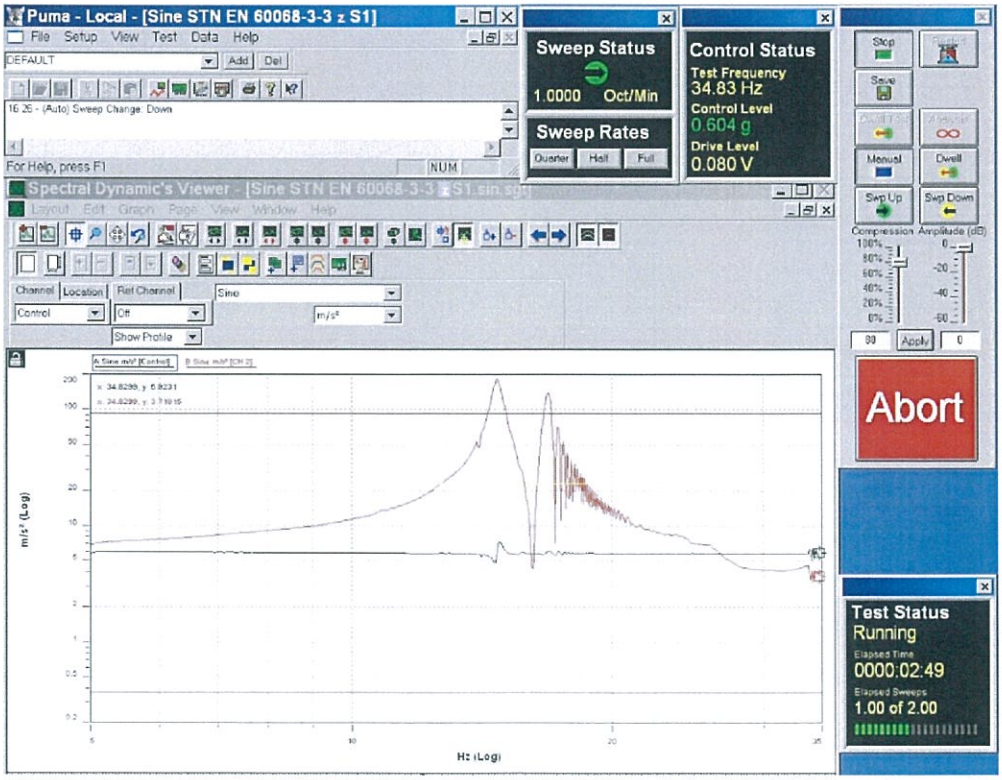

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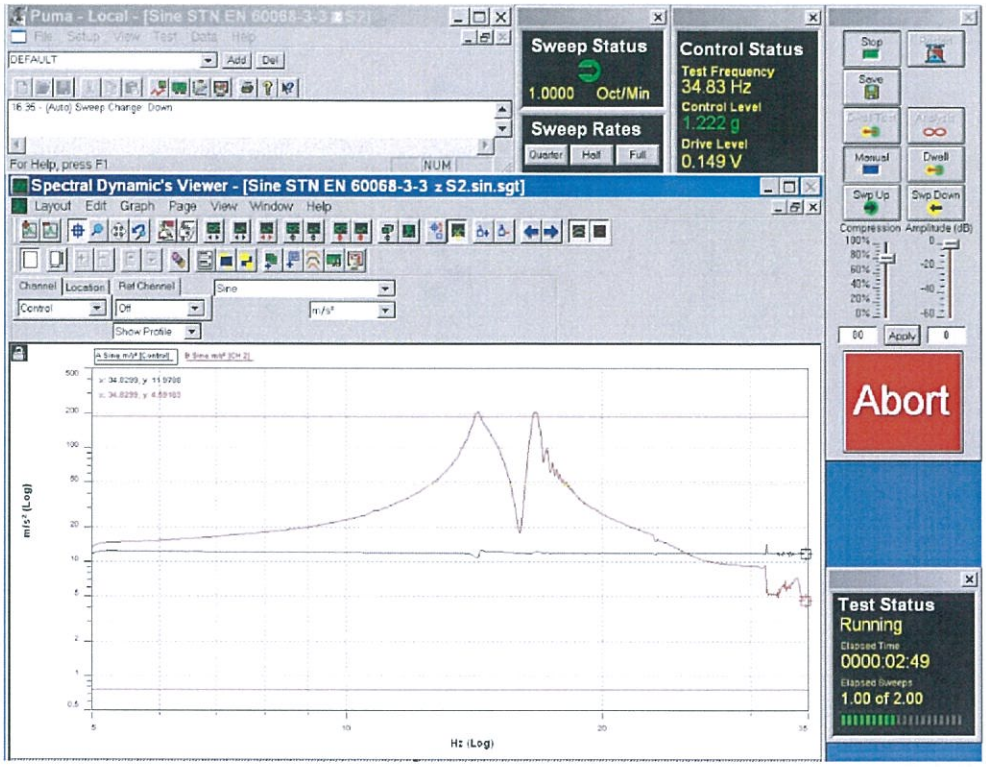
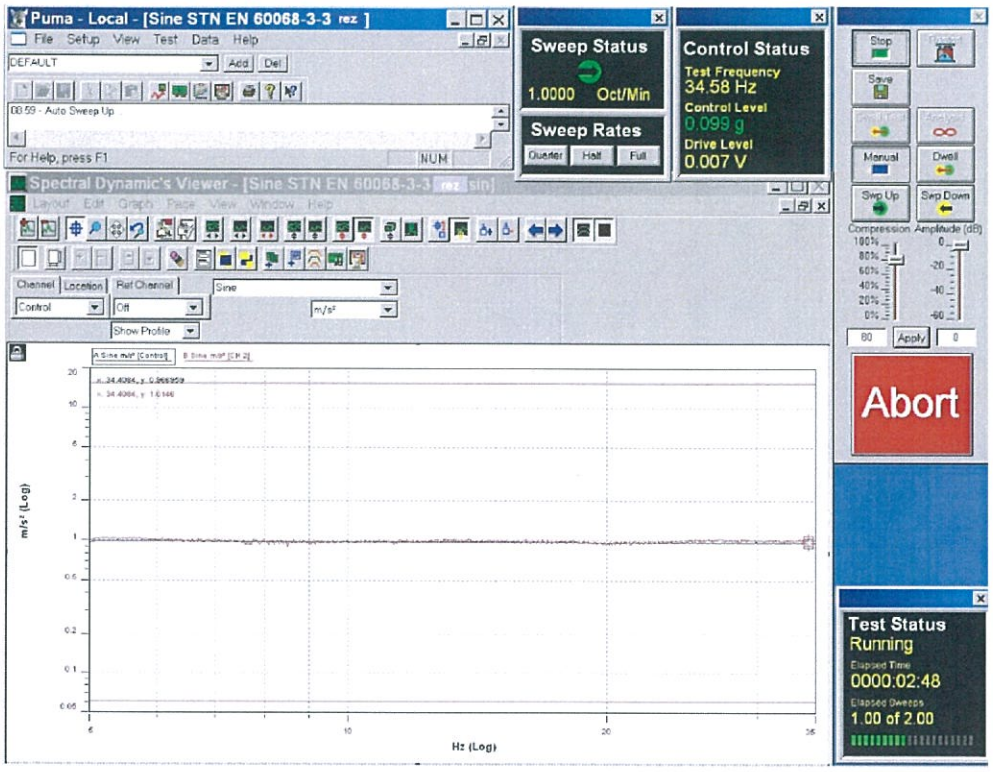
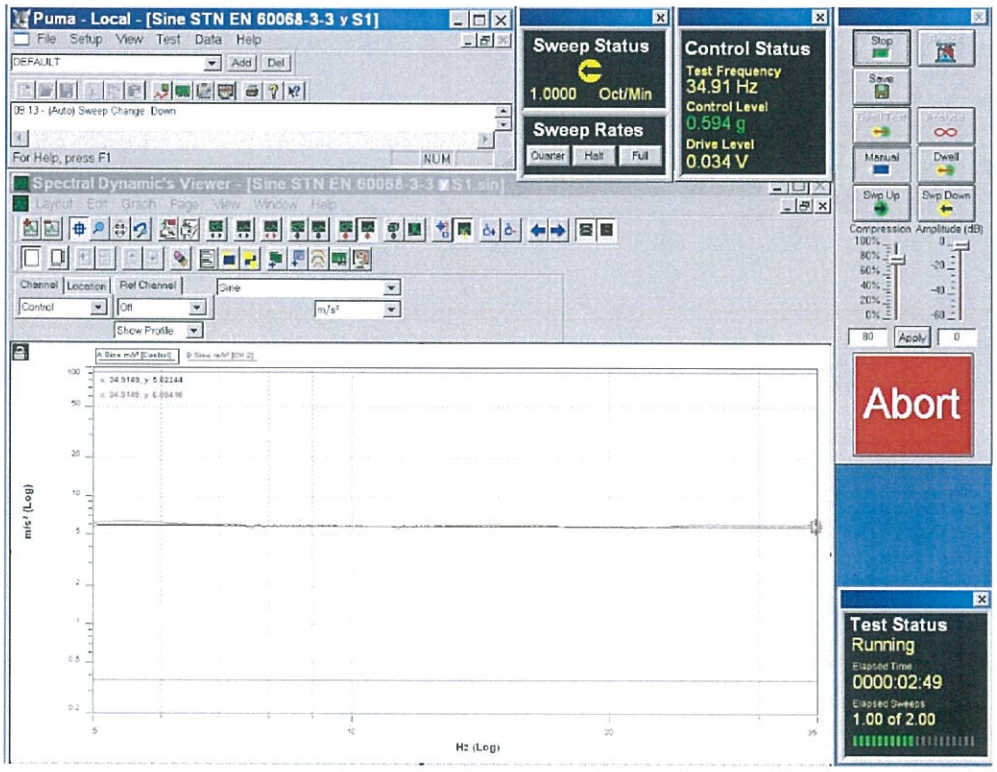


Recordings of signals from control sensor and sensor recording the vibration responses, cable channel type ATK–10–15, at test of resonant frequency assessment there in “y” axis.



Recordings of signals from control sensor and sensor recording the vibration responses, cable channel type ATK–10–15, at test of seismic eligibility Level S1 there in “y” axis.



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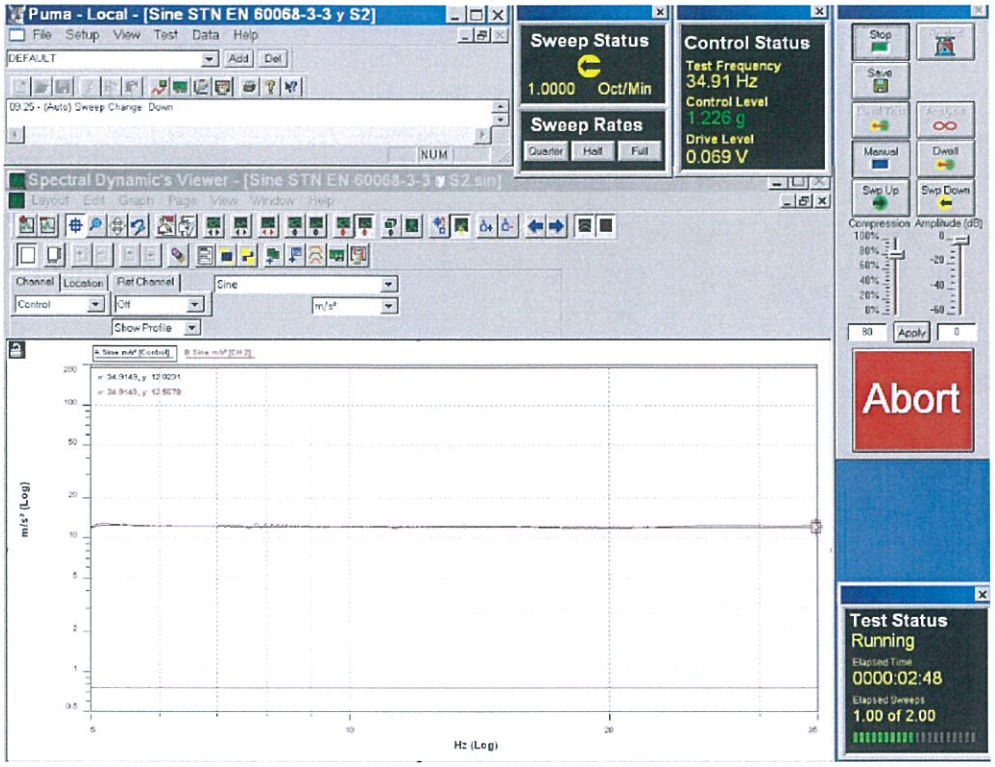

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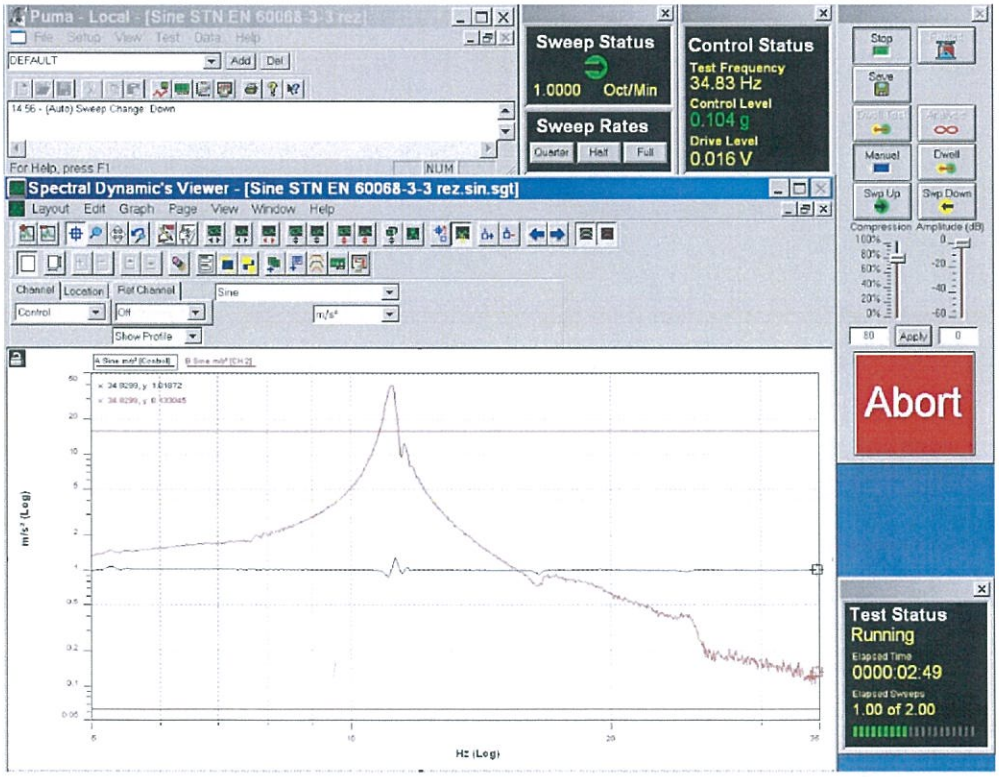

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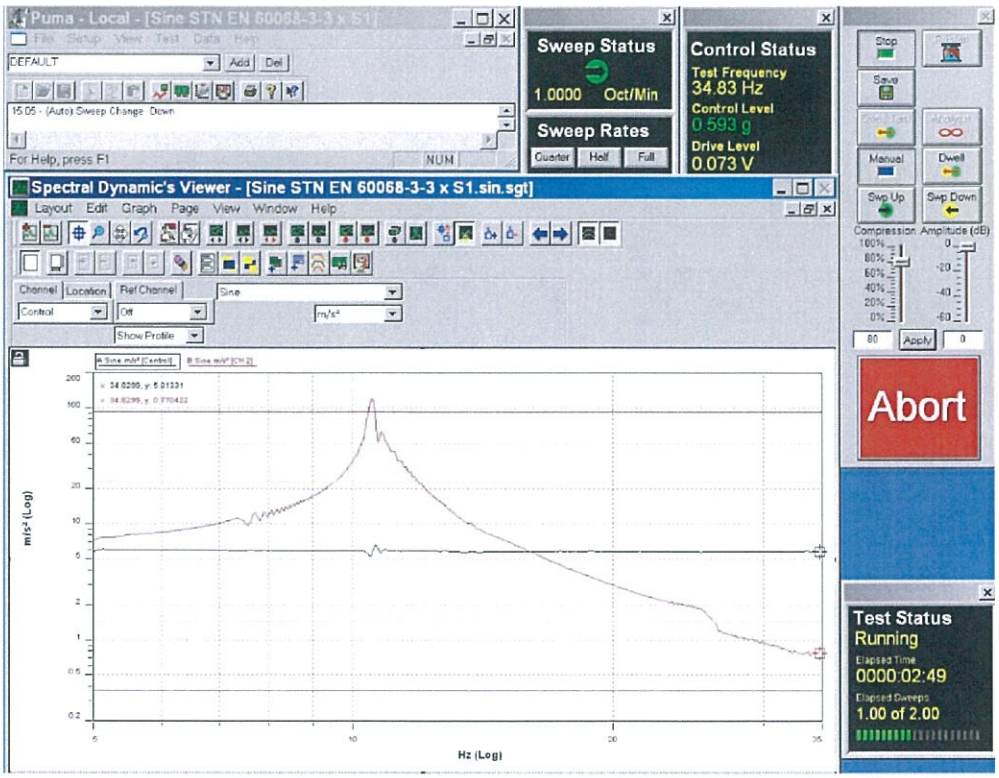
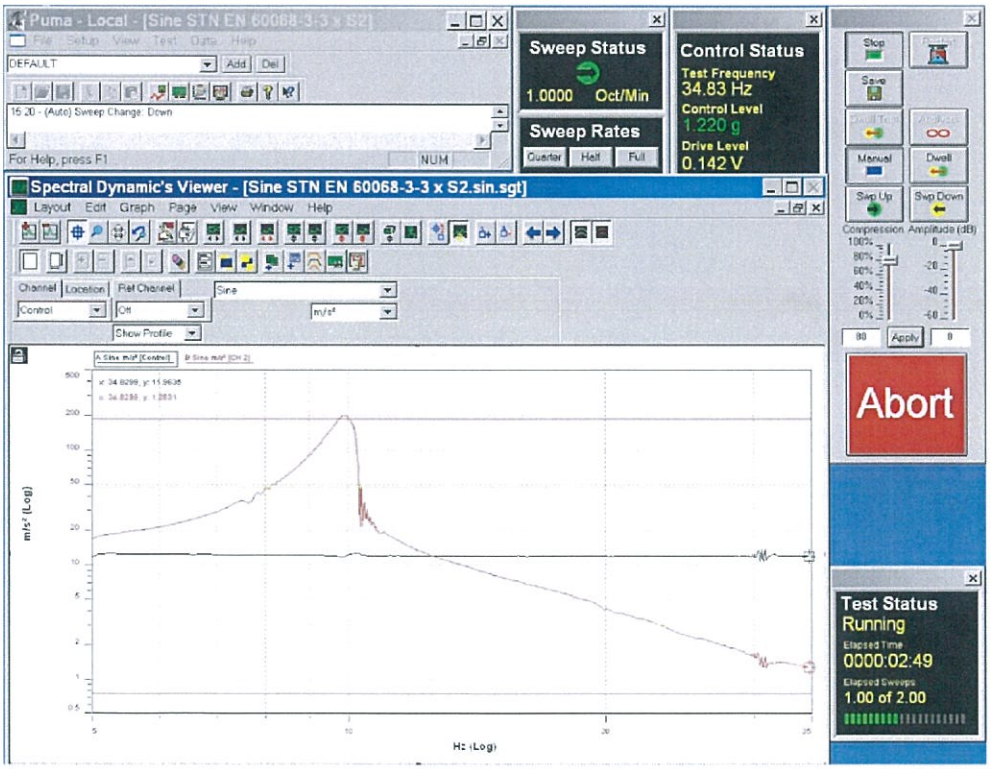
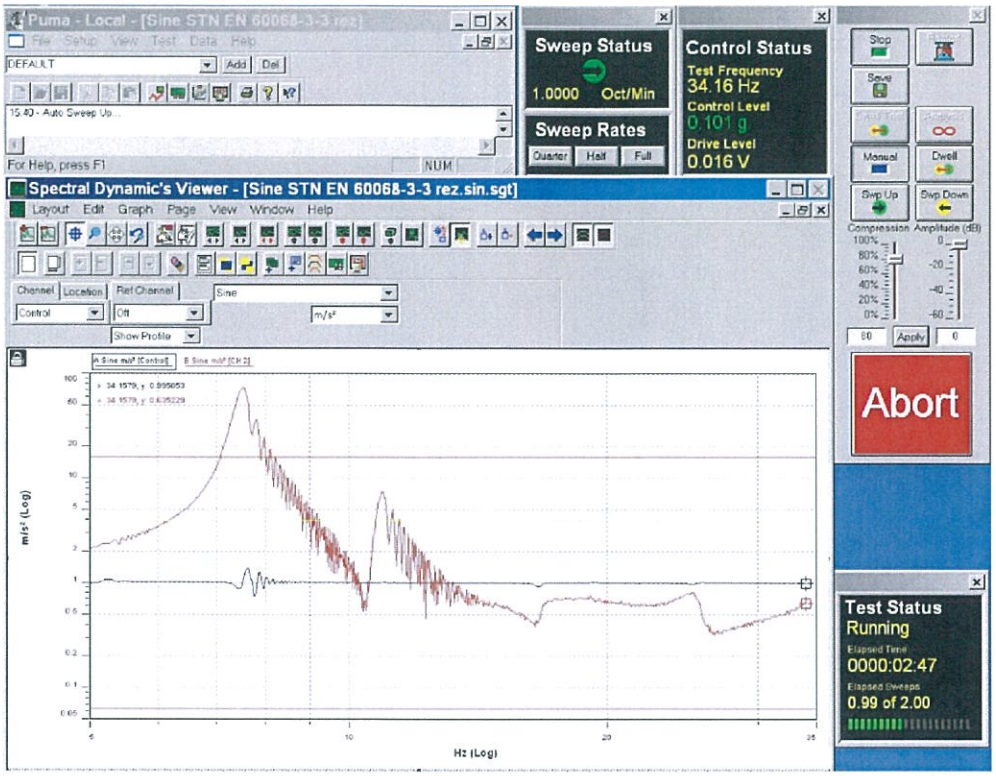


Recordings of signals from control sensor and sensor recording the vibration responses, cable channel type ATK–10–15, at test of seismic eligibility Level S2 there in “x” axis.



Recordings of signals from control sensor and sensor recording the vibration responses, cable channel type ATK–10–15, at test of resonant frequency assessment there in "z" axis.



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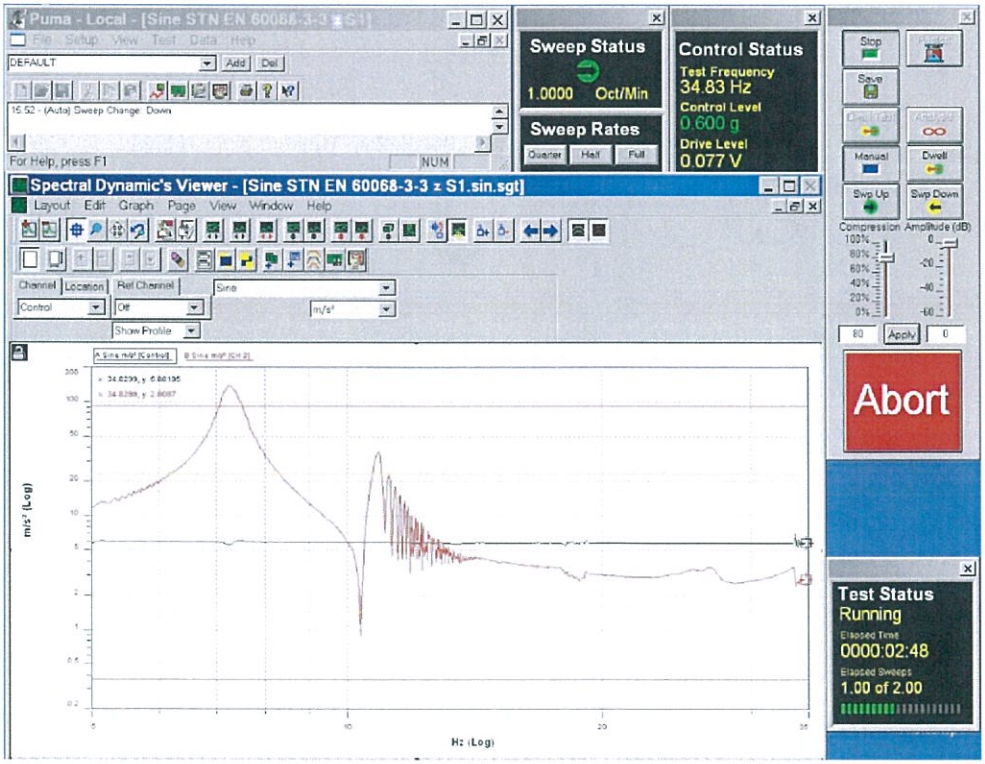

Recordings of signals from control sensor and sensor recording the vibration responses, cable channel type ATK–10–15, at test of seismic eligibility Level S2 there in "z" axis.