

# **Vibration Engineering CONSULTANTS**

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RP

BASKIN ENGINEERING

Rm 64A  
64C  
64D

April 15, 2005

**Site Survey Report  
Vibration, EMI and Acoustics**

Rm 64

**University of California, Santa Cruz  
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**Hitachi S4800  
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Prepared for

**University of California, Santa Cruz**

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- **Introduction**

The purpose of this measurement survey was to establish the floor vibration, the electromagnetic interference (EMI) and the acoustic intensity levels at the candidate locations for the proposed Hitachi S4800 Scanning Electron Microscope.

- **Instrumentation**

The instrumentation utilized to conduct the testing is itemized below:

Spectrum Analyzer	Data Physics ACE DP-104
Accelerometer	Wilcoxon Research 731A seismic accelerometer, Serial Number 1561 & 1568, 1000 Volt per G
AC EMI	MSI Magcheck 95, 1.0 millivolt per milligauss
DC EMI	MEDA u-Mag # 3267 Fluxgate Sensor
Microphone	RS 33-2050

All instrumentation and the spectrum analyzer are currently calibrated with documentation in place traceable to the National Institute of Standards and Technology.

The analyzer has a low range sensitivity to -130 dB referenced to 1 volt.

- **Procedures**

Vibration measurements were made on the floor in three directions at the locations where the scanning electron microscope is proposed to be located. The EMI and sound pressure measurements were made approximately four feet above the floor.

The Peak-Peak acceleration measurements were made at a bandwidth of 250 hertz. Power spectra functions of displacement are produced from the acceleration measurements by double integration. The displacement spectra with 250 hertz bandwidth, were taken and recorded on the disk of the analyzer.

The RMS EMI measurements were performed at a bandwidth of 625 hertz. Power spectra functions of EMI in three directions were recorded on disk for later processing and plotting.

The acoustic levels were measured with a calibrated microphone and the dBA and dBC levels were recorded and reported for each site.

All measurements were recorded on the internal disk of the analyzer for later processing. Measurements were taken under normal operating conditions.

The integrated displacement is calculated from the acceleration spectra by first dividing each amplitude value by the circular frequency ( $\omega = 2\pi \times \text{frequency}$ ) squared to obtain the

displacement spectra from the acceleration spectra and then integrating by computing the area under the curve. This method of calculation closely approximates the results obtained from an integrating analog displacement meter. It also accounts for both the broadband and narrow band displacement energy present in the floor spectra.

The test results are further summarized in the table(s) via peak to peak displacement, EMI ( rms ) values calculated from the power spectra functions and sound pressure level.

The measurement type, direction and measurement bandwidth are shown on each graph.

- **Specifications**

<b>Frequency Hz</b>	<b><math>\mu\text{m p-p}</math></b>
1.0	1.5
1.5	0.4
2.0	2.0
2.5	2.0
3 - 5	1.5
6	2.0
7	2.0
8 - 10	2.0

**EMI:** AC 0.1ut or 1 mg RMS  
DC 0.05ut or 0.5mg

**Acoustic Noise:** < 75 DBC

- **Conclusions**

**Site 1 Baskin 64 DE**

1. Vibration : Within published specification.
2. EMI : Within published specification.
3. Acoustical : Within published specification.
4. DC fields : No varying DC fields

**Site 2 Baskin 64 C**

5. Vibration : Within published specification.
6. EMI : Within published specification.
7. Acoustical : Within published specification.
8. DC fields : No varying DC fields

**Site 3 Baskin 64 A**

9. Vibration : Within published specification.
10. EMI : Within published specification.
11. Acoustical : Within published specification.
12. DC fields : No varying DC fields

**Vibration, EMI and Acoustical Levels**

**Site 1 Baskin 64 DE**

Vibration Levels				
Direction	Largest Displacement, microns Peak-Peak		Total Spectra RMS	Save
	$\mu\text{m}$	Hz		
X North - South	0.001	5.5	0.33	
Y East - West	0.001	5.3	0.33	
Z Vertical	0.001	24.2	0.72	
EMI				
	60 Hz RMS mGauss	180 Hz RMS mGauss	Total Spectra RMS	Save
X	0.1	0.01	0.21	
Y	0.1	0.01	0.24	
Z	0.1	0.02	0.15	
DC Field Change, mG p-p				
X	$\Delta$ 0.05			
Y	$\Delta$ 0.03			
Z	$\Delta$ 0.06			
Acoustics				
Level	56 dBA		58 dBC	

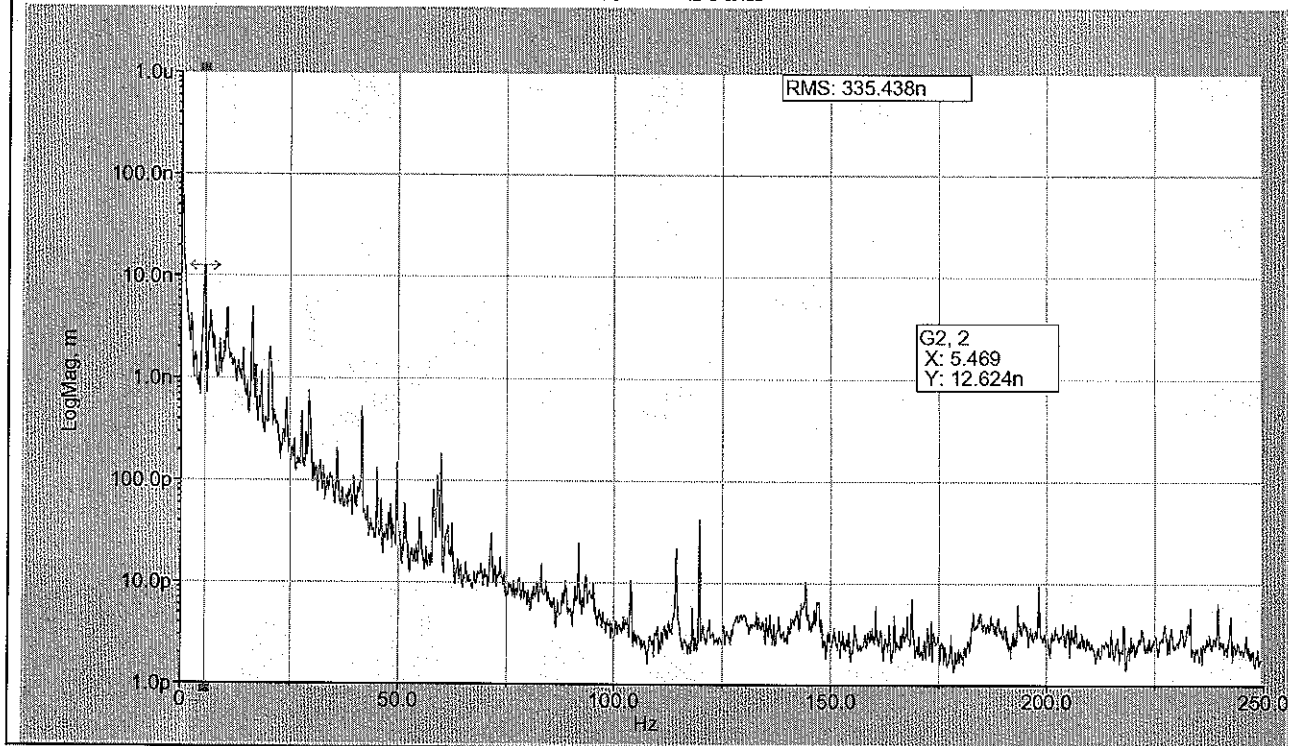
**Site 2 Baskin 64 C**

Vibration Levels				
Direction	Largest Displacement, microns Peak-Peak		Total Spectra RMS	Save
	$\mu\text{m}$	Hz		
X North - South	0.001	5.6	0.65	
Y East - West	0.002	20.8	0.002	
Z Vertical	0.001	24.2	0.39	
EMI				
	60 Hz RMS mGauss	180 Hz RMS mGauss	Total Spectra RMS	Save
X	0.1	0.1	0.17	
Y	0.18	0.1	0.30	
Z	0.13	0.05	0.24	
DC Field Change, mG p-p				
X	$\Delta$ 0.17			
Y	$\Delta$ 0.03			
Z	$\Delta$ 0.04			
Acoustics				
Level	50 dBA		58 dBC	

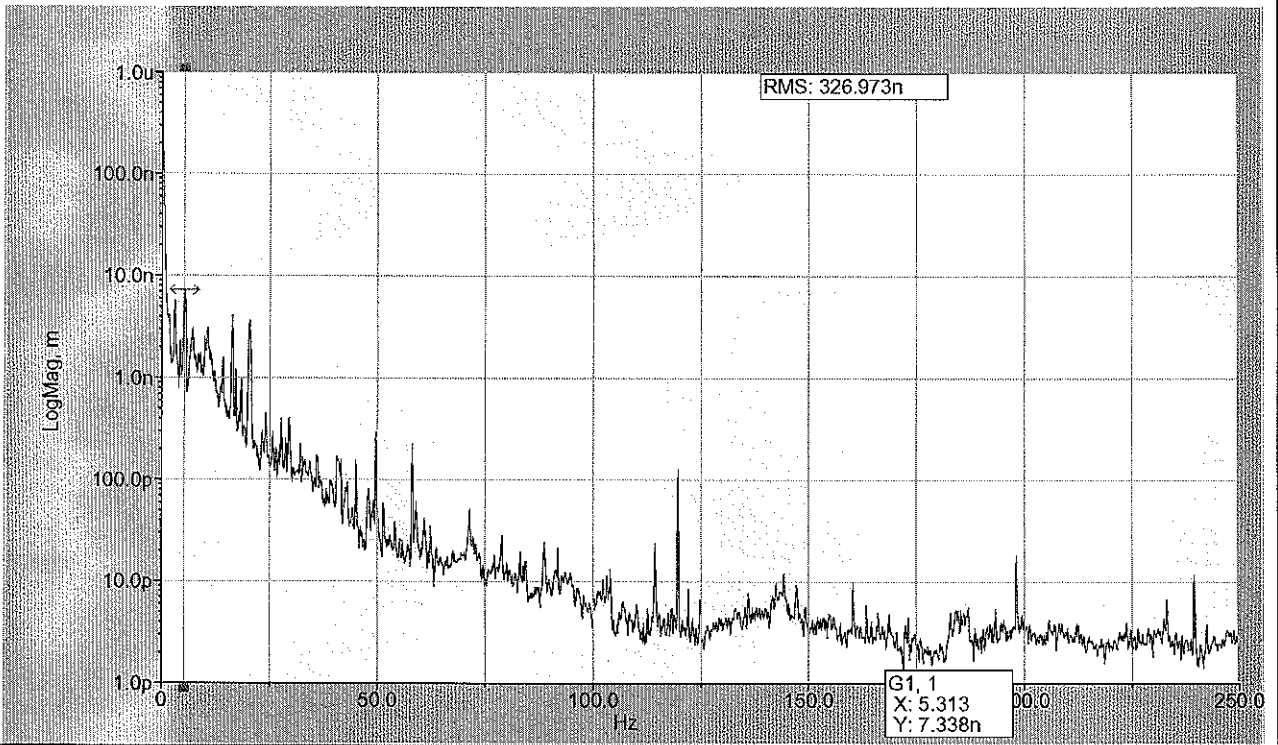
**Site 3 Baskin 64 A**

Vibration Levels				
Direction	Largest Displacement, microns Peak-Peak		Total Spectra RMS	Save
	$\mu\text{m}$	Hz		
X North - South	0.1	5.6	0.005	
Y East - West	0.1	20.9	0.005	
Z Vertical	0.1	20.6	0.40	
EMI				
	60 Hz RMS mGauss	180 Hz RMS mGauss	Total Spectra RMS	Save
X	0.69	0.10	0.72	
Y	0.24	0.05	0.28	
Z	0.08	0.05	0.15	
DC Field Change, mG p-p				
X	$\Delta$ 0.03			
Y	$\Delta$ 0.19			
Z	$\Delta$ 0.01			
Acoustics				
Level	60 dBA		63 dBC	

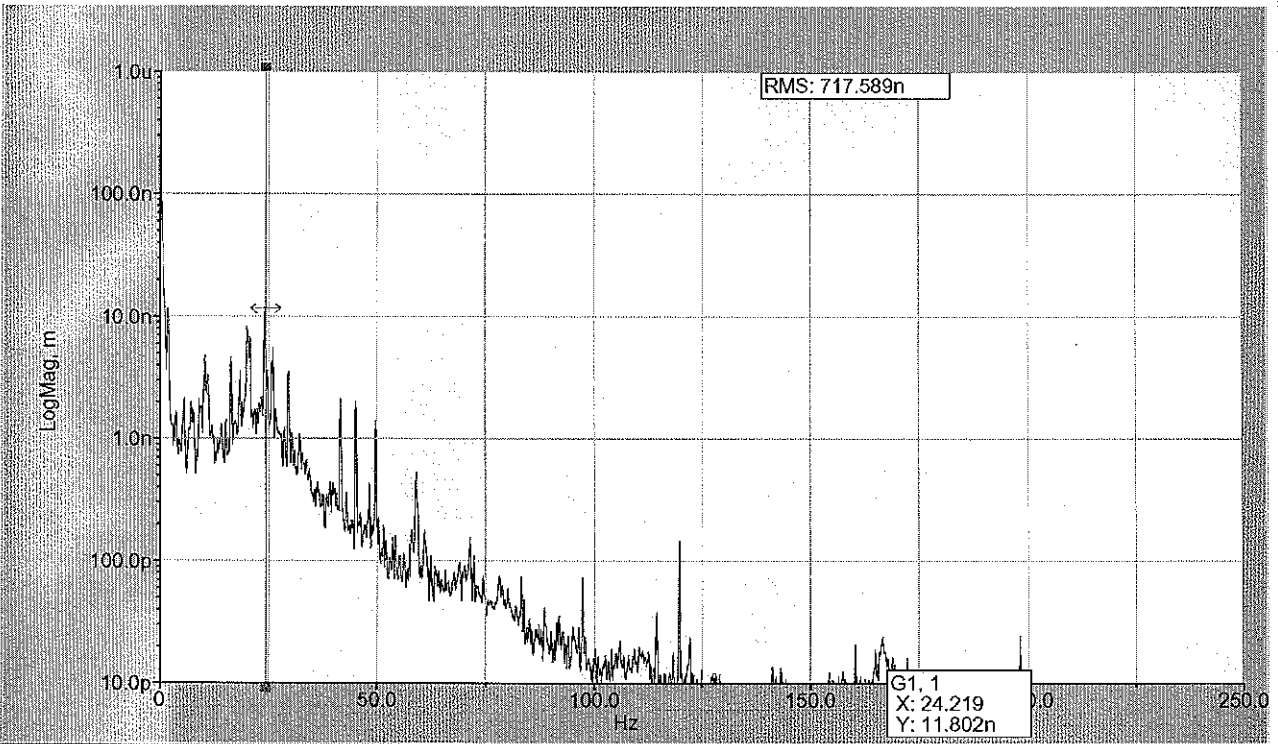
**Site 1 Baskin 64 DE – DISPLACEMENT North - South**



Site 1 Baskin 64 DE – DISPLACEMENT East - West

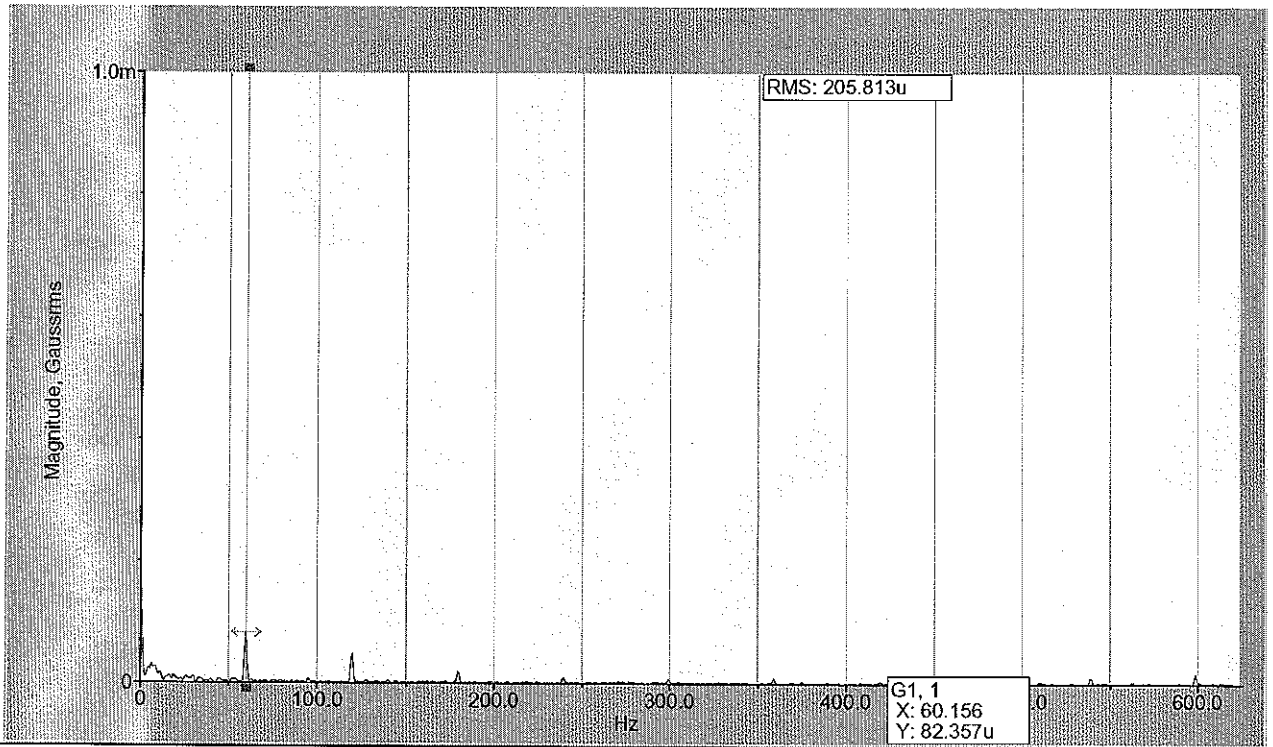


Site 1 Baskin 64 DE – DISPLACEMENT Z

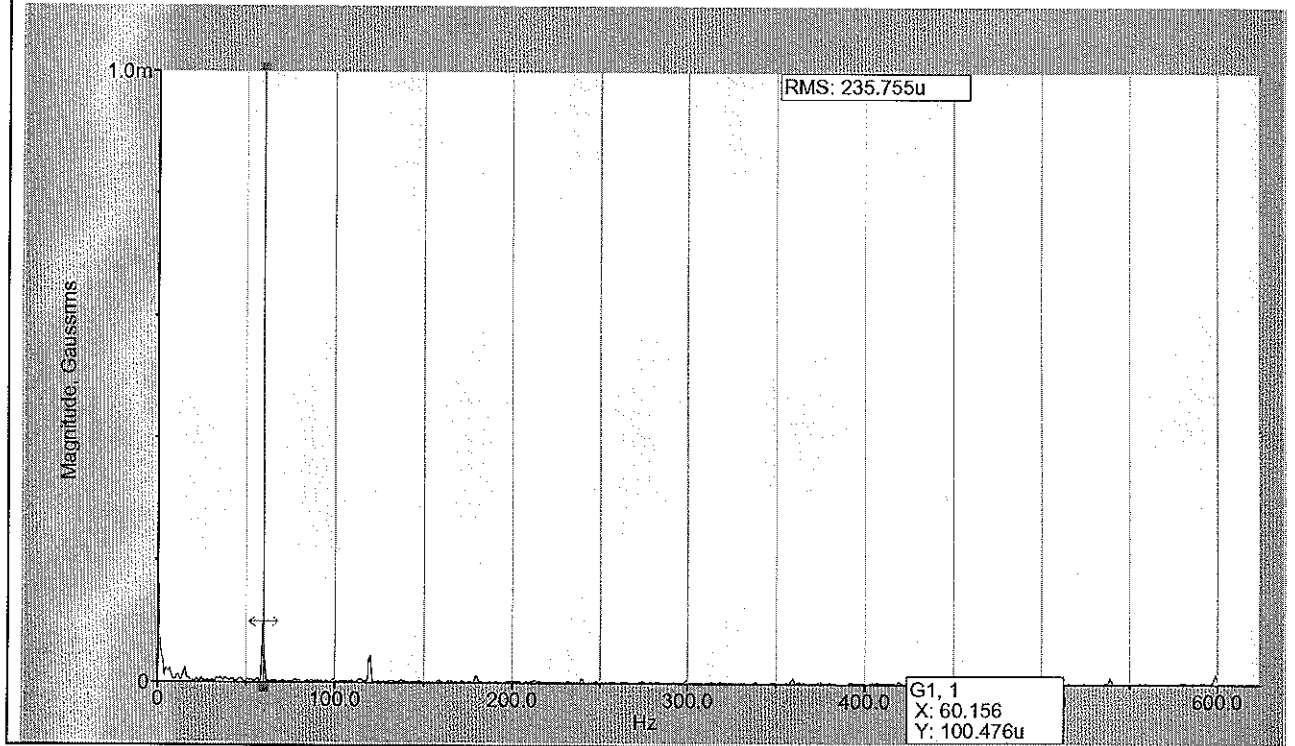




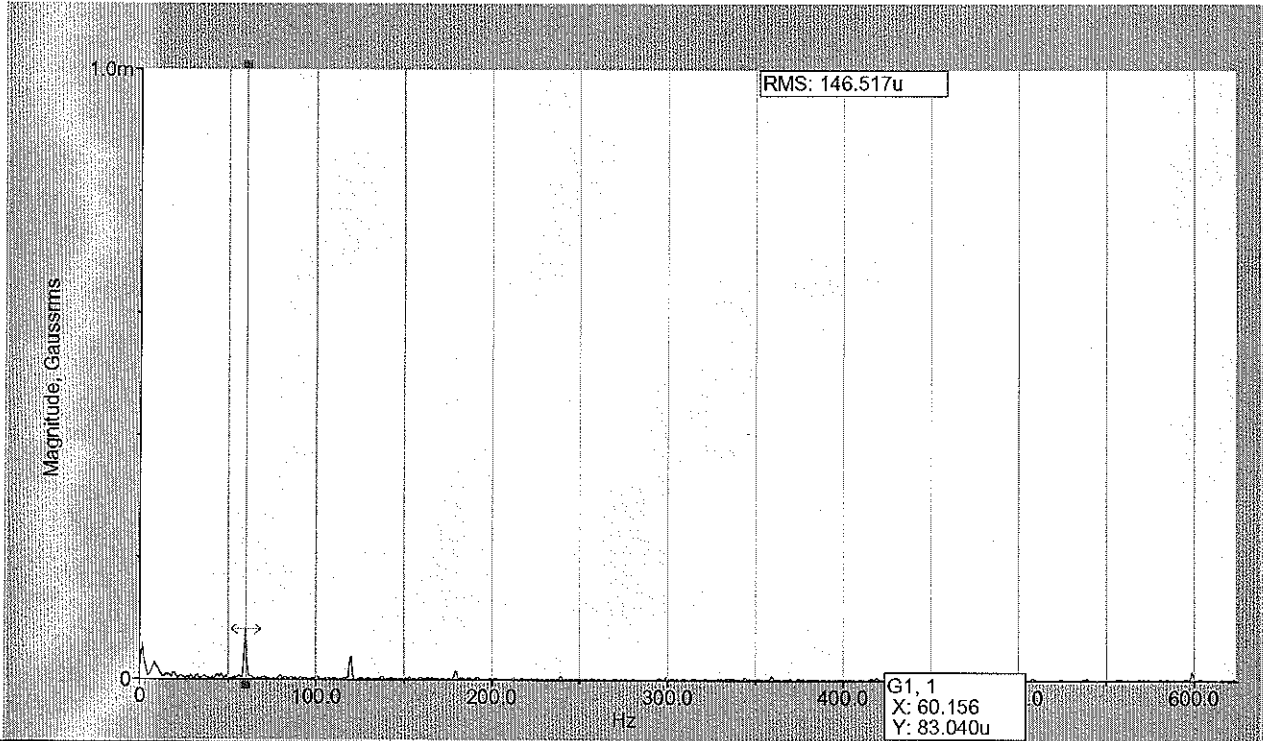
Site 1 Baskin 64 DE – EMI North - South



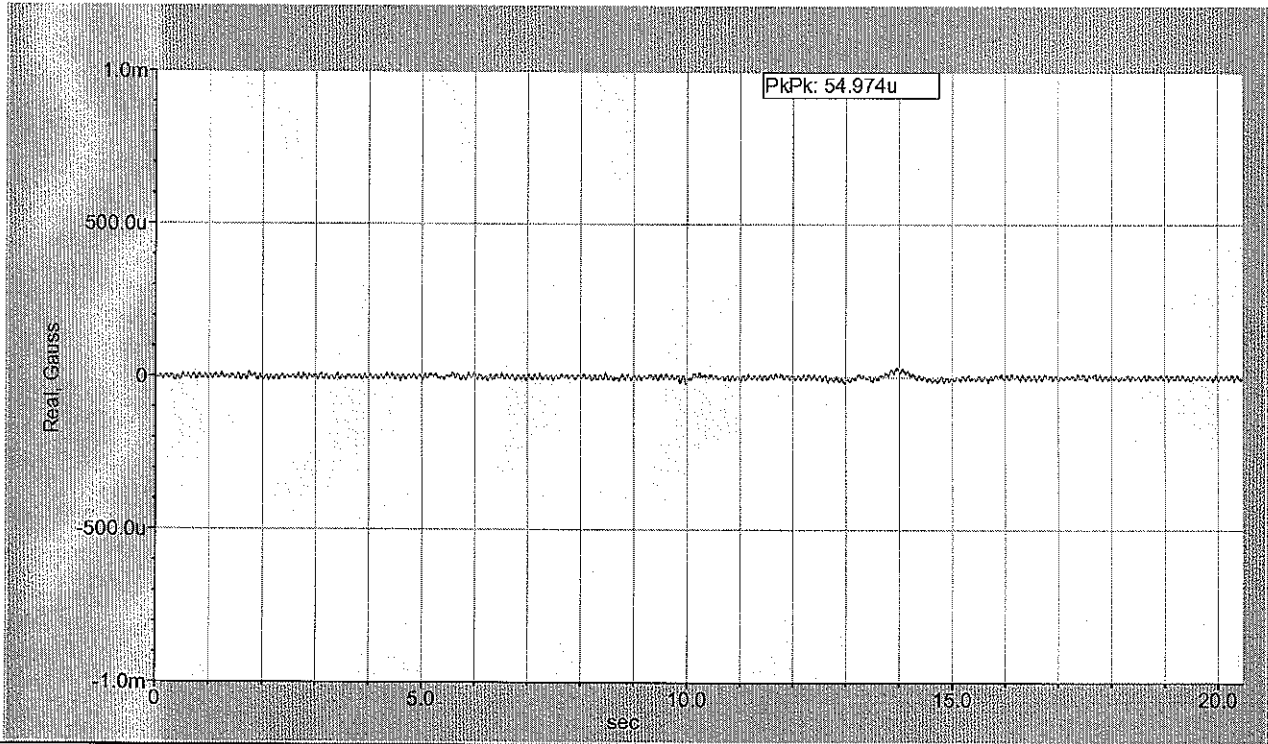
Site 1 Baskin 64 DE – EMI East - West



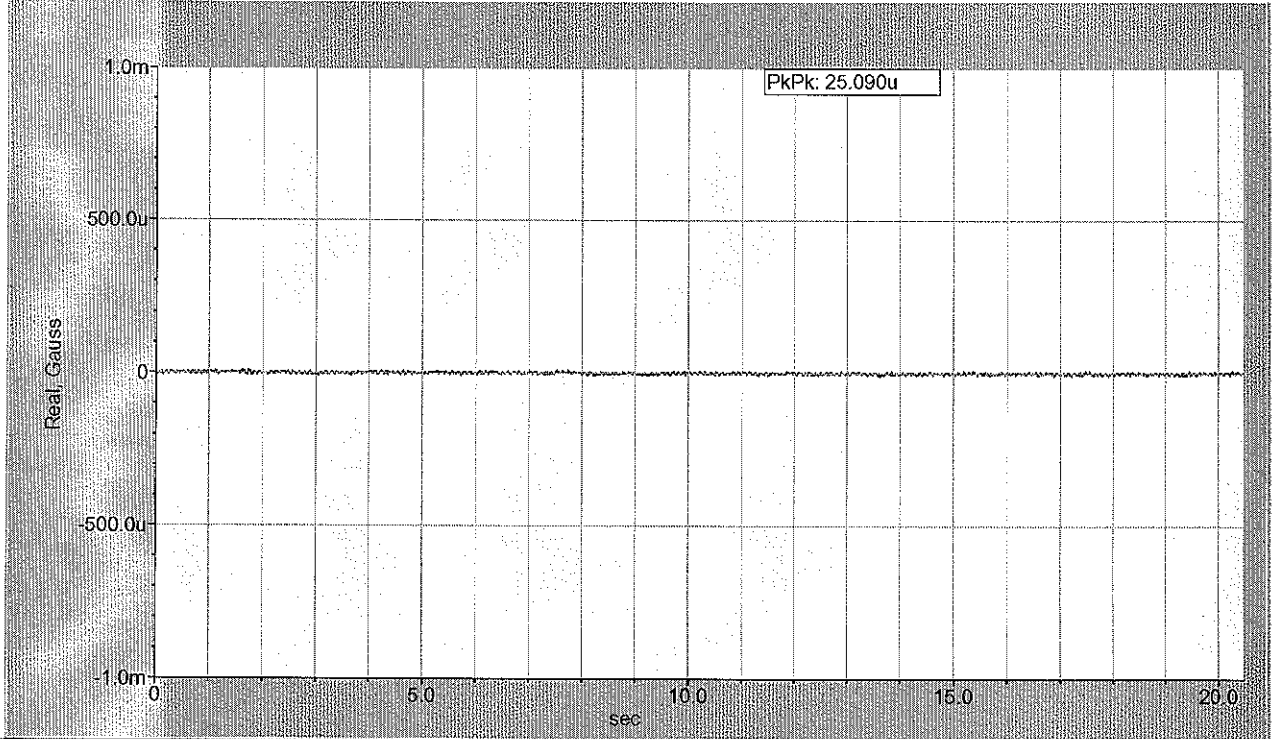
Site 1 Baskin 64 DE - EMI Z



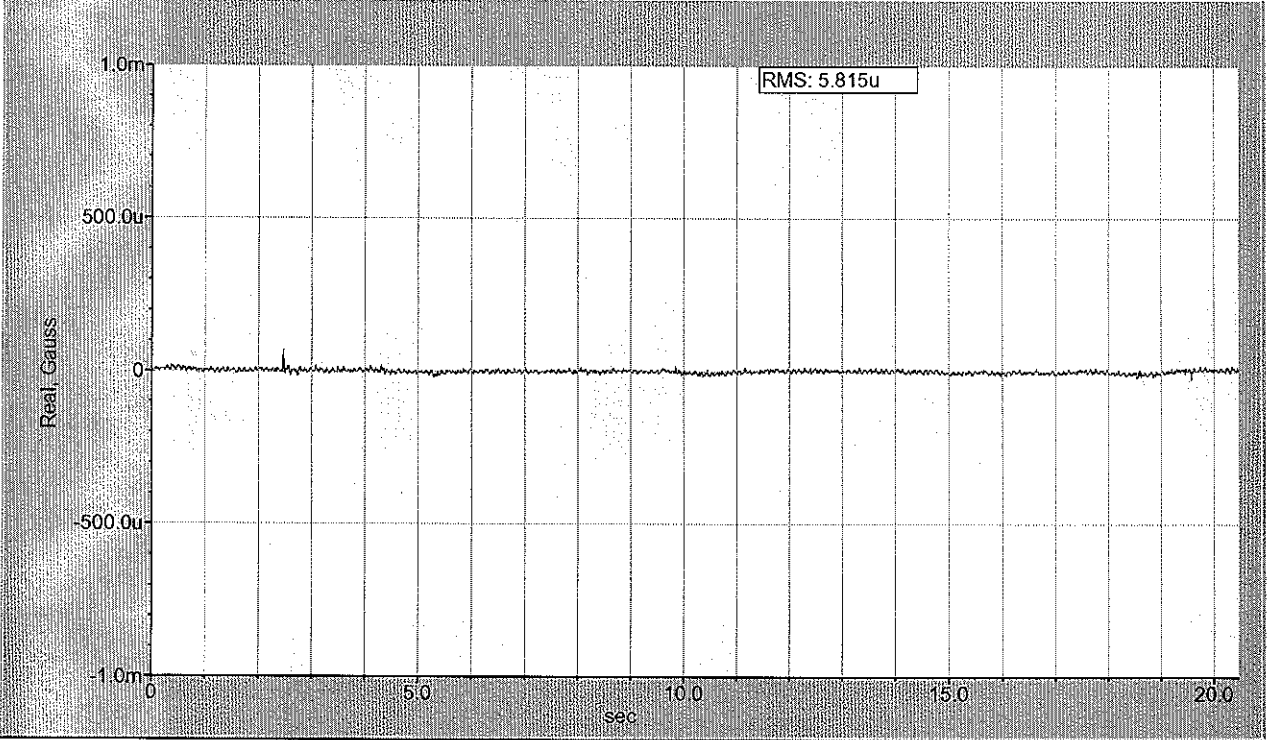
Site 1 Baskin 64 DE - DC Fields North - South



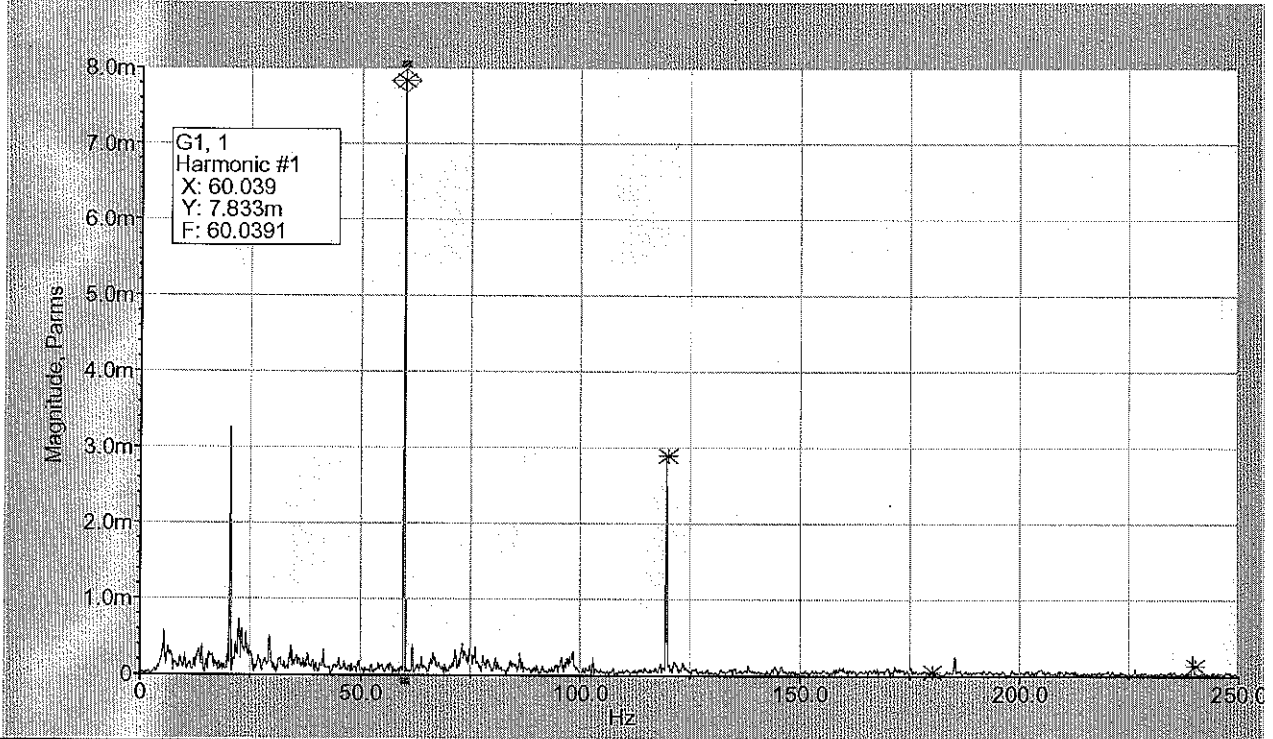
Site 1 Baskin 64 DE – DC Fields East - West



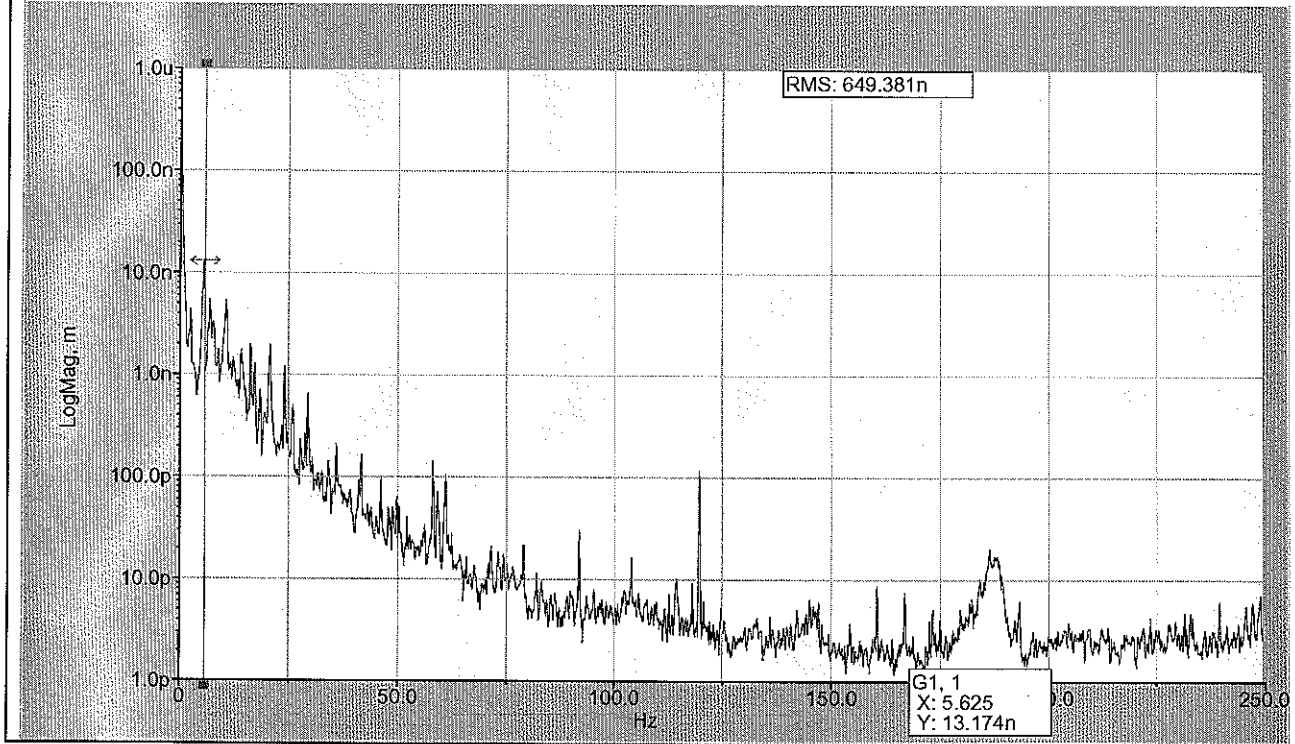
Site 1 Baskin 64 DE – DC Fields Z



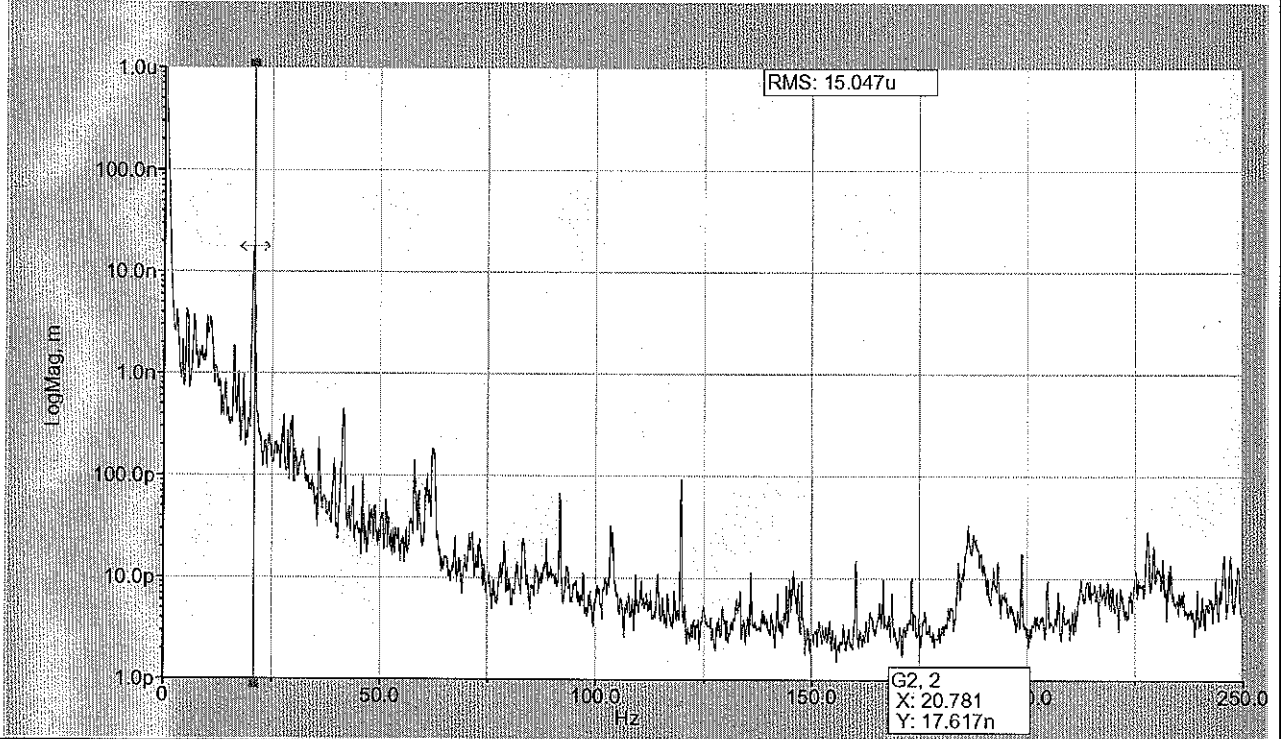
Site 1 Baskin 64 DE – ACOUSTICAL LEVEL, 56 dBa, 58 dBc



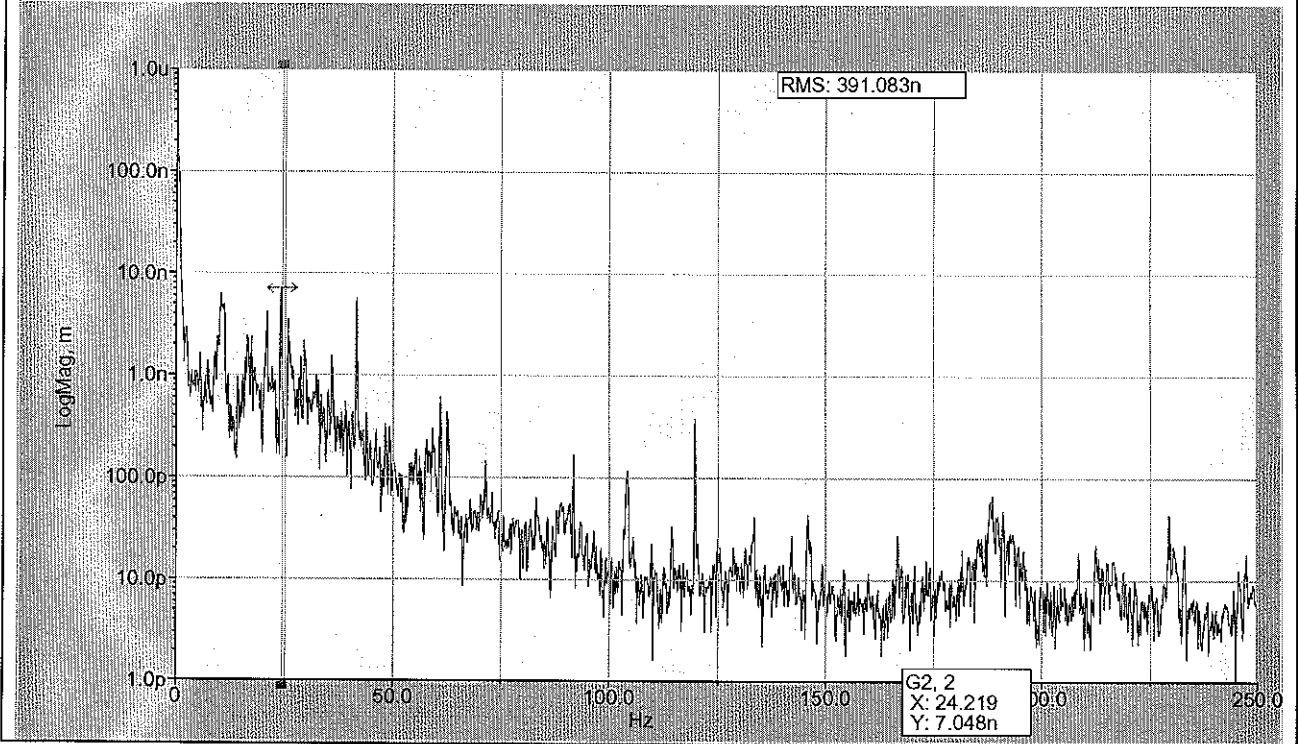
Site 2 Baskin 64 C – DISPLACEMENT North – South



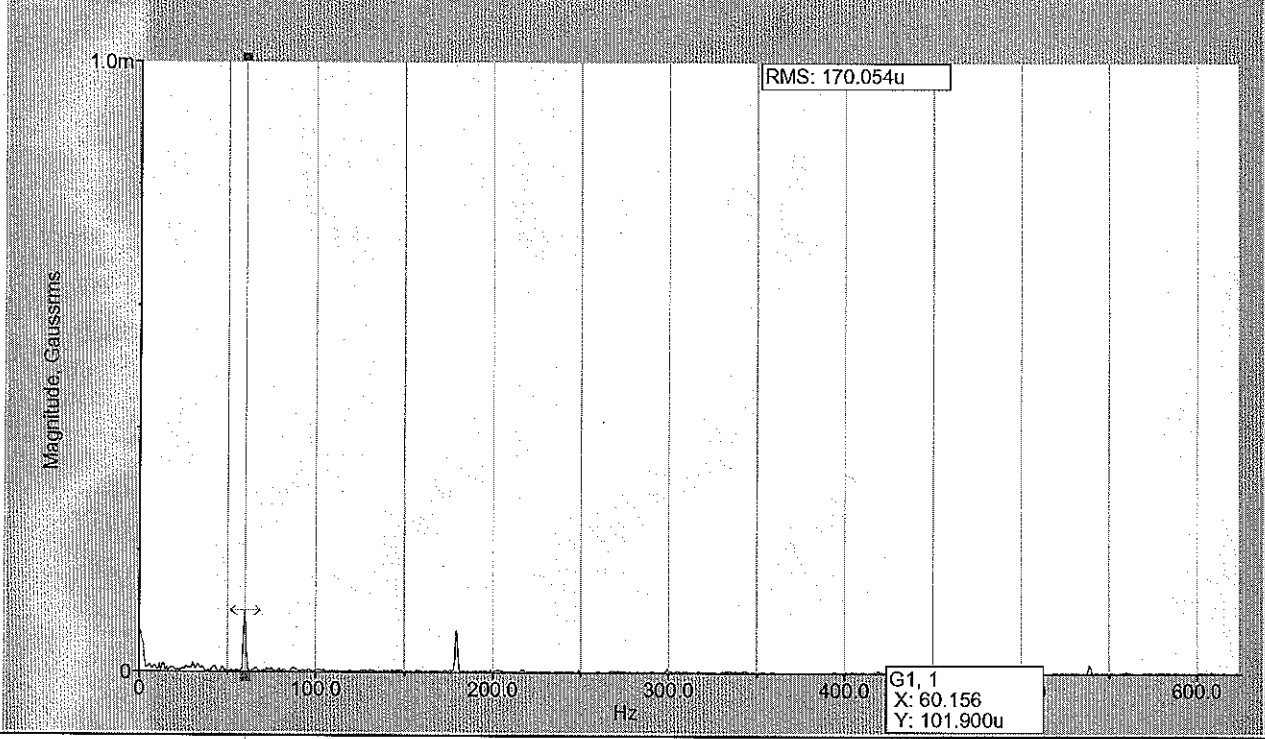
Site 2 Baskin 64 C – DISPLACEMENT East – West



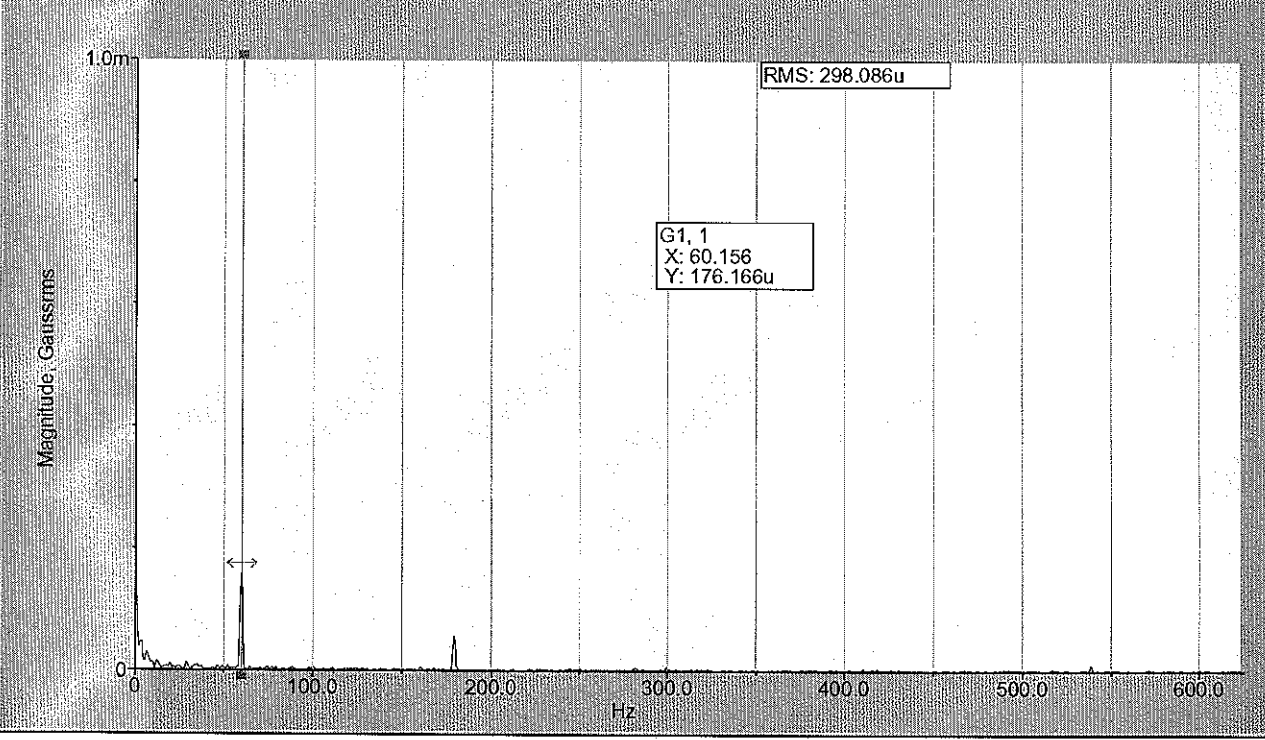
Site 2 Baskin 64 C – DISPLACEMENT Z



Site 2 Baskin 64 C – EMI North – South

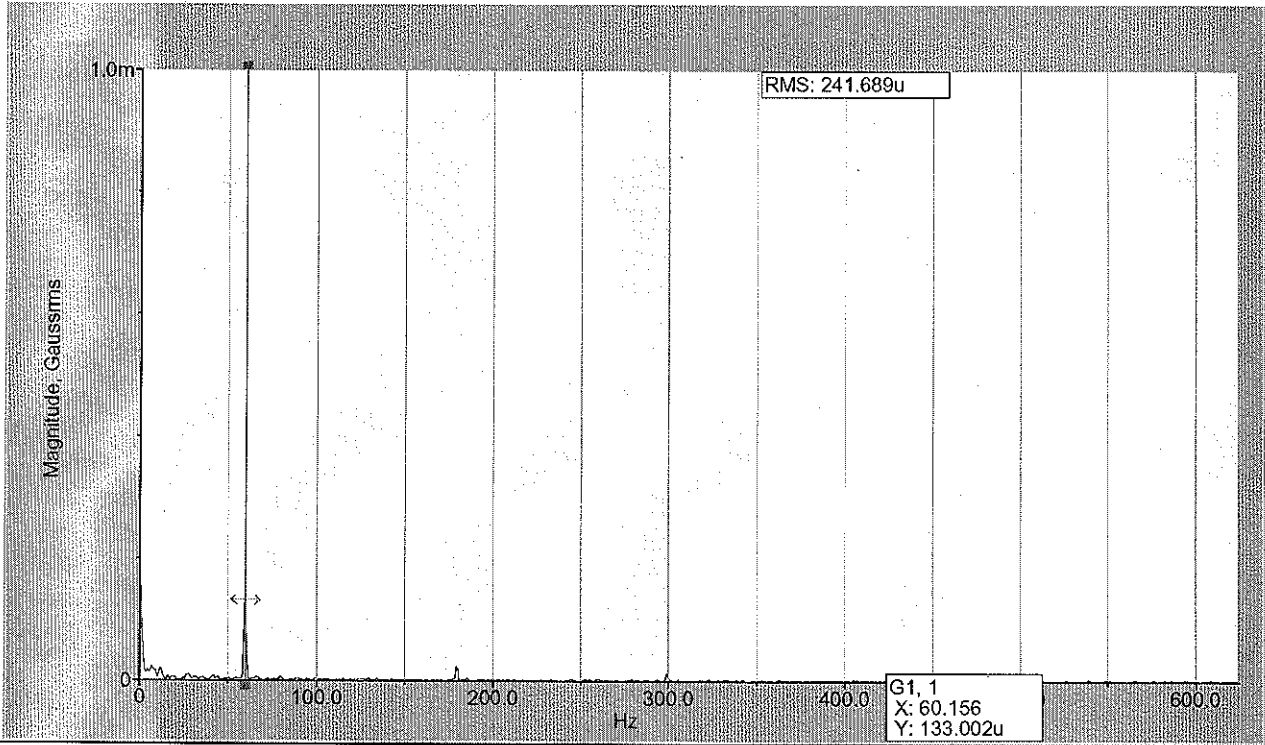


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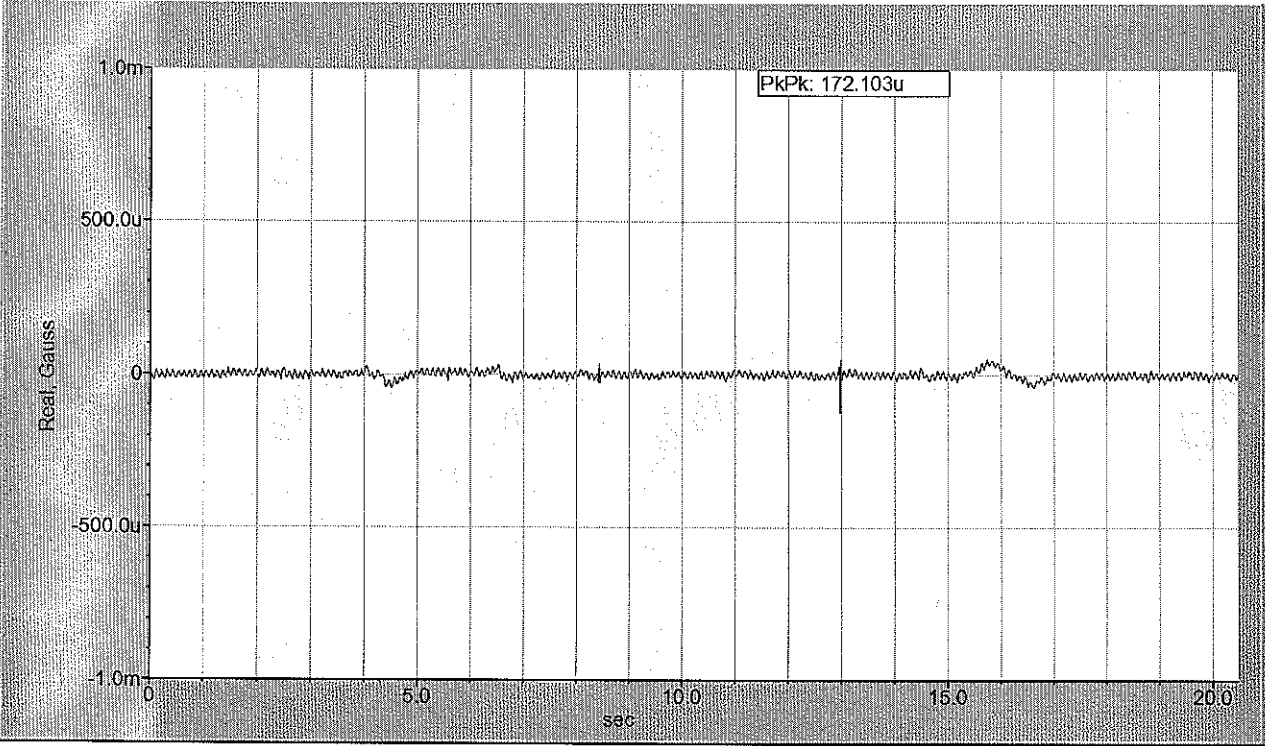




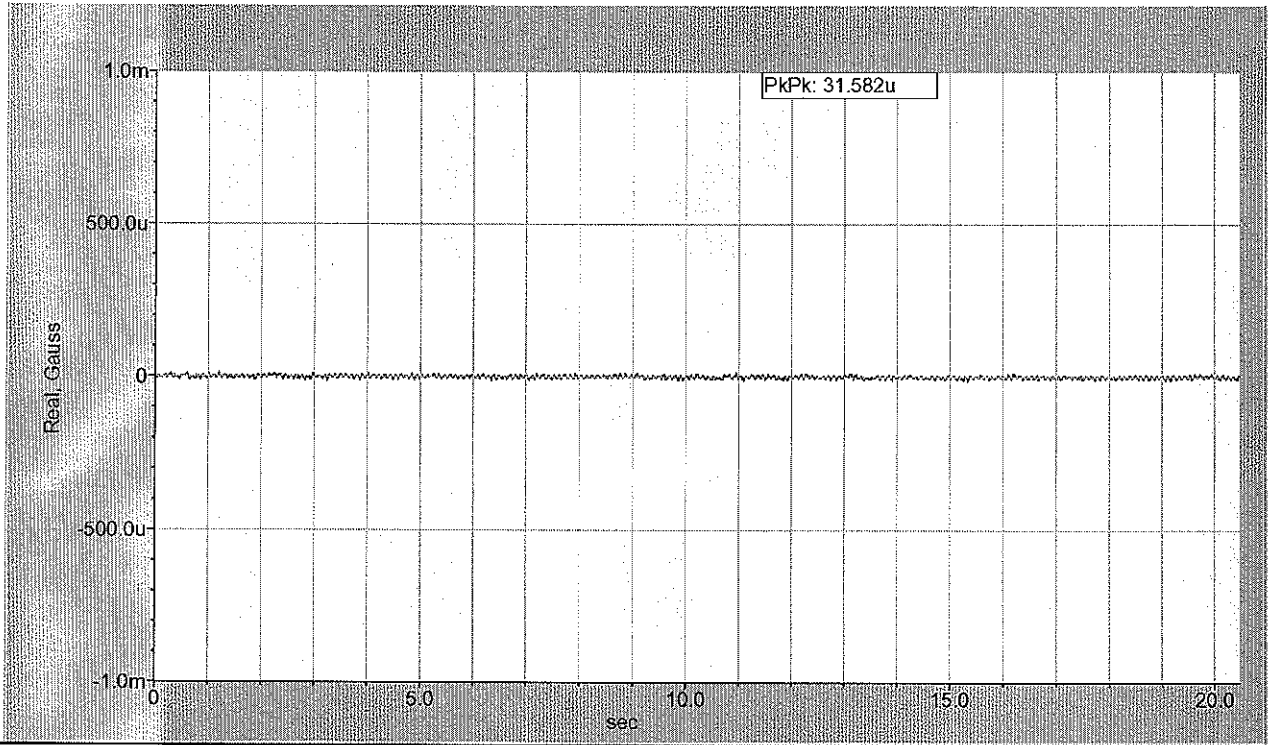
Site 2 Baskin 64 C – EMI Z



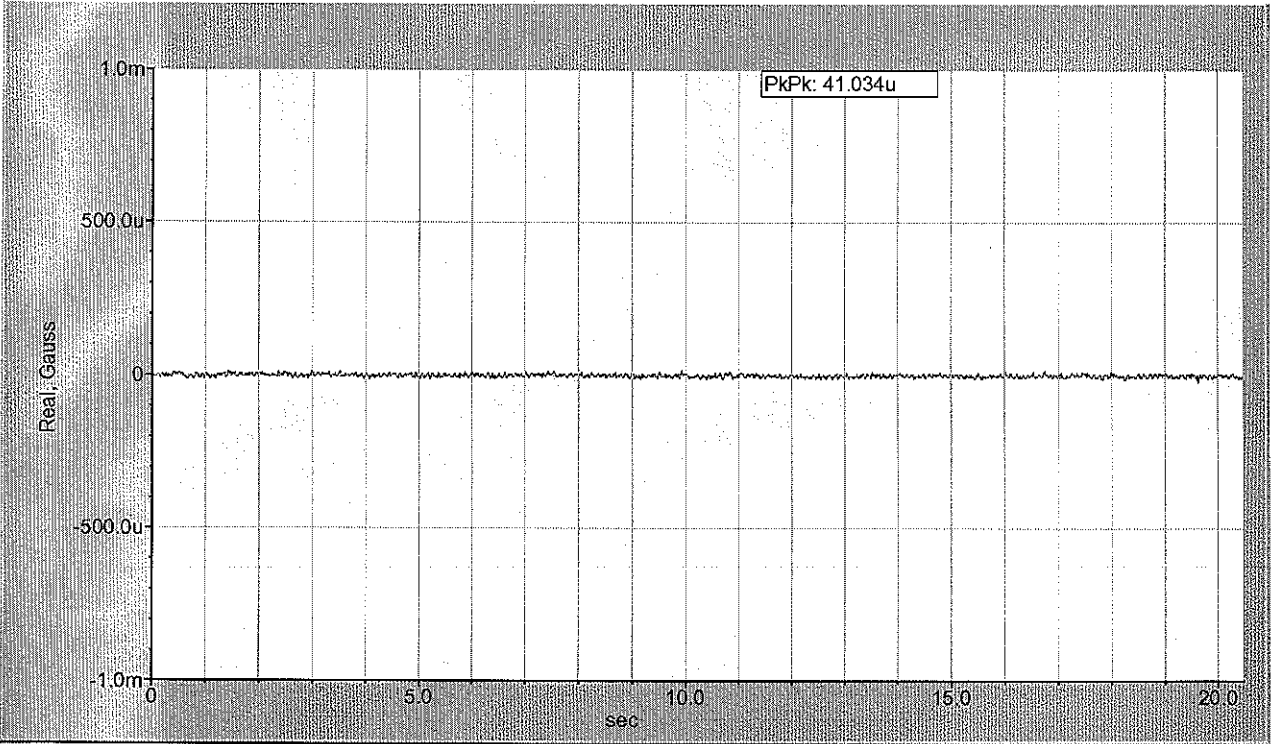
Site 2 Baskin 64 C – DC Fields North – South



Site 2 Baskin 64 C – DC Fields East – West

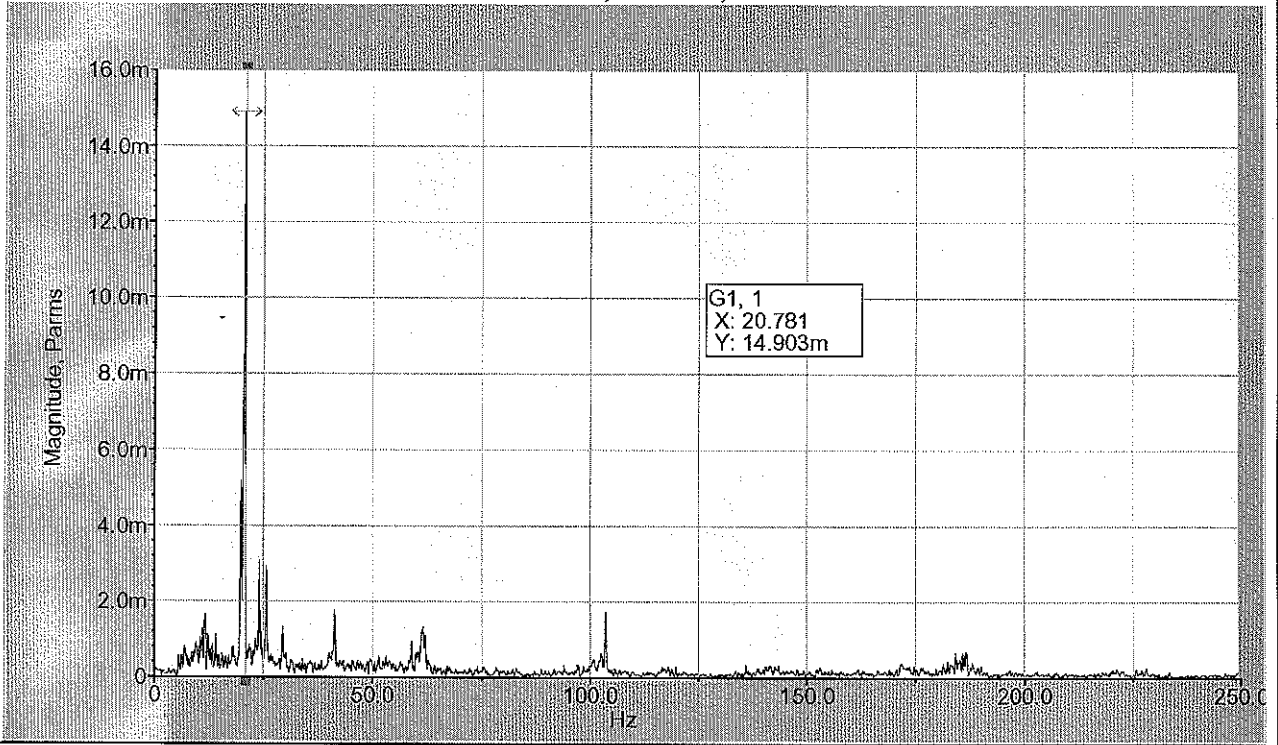


Site 2 Baskin 64 C – DC Fields Z

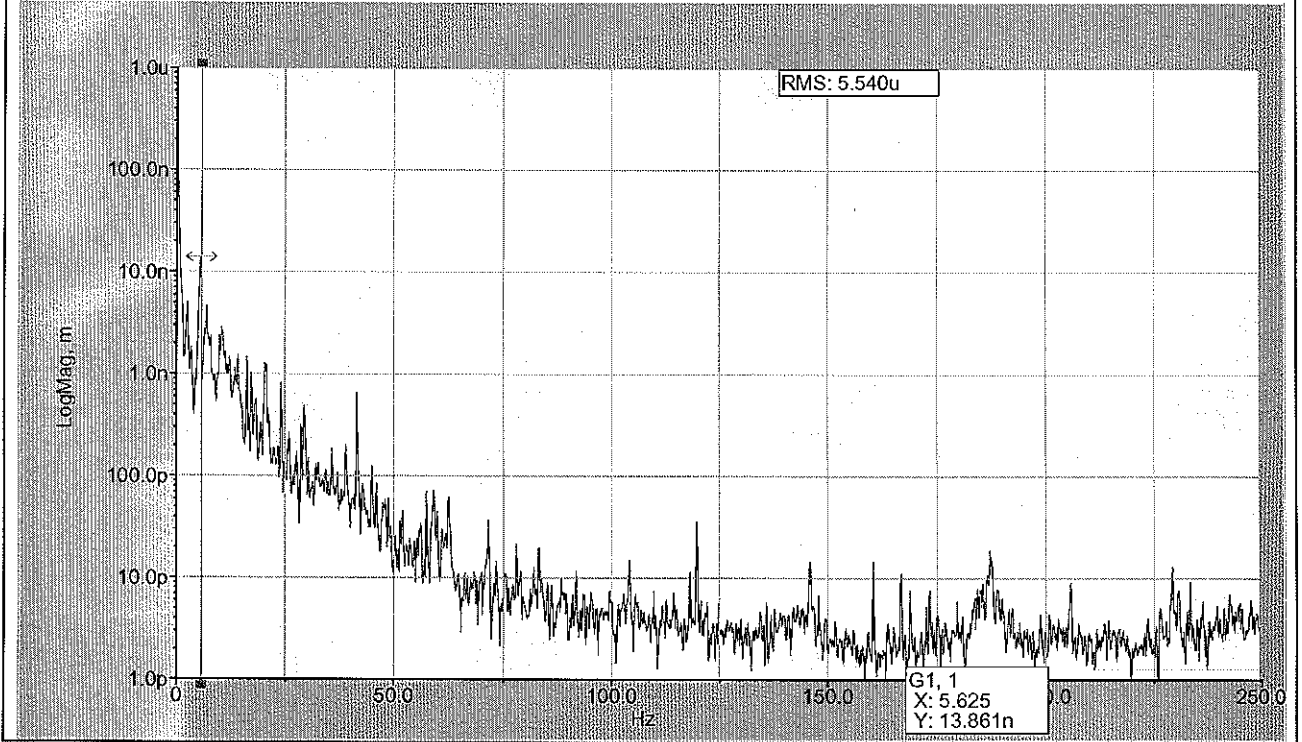




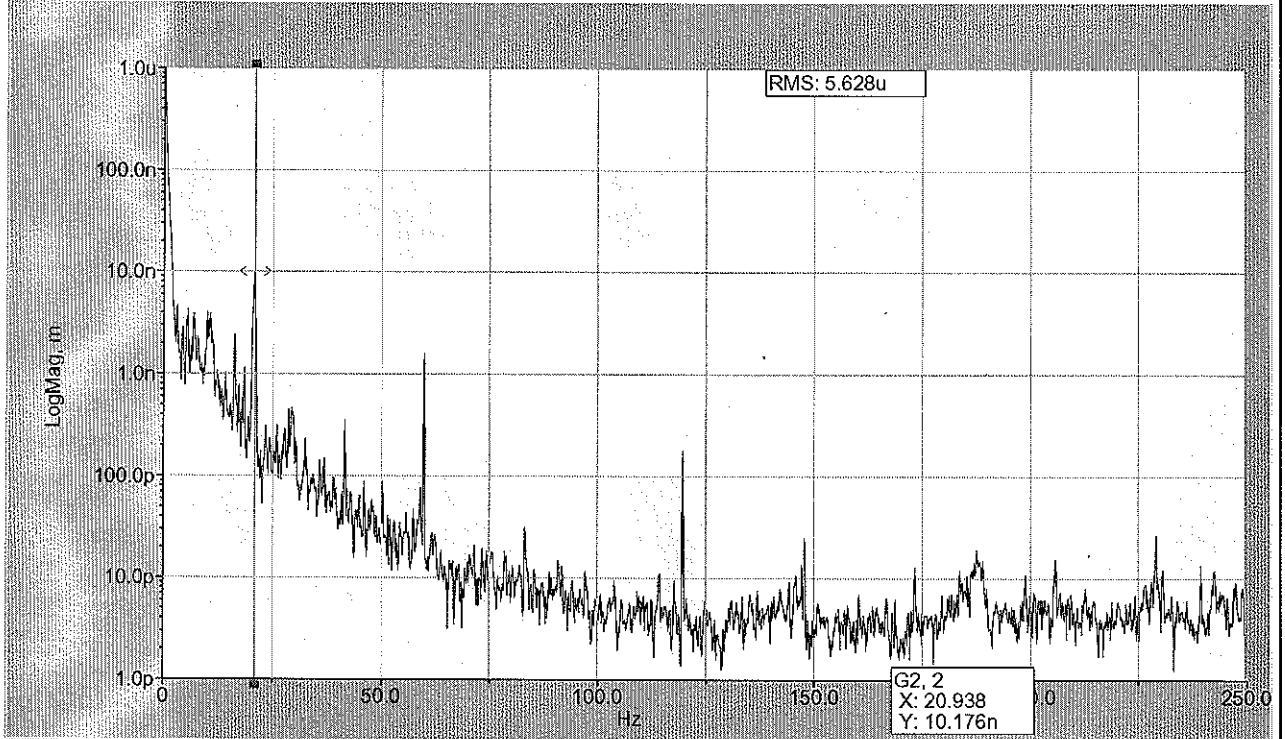
Site 2 Baskin 64 C – ACOUSTICAL LEVEL, 50 dBa, 58 dBc



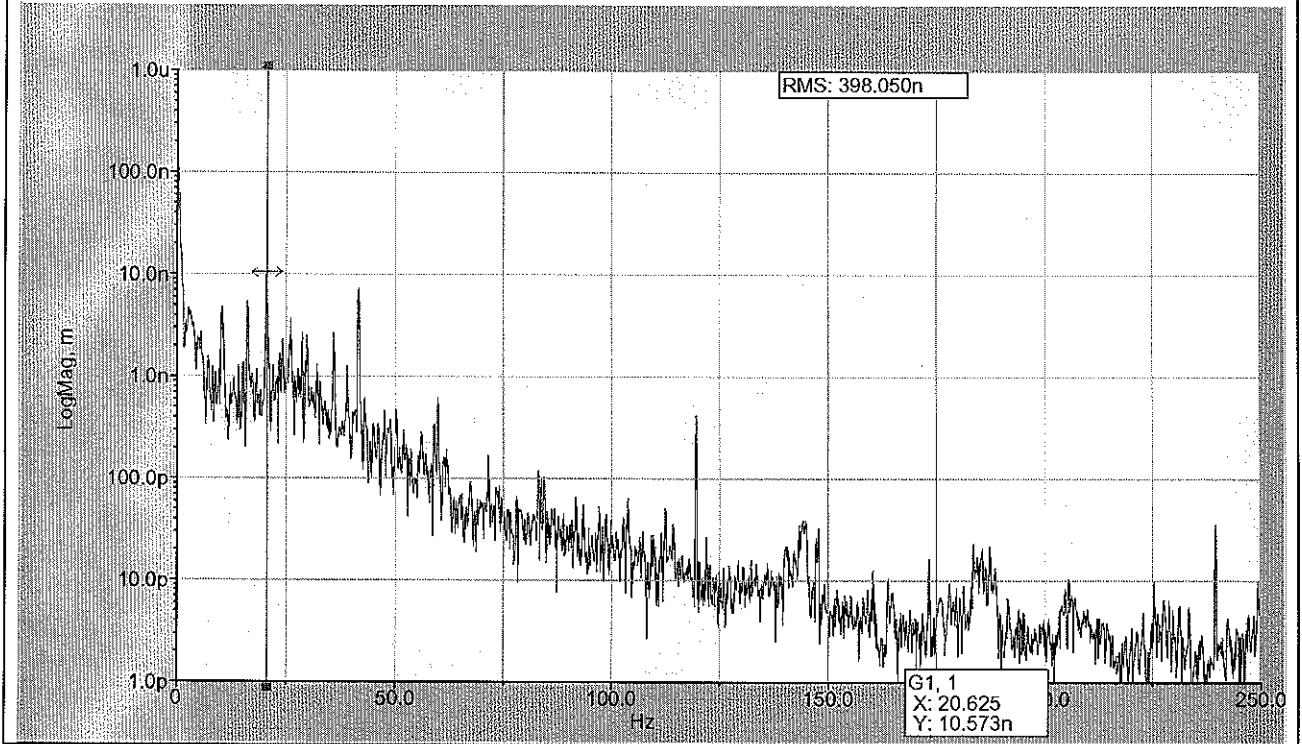
Site 3 Baskin 64 A – DISPLACEMENT North – South



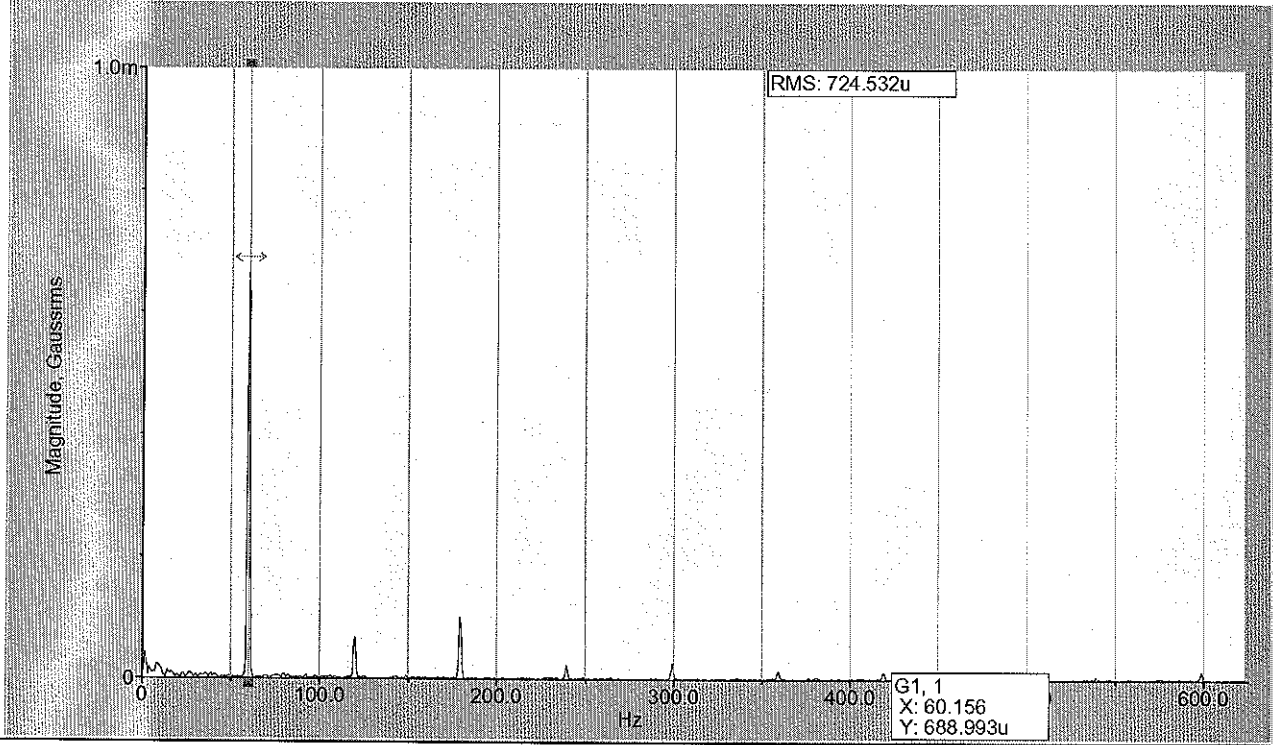
Site 3 Baskin 64 A – DISPLACEMENT East – West



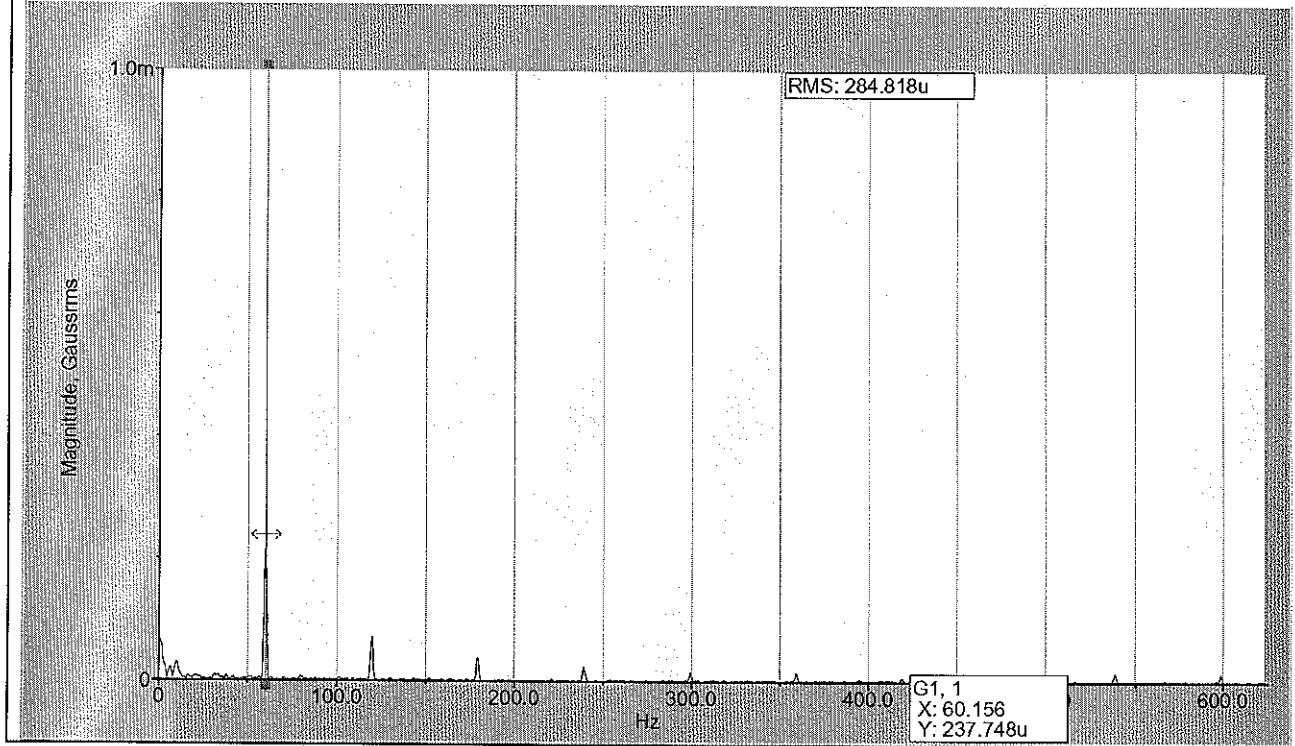
Site 3 Baskin 64 A – DISPLACEMENT Z



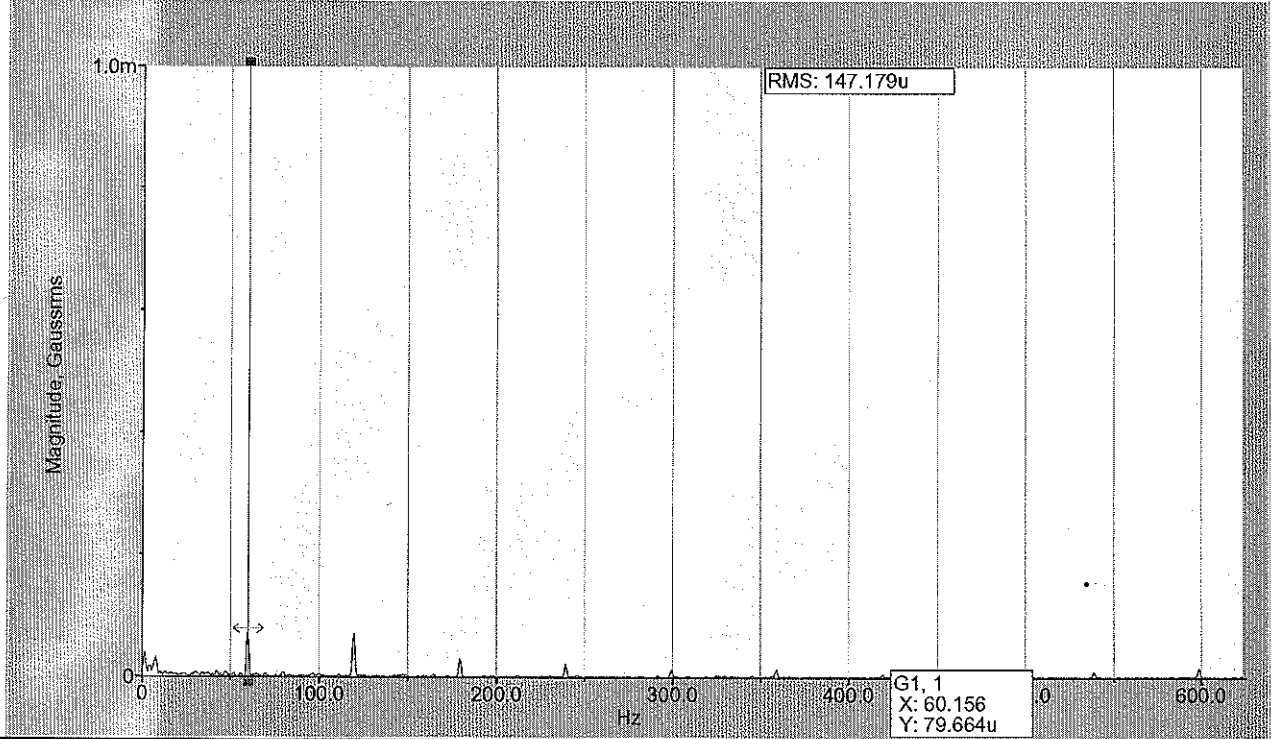
Site 3 Baskin 64 A – EMI North – South



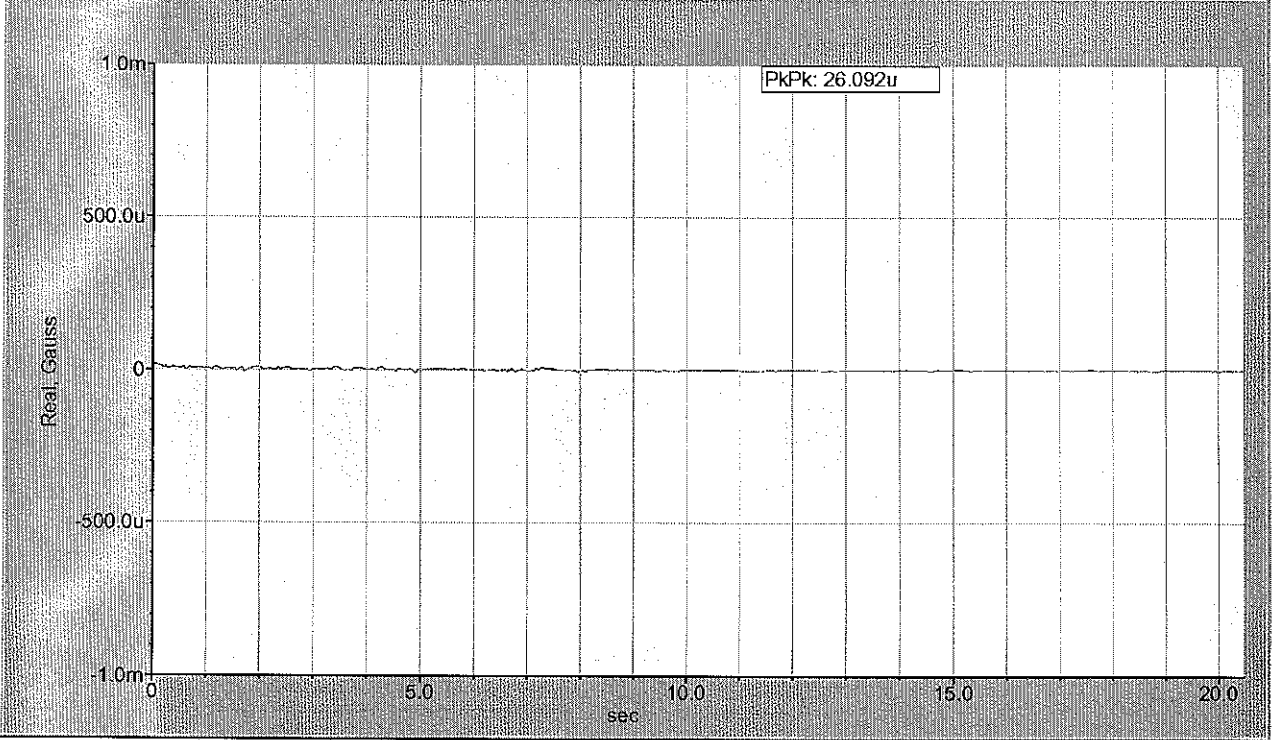
Site 3 Baskin 64 A – EMI East – West



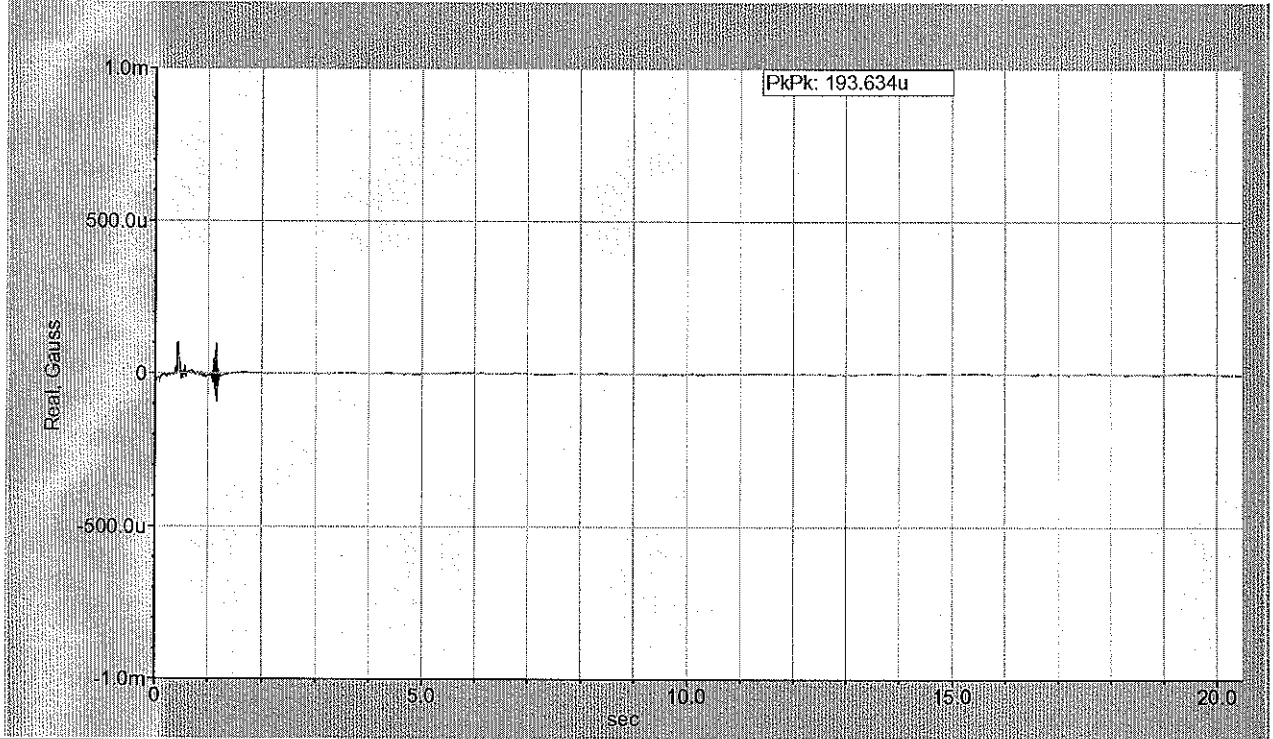
Site 3 Baskin 64 A – EMI Z



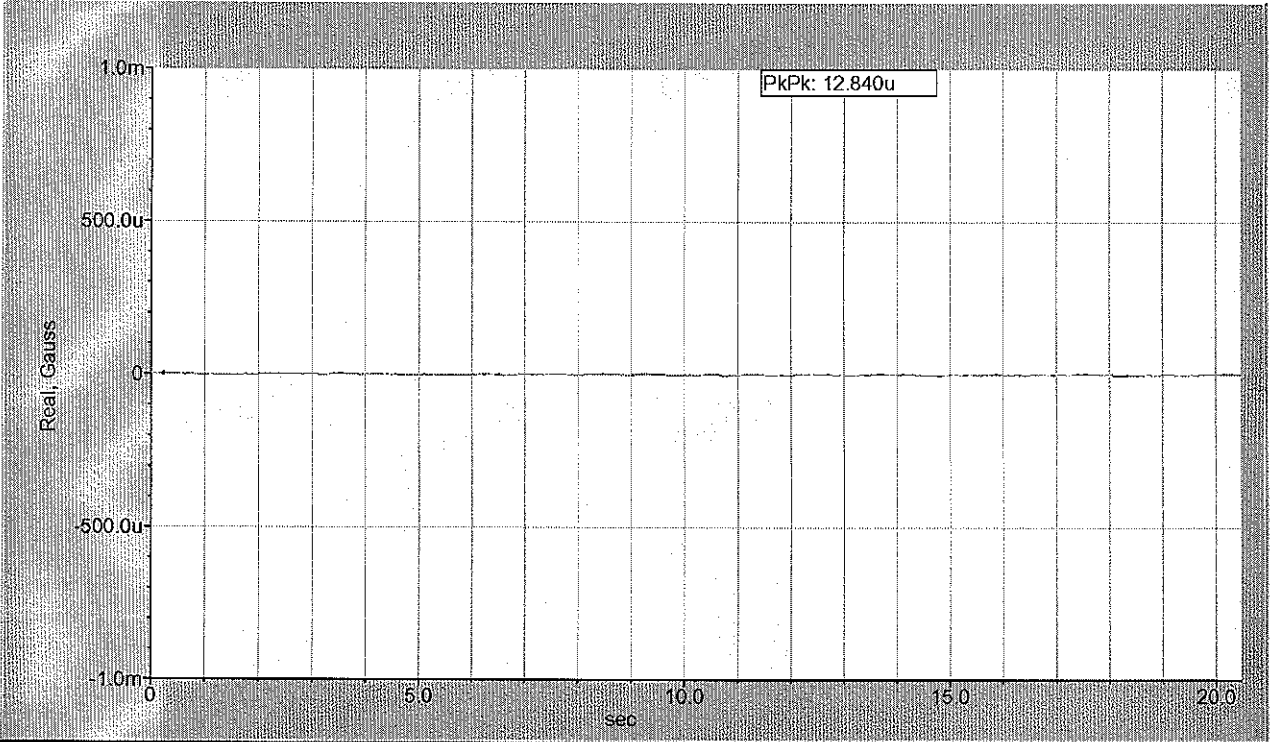
Site 3 Baskin 64 A – DC Fields North – South



Site 3 Baskin 64 A – DC Fields East – West



Site 3 Baskin 64 A – DC Fields Z



Site 3 Baskin 64 A – ACOUSTICAL LEVEL, 60 dBa, 63 dBc

