ATTACHMENT 7

C.D.I. Technical Note No. 05-37, "Blind Evaluation of Continuum Dynamics, Inc. Steam Dryer Load Methodology Against Quad Cities Unit 2 In-Plant Data At 2831 MWt," Revision 1

C.D.I. Technical Note No. 05-37

Blind Evaluation Of Continuum Dynamics, Inc. Steam Dryer Load Methodology Against Quad Cities Unit 2 In-Plant Data At 2831 MWt

Revision 1

Prepared by

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Approved by

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October 2005

Summary

Measured in-plant strain gage data, recorded in the four main steam lines of Quad Cities Unit 2 (QC2) at 2831 MWt (TC39), were collected at two positions upstream of the ERV standpipes on each of the main steam lines and were used to drive an acoustic circuit model of the QC2 steam dome and steam lines. The strain gage data were first converted to pressures, and were then used to extract acoustic sources in the system. Once these sources were obtained, the model was validated by predicting the pressure time histories at 26 locations on the instrumented dryer, where operational pressure sensors were positioned. These predictions were produced blind, i.e., without knowledge of the pressure sensor data, then subsequently compared against the pressure sensor data. Modeling parameters were NOT changed from the parameters developed previously for the "Modified Evaluation" [1], which resulted from examining data taken at 2885 MWt (TC41).

This effort provides Exelon with an additional evaluation of the modified acoustic circuit model parameters that come directly from evaluating against measured dryer data, and compares model predictions using the "Modified Evaluation" parameters at both 2493 MWt (TC32) and 2885 MWt.

It is argued by comparing measured and predicted strains (done by others) that the model parameters for the "Modified Evaluation" provide nearly a factor of two conservatism in predicted stress and therefore the "Modified Evaluation" parameters are appropriate for use in dryer stress evaluations.

Introduction

In Spring 2005 Exelon installed new steam dryers into QC2 and Quad Cities Unit 1. This replacement design, developed by General Electric, sought to improve dryer performance and overcome structural inadequacies identified on the original dryers, which had been in place for the last 30 years. As a means for validating the acoustic circuit analysis, the QC2 dryer was instrumented with pressure sensors at 27 locations. These pressure data formed the set of data to be first predicted (blind evaluation) and then corrected (modified evaluation) utilizing only data measured on the main steam lines. Initial data investigation was undertaken at 790 MWe (2493 MWt), just short of Original Licensed Thermal Power (OLTP) conditions, and at 930 MWe (2885 MWt), near Extended Power Uprate (EPU) conditions. This effort is discussed in [1].

Following release of [1], Exelon requested that Continuum Dynamics, Inc. (C.D.I.) conduct an additional blind evaluation, subsequently providing the strain gage data at 912 MWe (2831 MWt).

Model Predictions and Comparisons

Model evaluation consisted of utilizing the Acoustic Circuit Model with the "Modified Evaluation" model parameters, developed in [1], with additional strain gage data taken at eight main steam line locations by Exelon. The process involved the following chronological steps: | Rev. 1

1. The main steam line strain gage data for 2831 MWe (TC39) were provided by Exelon personnel to C.D.I. | Rev. 1

2. A blind prediction of the pressures at the locations of the 26 pressure sensors on the dryer was made with the model parameters determined from the "Modified Evaluation" discussed in [1]. This prediction covered approximately 65 seconds of data collection after trigger (a trigger signal matches the strain gage data with the pressure sensor data).

3. The predictions at the 26 operational pressure sensors on the steam dryer were provided to Exelon personnel.

4. Then, Exelon personnel provided the pressure sensor data collected on the steam dryer to C.D.I.

5. A comparison was made between the predictions and the data at the operational pressure sensors, and margin was evaluated.

Table 1 summarizes the blind evaluation for all operational sensors. Figures 1 to 26 compare the Power Spectral Density (PSD) of the blind predictions with the data at 912 MWe, while Figure 27 compares the pressure range (the maximum pressure minus the minimum pressure) and RMS values at the pressure sensors.

Figure 28 compares the ratio of predicted pressure to data for the three power levels examined by C.D.I. Here the parameters examined are the pressure range and the RMS of the pressure. Note that if this ratio is greater than 1.0, the prediction is conservative. This result indicates that the Acoustic Circuit Model using "Modified Evaluation" parameters is somewhat more conservative at lower power levels.

Figure 29 is constructed by summing the predicted range over all 21 transducer locations on the external surfaces of the dryer and dividing this sum by the sum of the measured range of the 21 transducers. Similarly, this same ratio is computed for RMS values. Since it is believed that it is the peak pressure on the dryer that correlates with peak stresses, the range curve is indicative of the global conservatism in the loading methodology. The average peak load is conservative at low power in excess of 30% and is conservative at highest power by about 5%. Note that transducers P13, P14, P16, P23 and P27 are not included in this summation, as they are not located on external dryer surfaces.

Discussion and Conclusions

Figure 29 shows that the acoustic circuit model predictions of RMS are nonconservative by about 5% between 900 MWe and 930 MWe (specifically at 912 MWe). Figure 28 shows that, similar to previous predictions at 930 MWe [1], pressure sensor signals are underpredicted by the model. This is a consequence of a model prediction acceptance criterion that required only that model predictions be within 90% of the data for pressure sensors P3, P12, P20, and P21. This criteria was probably motivated by the fact that error analysis of pressure transducers

located on the dryer are anticipated to measure fluctuating pressures with a high bias of up to 10% as a consequence of installation hardware [2].

In an effort to further improve model predictions with data, additional sensitivity analyses were undertaken. The goal of these analyses was to raise the level of pressures predicted for transducers located above the elevation of the main steam line inlets, without raising the level on transducers located below that elevation. It was determined that decreasing the damping in the steam dome accomplished this objective. It is believed that previous benchmarking and model tuning settled on a steam dome damping value that was too large, and it is now believed that most of the damping of acoustic waves occurs inside the steam dryer, where surface areas are large and the steam froth interface absorbs most of the radiated acoustic energy. Rev. 1

Specifically, Exelon asked C.D.I. to refine the model parameters driving the acoustic circuit prediction, in the 145 – 165 Hz range. These parameters include: (1) the absorption at the steam froth interface beneath the dryer; (2) the absorption at the steam water interface between the skirt and the steam dome; (3) the damping in the steam dome; and (4) the damping in the main steam lines. C.D.I. has been able to bound nearly all of the signals measured at the 26 operational pressure sensors by a modest reduction of damping in the steam dome and a comparable increase in damping in the main steam line [3]. Further refinements are expected to result in a conservative simulation of all of the pressure sensors.

The acoustic circuit model load predictions are then input into a finite element structural model of the dryer. A fair question to ask is, do the predictions shown in this report translate into a conservative prediction of strain from the finite element model? Exelon has shown independently [4] that the finite element model predictions are conservative by as much as a factor of two in prediction of strain on the dryer, when compared with data. These comparisons [4] show cumulative strain predicted by the finite element model with strain gage data. Thus, the Modified Evaluation acoustic circuit model provides loads that result in conservative predictions of stress (up to a factor of two) and suggests that building additional margin into the acoustic circuit model is not justified. Rev. 1

Reference

1. Continuum Dynamics, Inc. 2005. Evaluation of Continuum Dynamics, Inc. Steam Dryer Load Methodology. C.D.I. Report No. 05-10.

2. Exelon Corporation. 2005. An Assessment of the Uncertainty in the Application of the Modified 930 MWe Acoustic Circuit Model Predictions For the Replacement Quad Cities Units 1 and 2 Steam Dryers. Document No. AM-2005-0012. Rev. 1

3. Continuum Dynamics, Inc. 2005. Improved Methodology to Predict Full Scale Steam Dryer Loads from In-Plant Measurements. C.D.I. Report No. 05-23 (to be issued).

4. Exelon Corporation. 2005. A Comparison of the Cumulative Mean Square Strain in the Application of the Modified 930 MWe Acoustic Circuit Model and FEA to the QC2 TC41 In-Vessel Test Condition. Document No. AM-2005-0010.

Table 1. Comparison between the 912 MWe data and modified evaluation predictions. The data have been filtered to include the frequencies from 0 Hz to 200 Hz only.

Pressure Sensor Number	Data Minimum (psid)	Predicted Minimum (psid)	Data Maximum (psid)	Predicted Maximum (psid)	Data RMS (psid)	Predicted RMS (psid)
P1	-1.263	-1.070	1.114	1.127	0.362	0.311
P2	-1.226	-0.813	1.187	0.893	0.410	0.205
P3	-1.684	-1.845	1.589	1.853	0.468	0.509
P4	-0.829	-0.581	0.815	0.649	0.250	0.160
P5	-0.930	-0.640	0.900	0.629	0.274	0.153
P6	-1.175	-1.407	1.232	1.382	0.344	0.361
P7	-0.988	-0.598	0.926	0.618	0.295	0.183
P8	-1.125	-0.694	1.087	0.772	0.345	0.180
P9	-1.275	-1.436	1.272	1.502	0.408	0.425
P10	-0.919	-1.244	0.930	1.132	0.286	0.326
P11	-1.104	-0.736	1.079	0.769	0.335	0.182
P12	-1.608	-1.508	1.640	1.520	0.519	0.479
P13	-0.522	-0.194	0.509	0.257	0.142	0.054
P14	-0.785	-0.240	0.760	0.293	0.247	0.073
P15	-1.410	-1.086	1.447	1.162	0.447	0.267
P16	-0.490	-0.156	0.512	0.163	0.146	0.040
P17	-0.656	-0.815	0.655	0.850	0.192	0.215
P18	-1.041	-1.275	1.060	1.278	0.379	0.435
P19	failed	failed	failed	failed	failed	failed
P20	-1.411	-1.787	1.321	1.842	0.440	0.500
P21	-1.910	-2.476	1.962	2.417	0.776	0.798
P22	-1.272	-2.183	1.154	2.132	0.337	0.544
P23	-0.367	-0.120	0.347	0.133	0.097	0.031
P24	-0.729	-0.971	0.669	0.986	0.182	0.236
P25	-0.977	-1.996	1.000	1.915	0.315	0.561
P26	-0.278	-0.161	0.278	0.180	0.077	0.040
P27	-0.513	-0.124	0.514	0.157	0.188	0.034

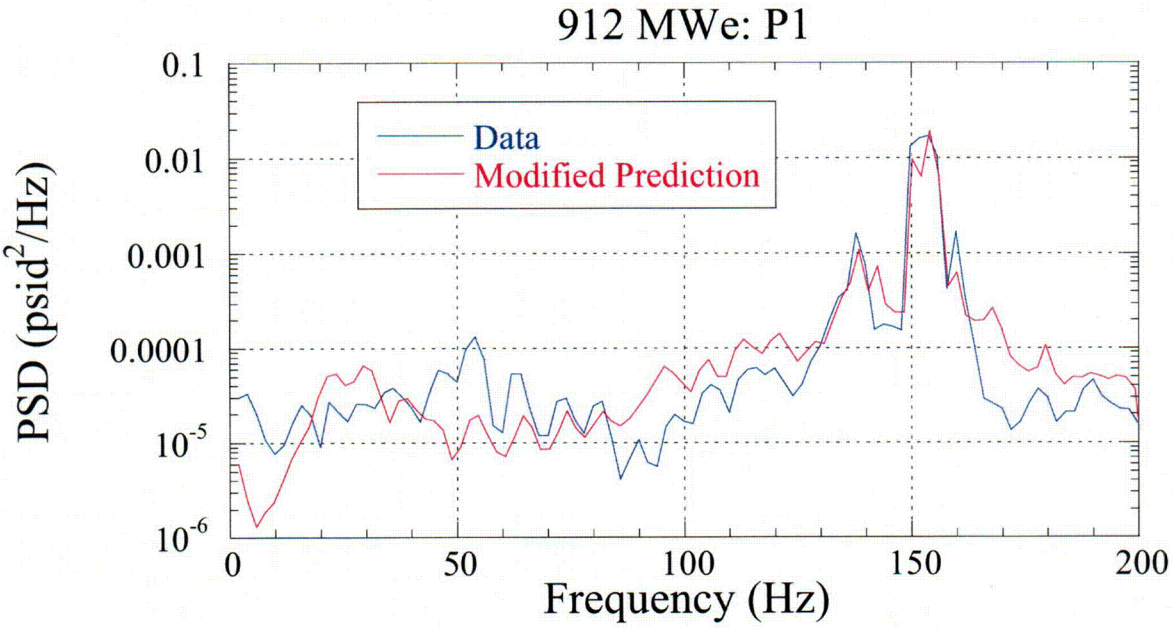

Figure 1. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P1.

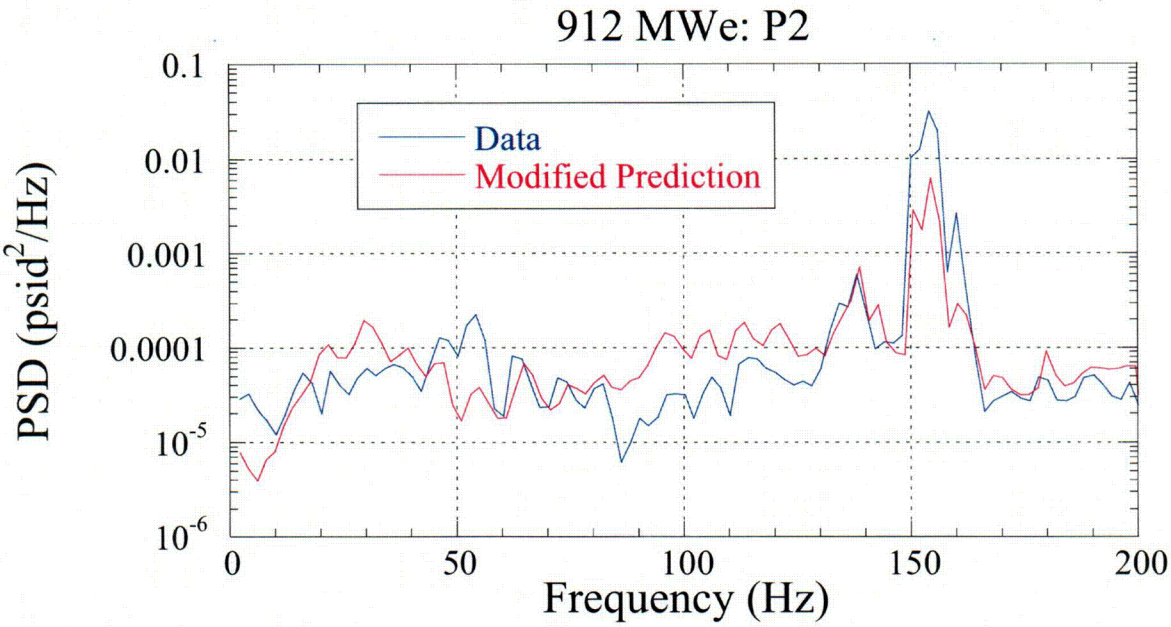

Figure 2. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P2.

C01

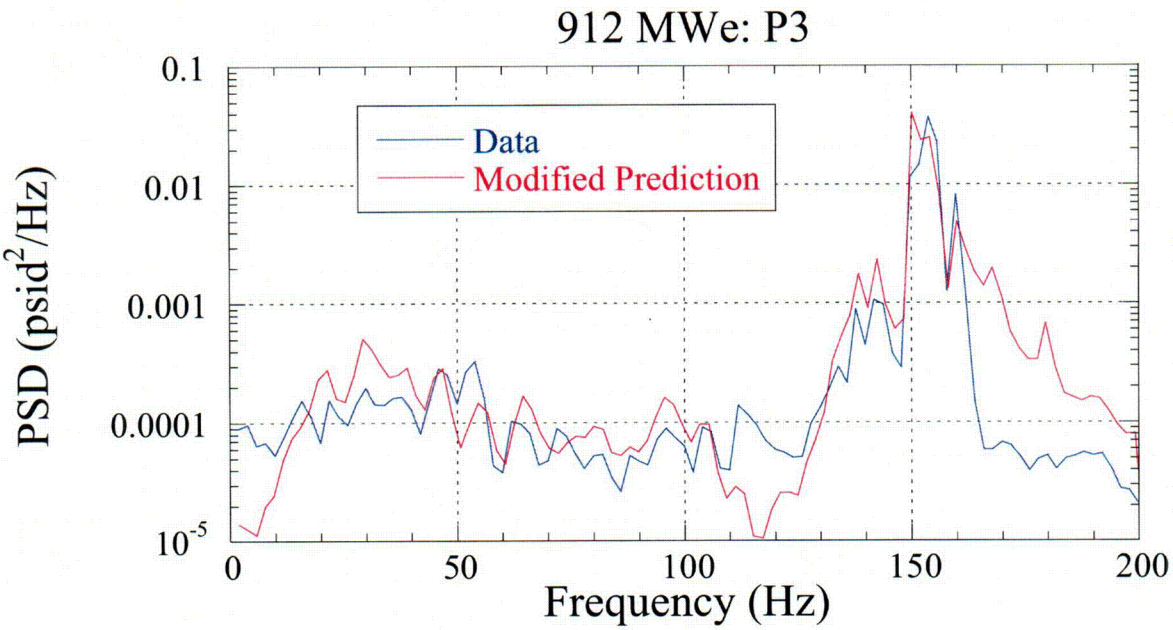

Figure 3. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P3.

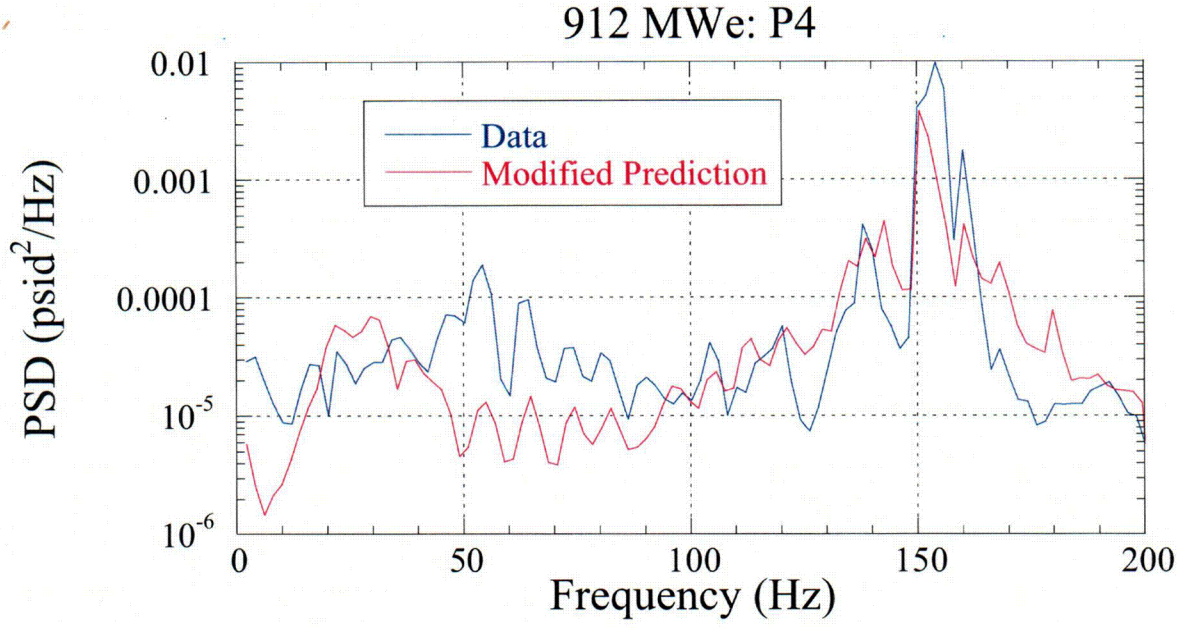

Figure 4. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P4.

C02

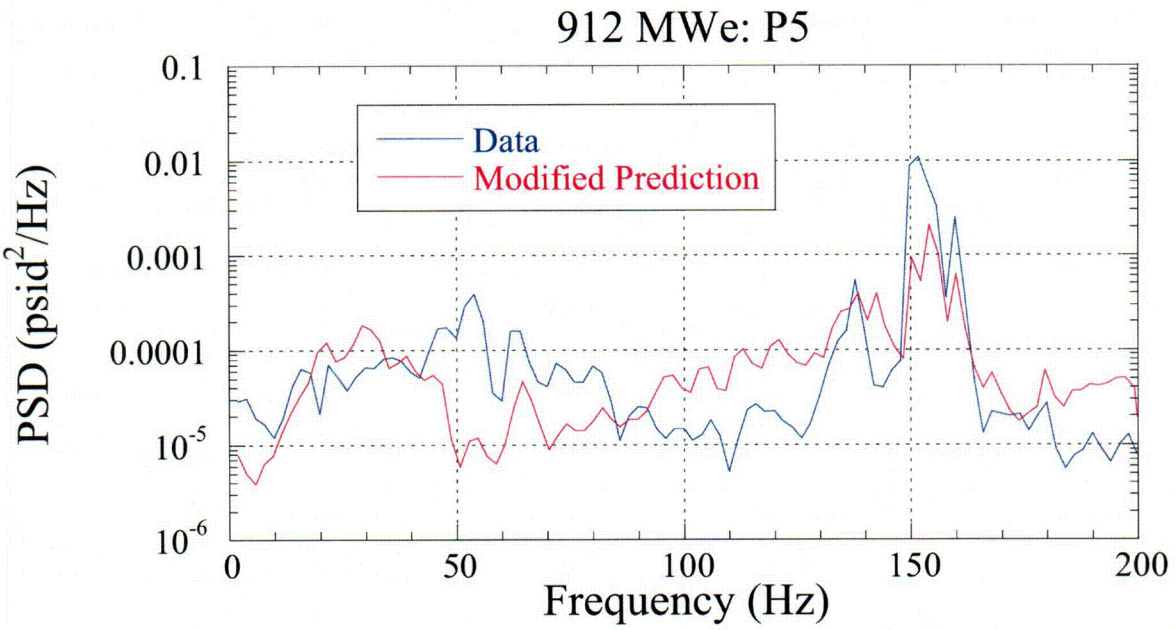

Figure 5. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P5.

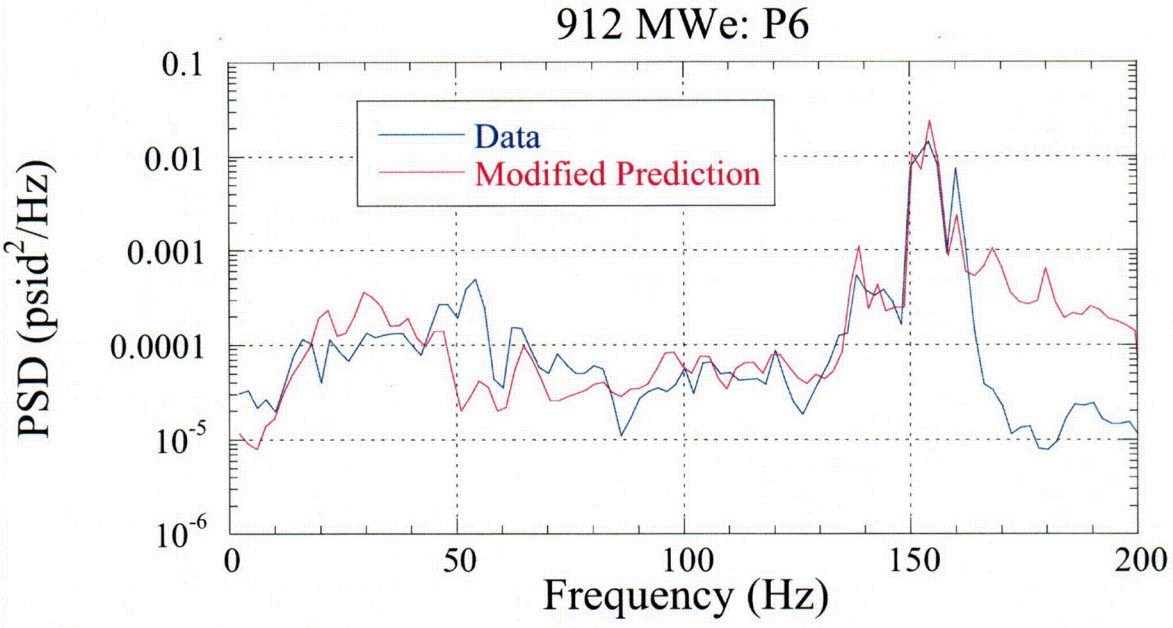

Figure 6. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P6.

C03

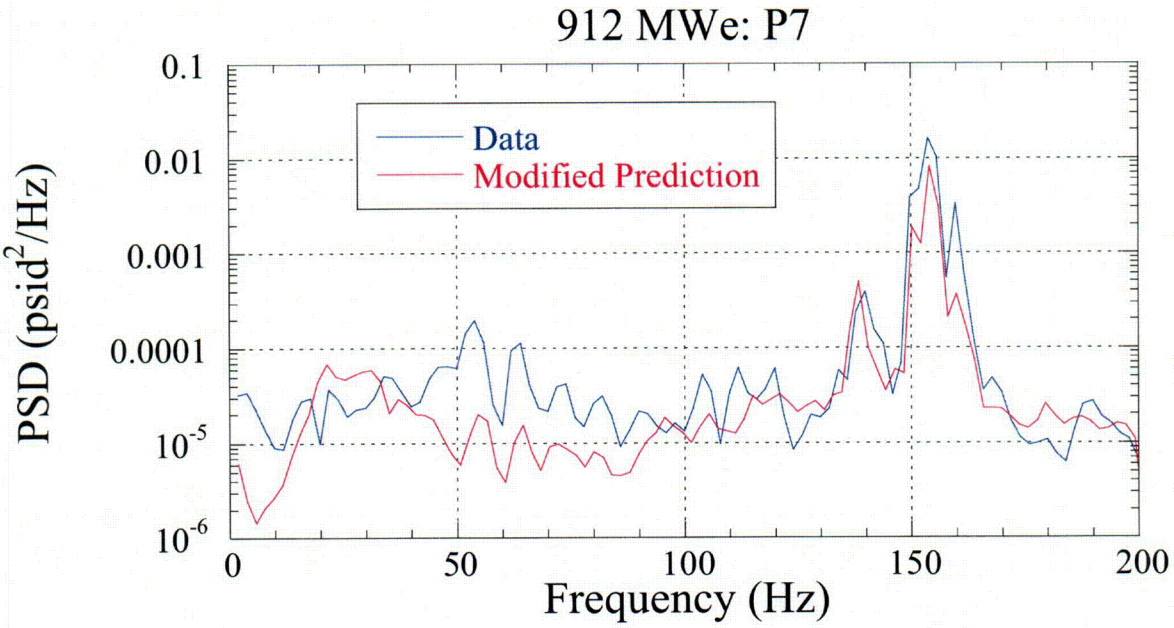

Figure 7. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P7.

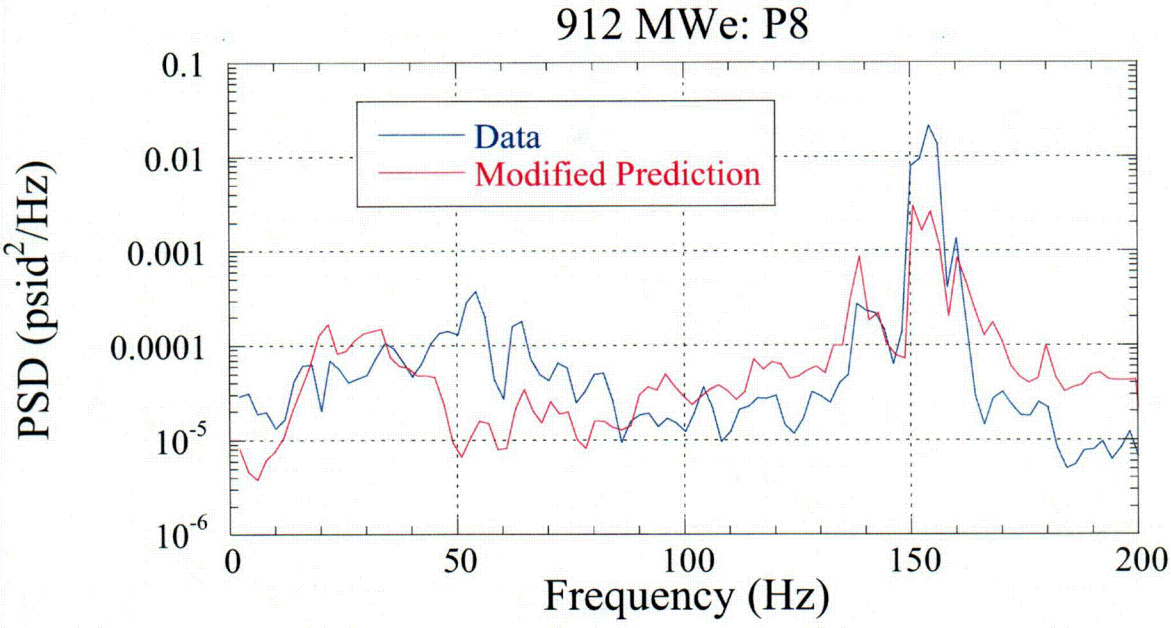

Figure 8. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P8.

Cof

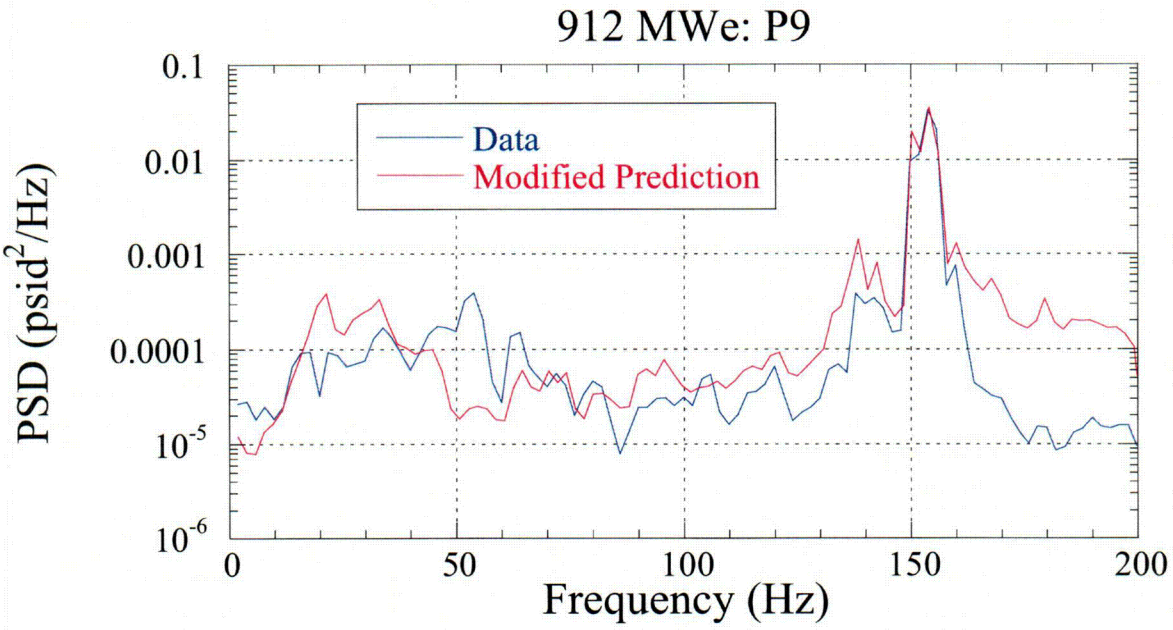

Figure 9. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P9.

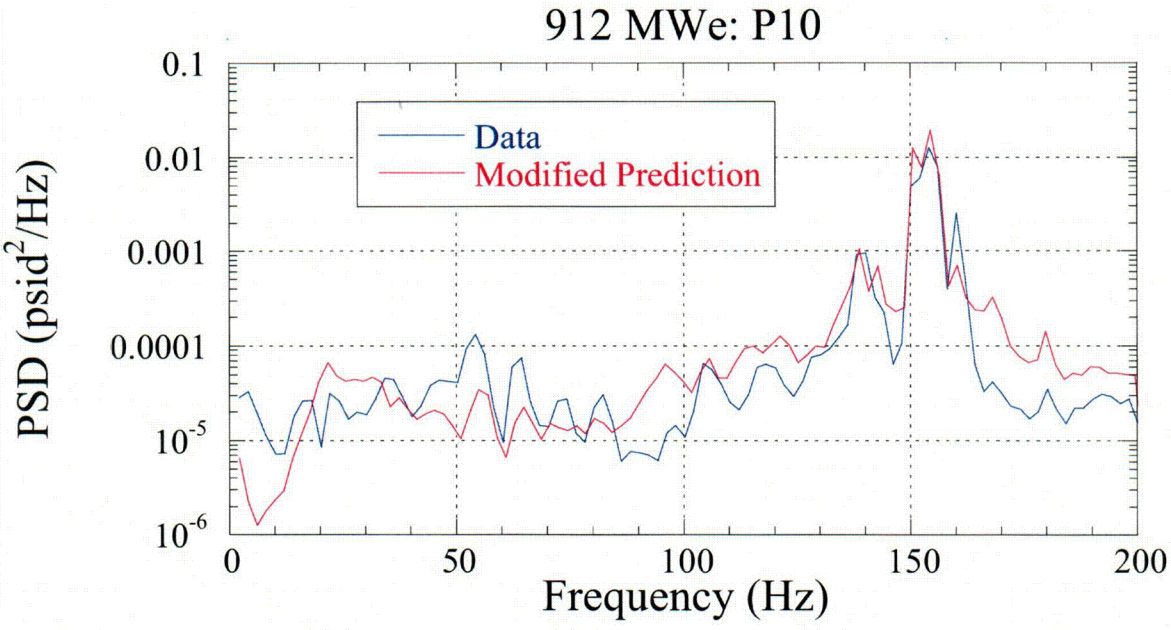

Figure 10. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P10.

C05

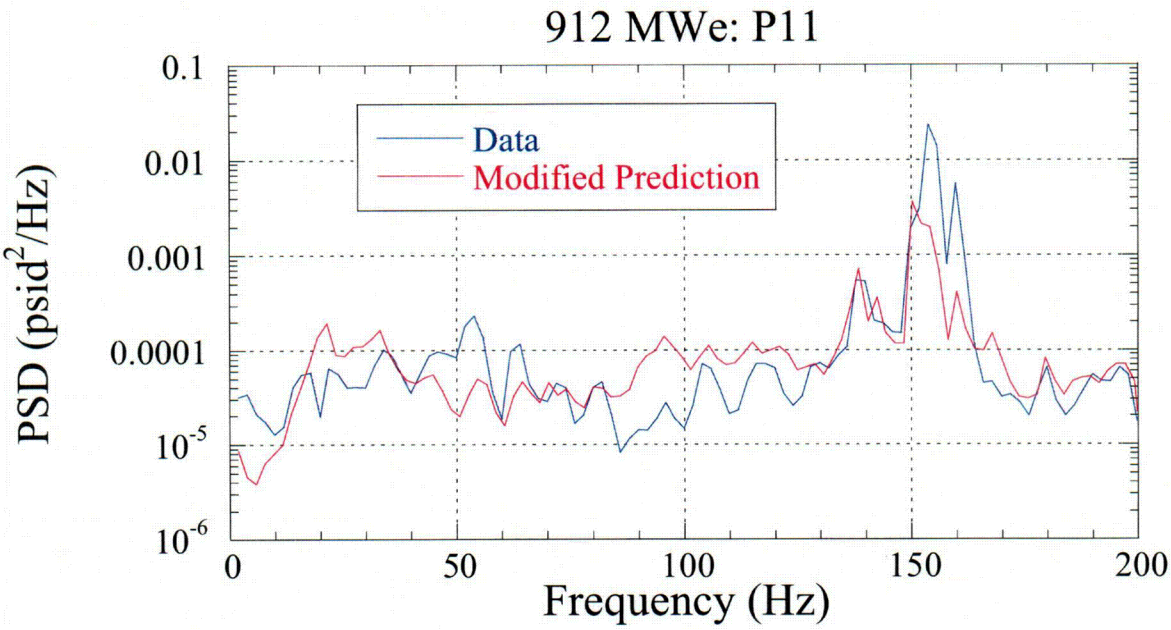

Figure 11. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P11.

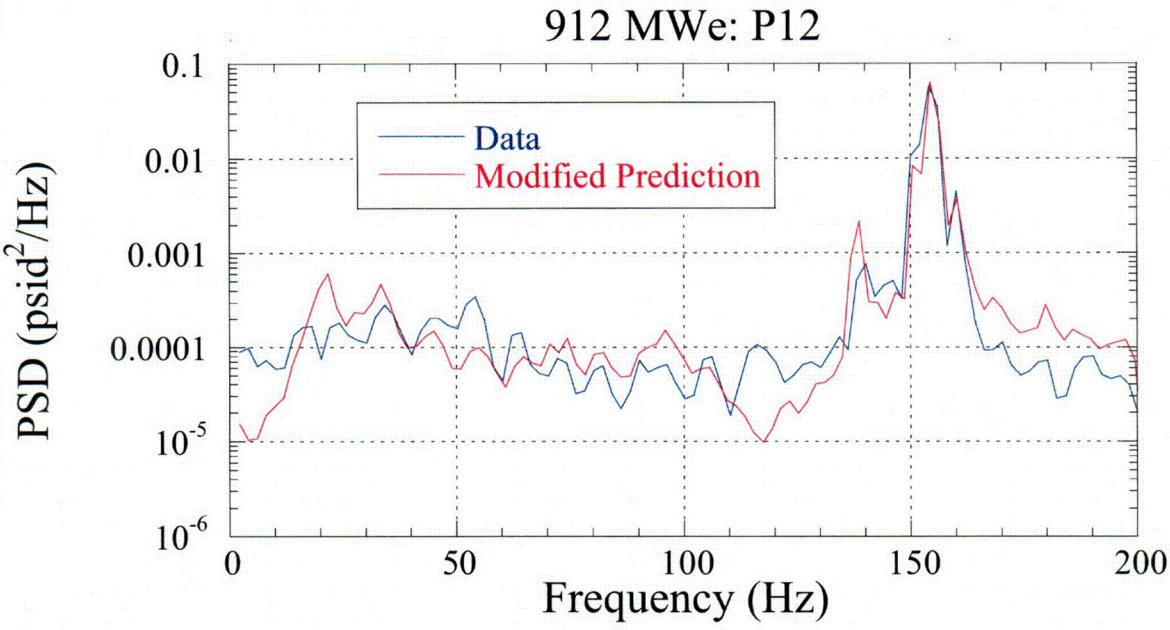

Figure 12. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P12.

C06

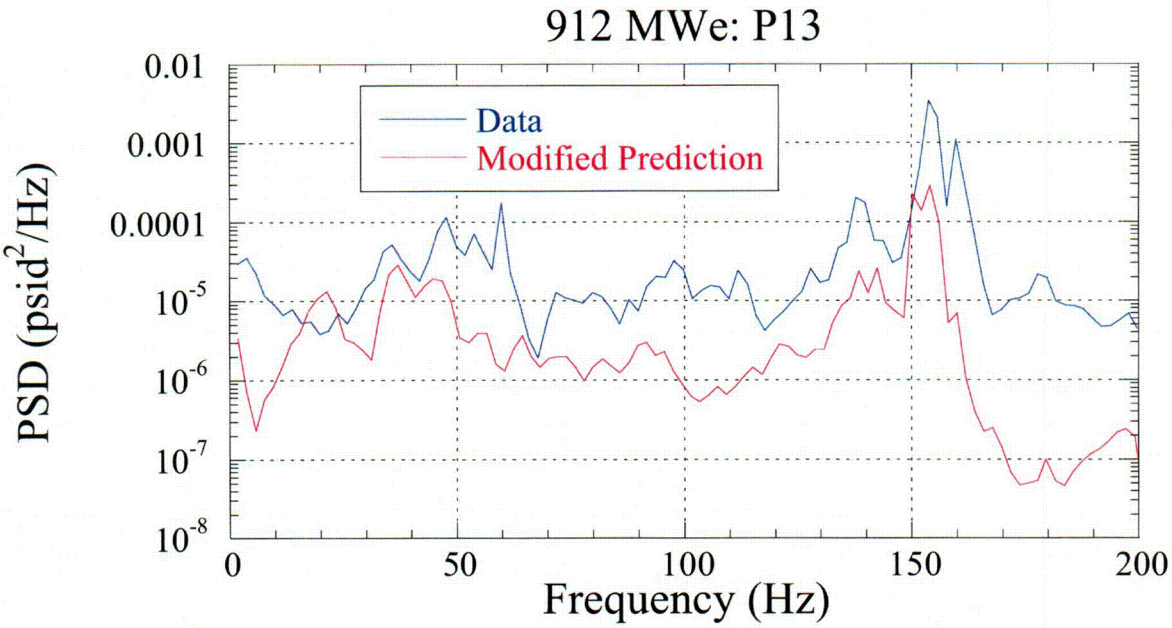

Figure 13. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P13 (which is inside the dryer).

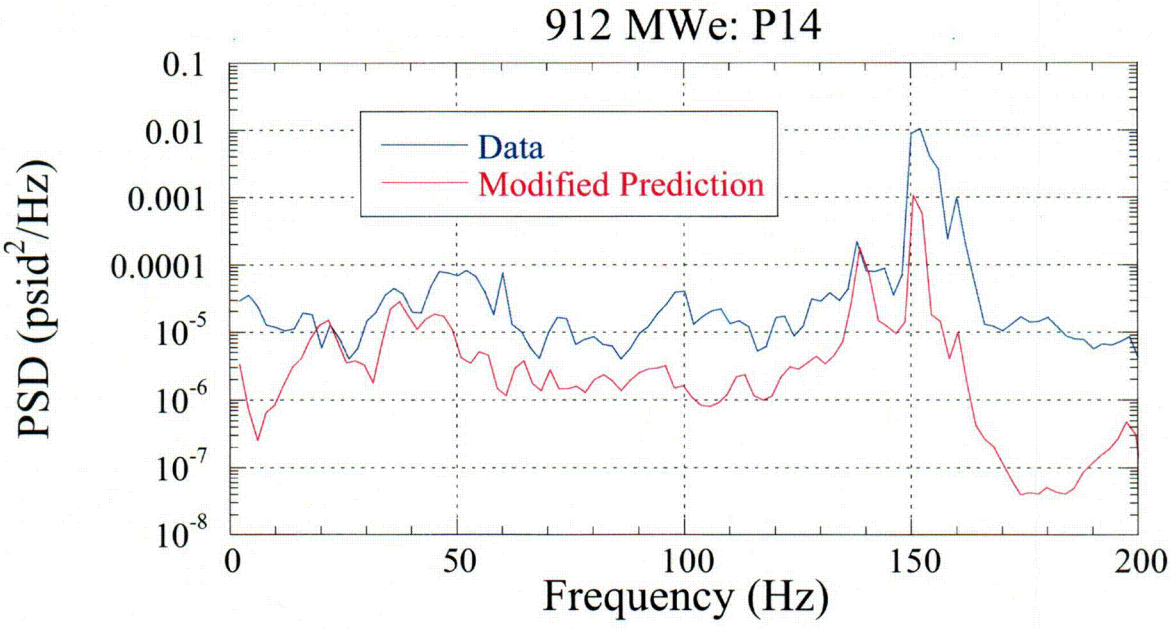

Figure 14. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P14 (which is inside the dryer).

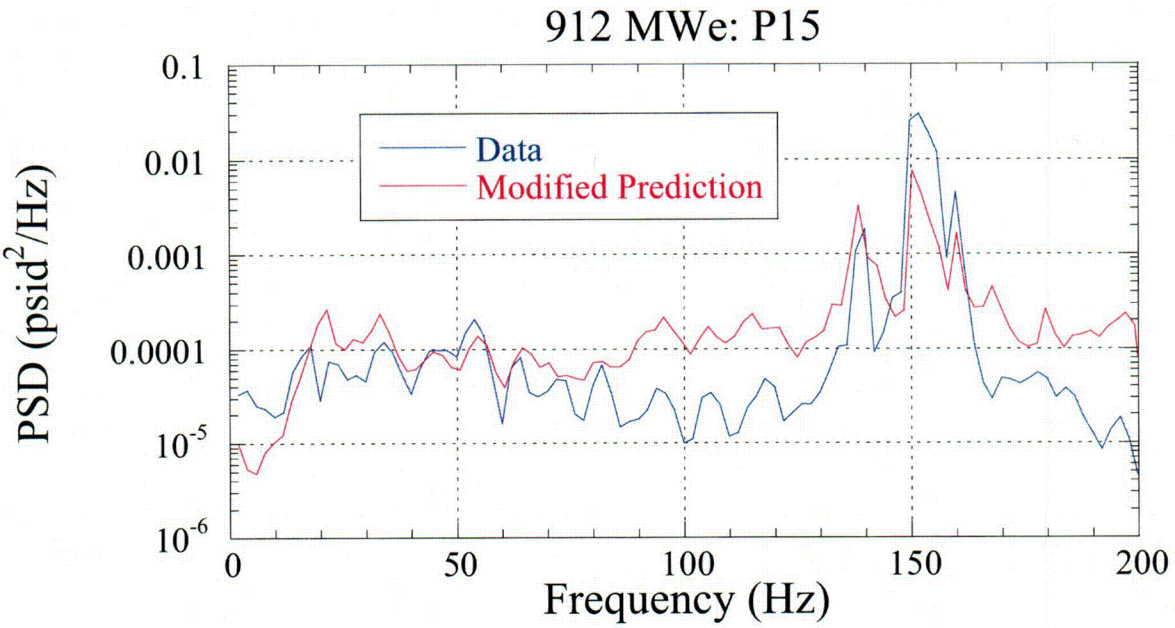

Figure 15. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P15.

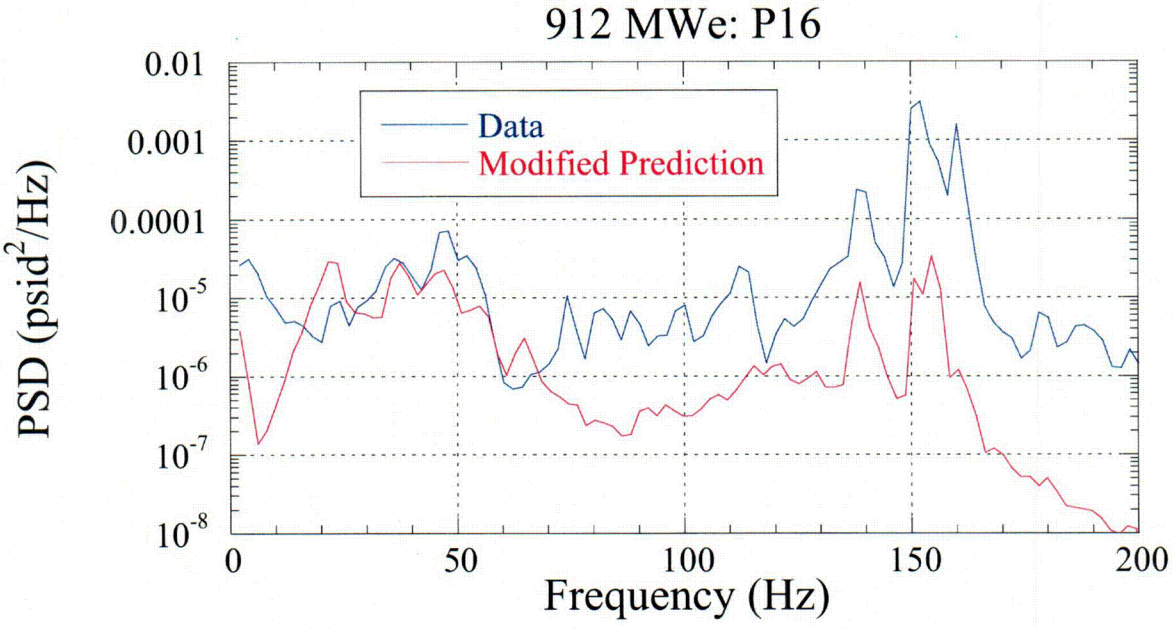

Figure 16. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P16 (which is on an inner bank hood).

C08

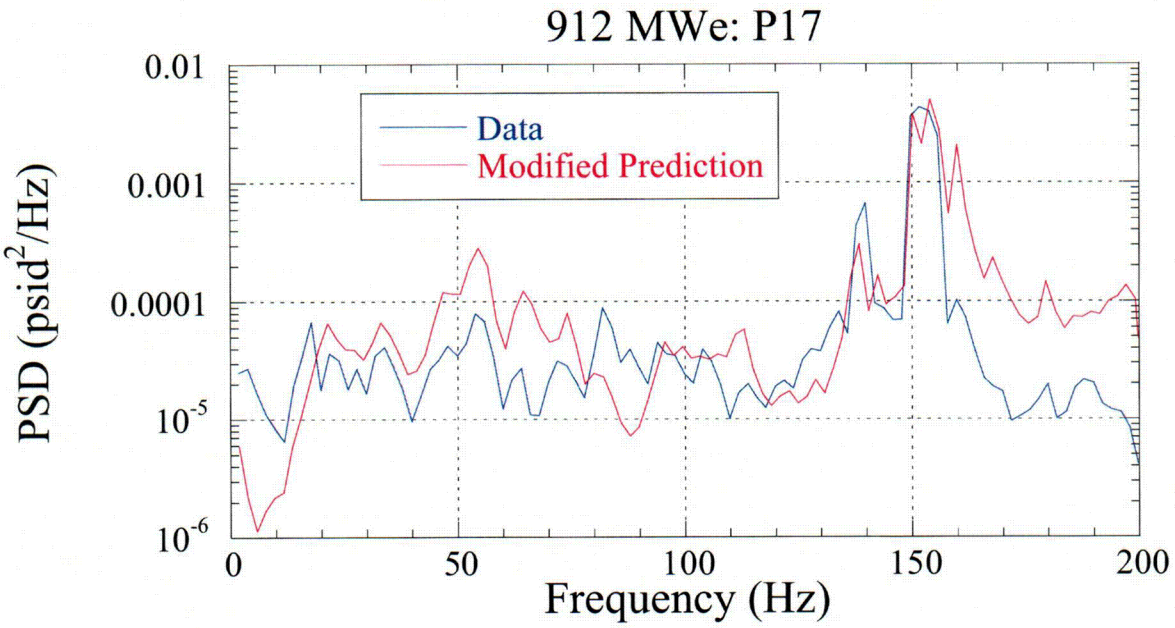

Figure 17. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P17.

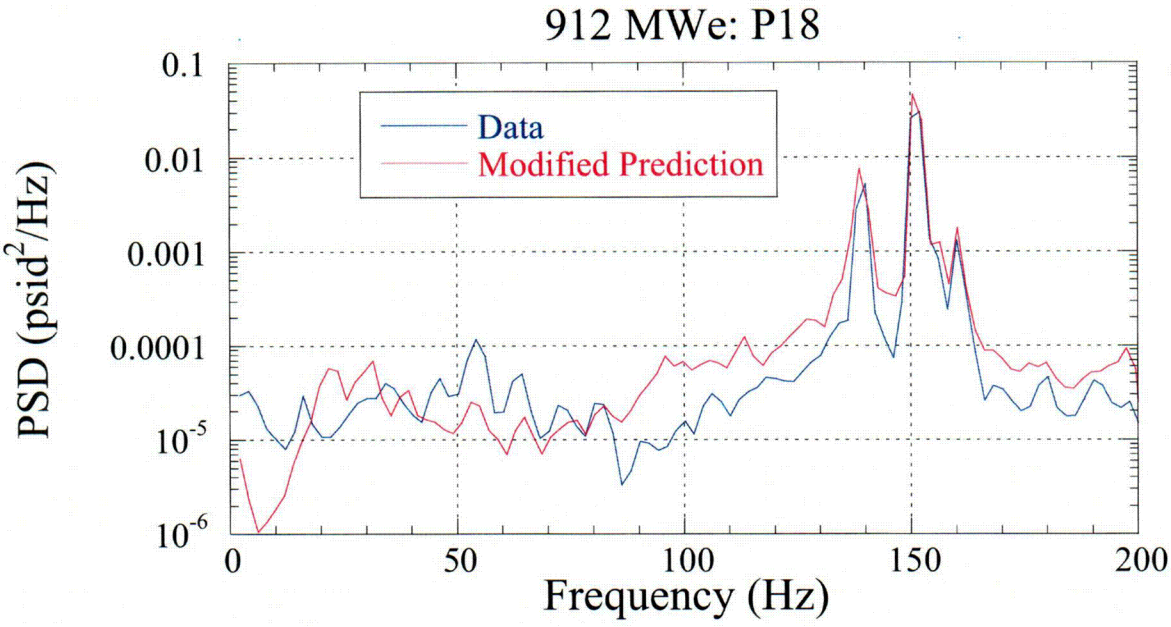

Figure 18. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P18.

C09

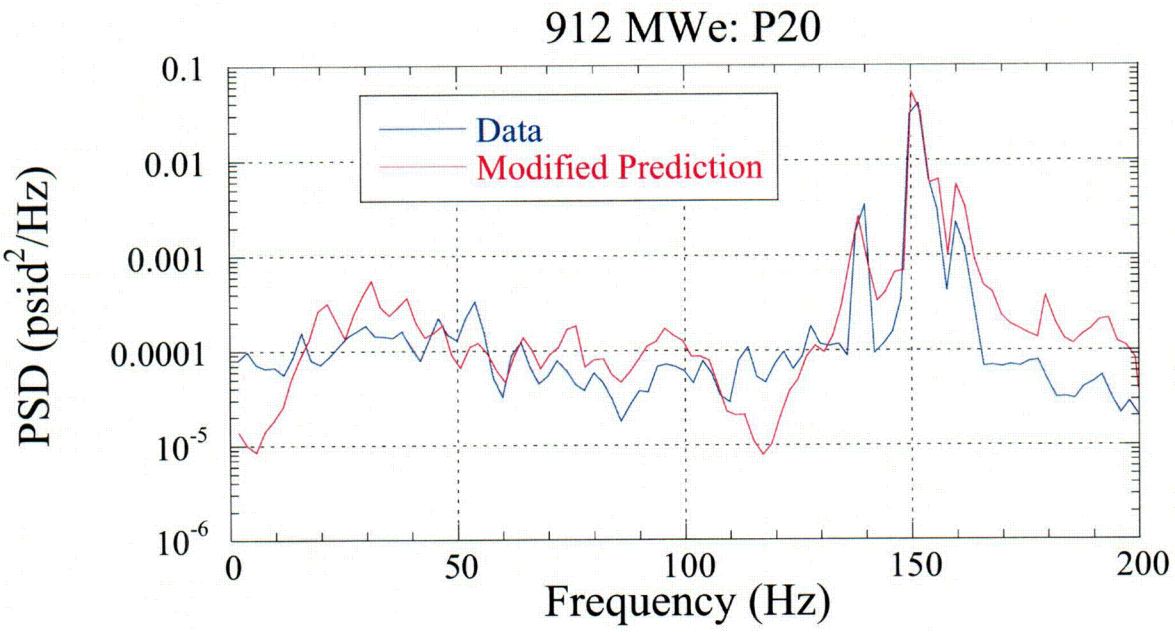

Figure 19. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P20.

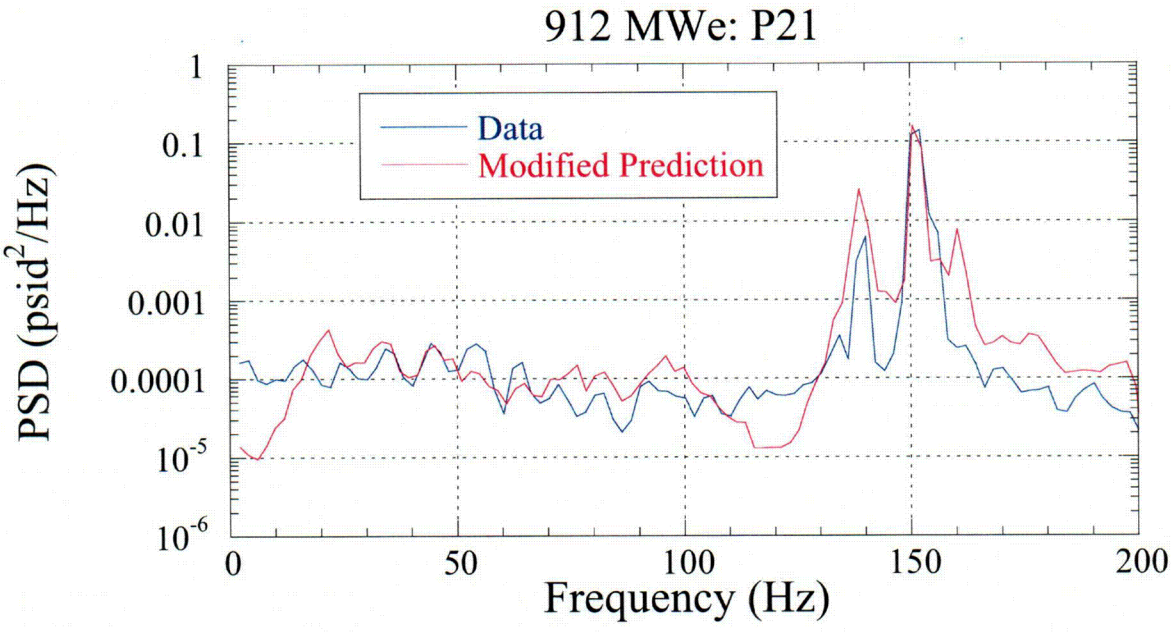

Figure 20. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P21.

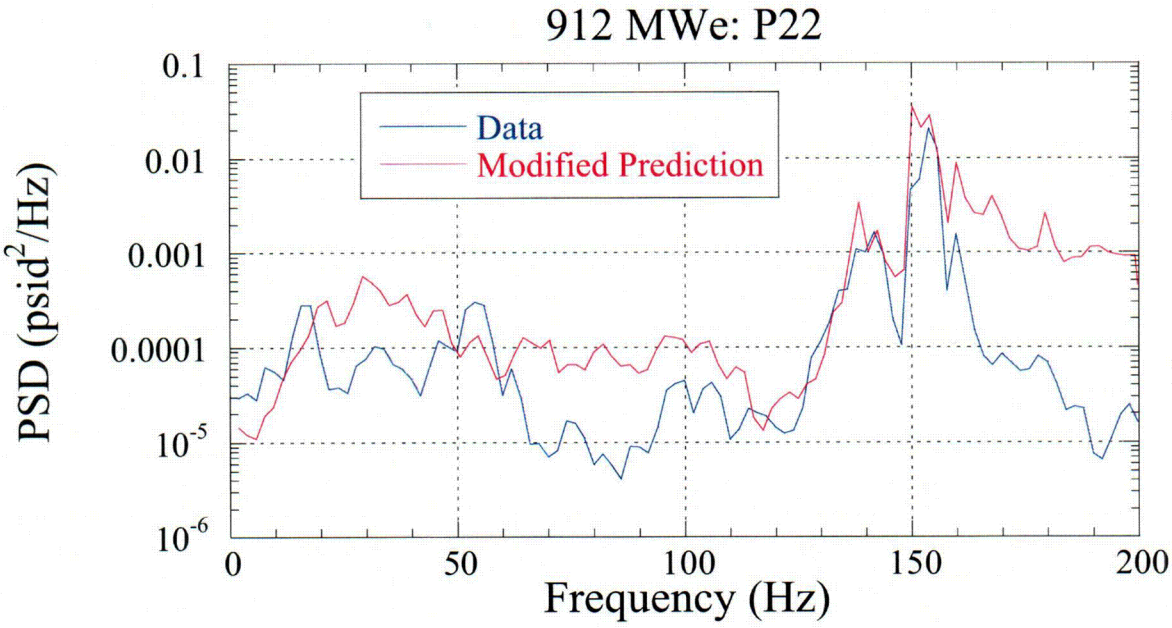

Figure 21. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P22.

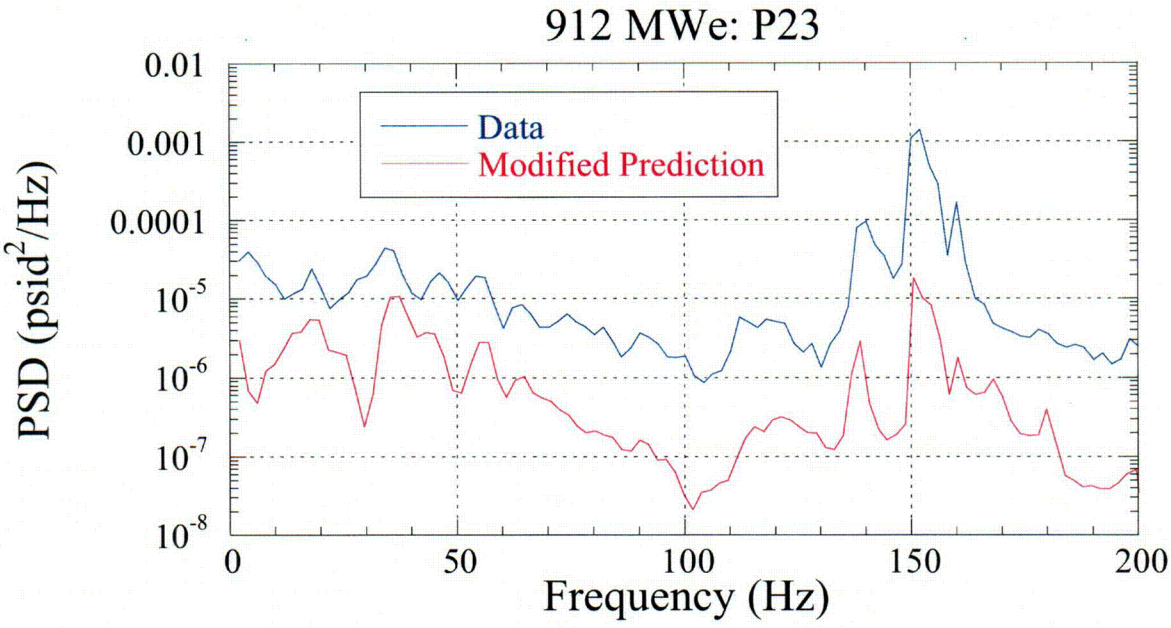

Figure 22. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P23 (which is inside the dryer).

C11

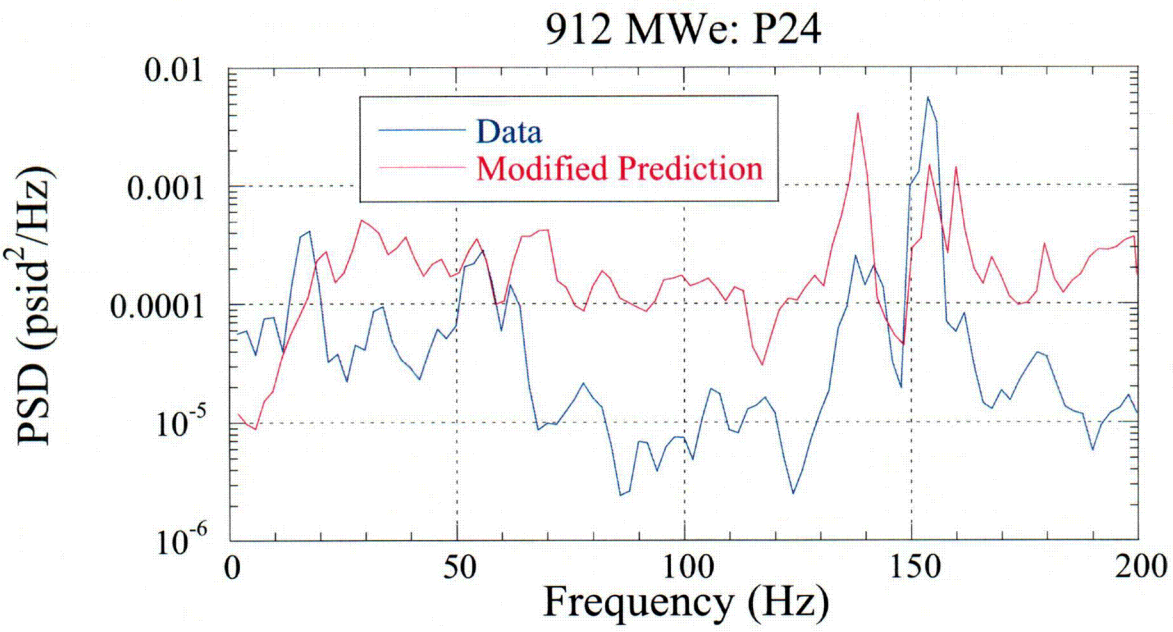

Figure 23. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P24.

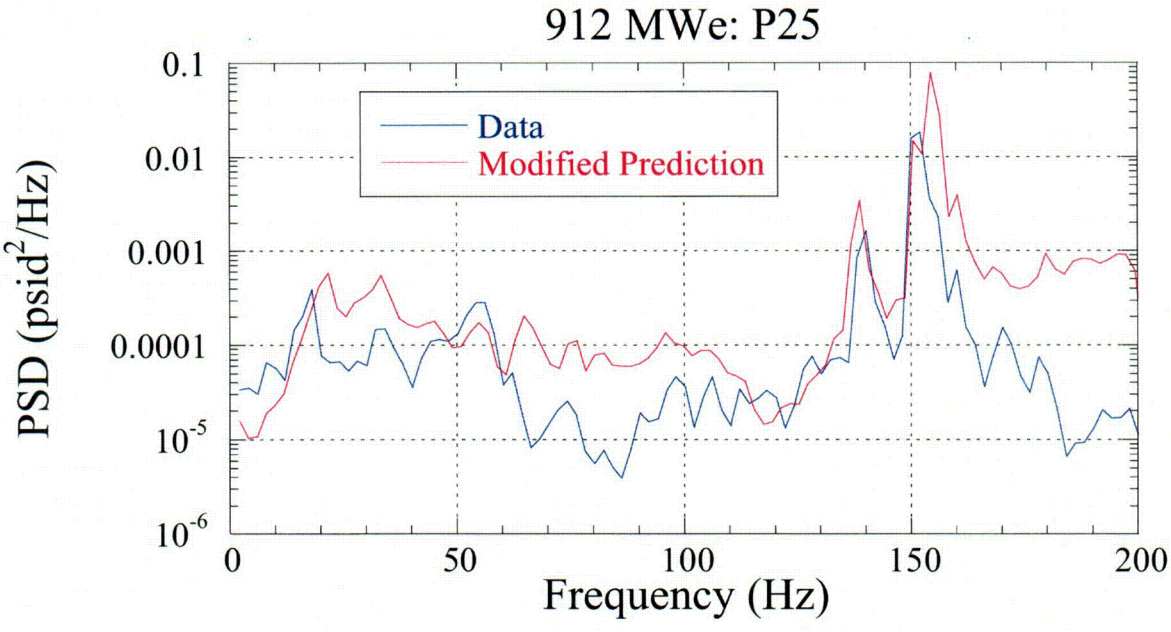

Figure 24. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P25.

C12

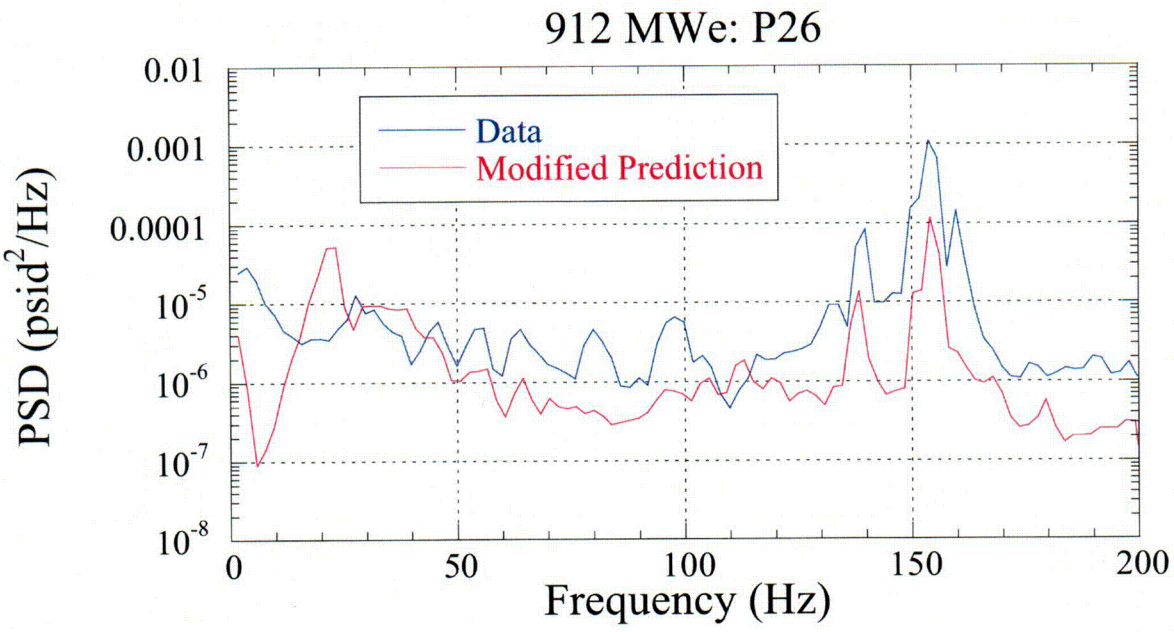

Figure 25. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P26.

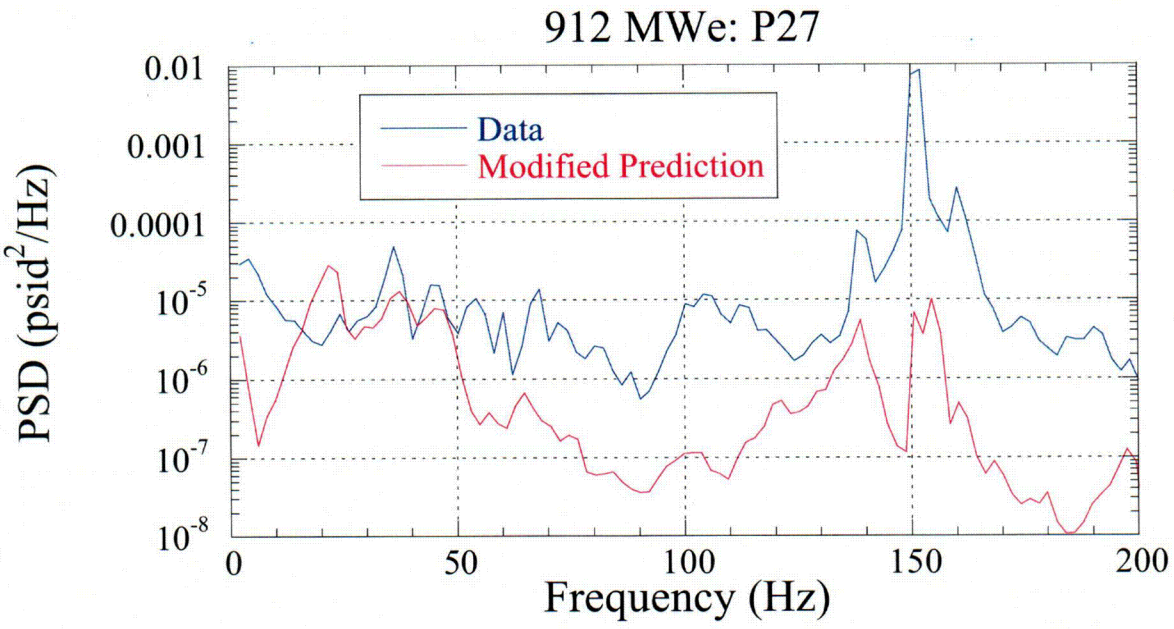

Figure 26. PSD comparison between pressure sensor data (blue curve) and the modified prediction (red curve), for P27 (which is on an inner bank hood).

C13

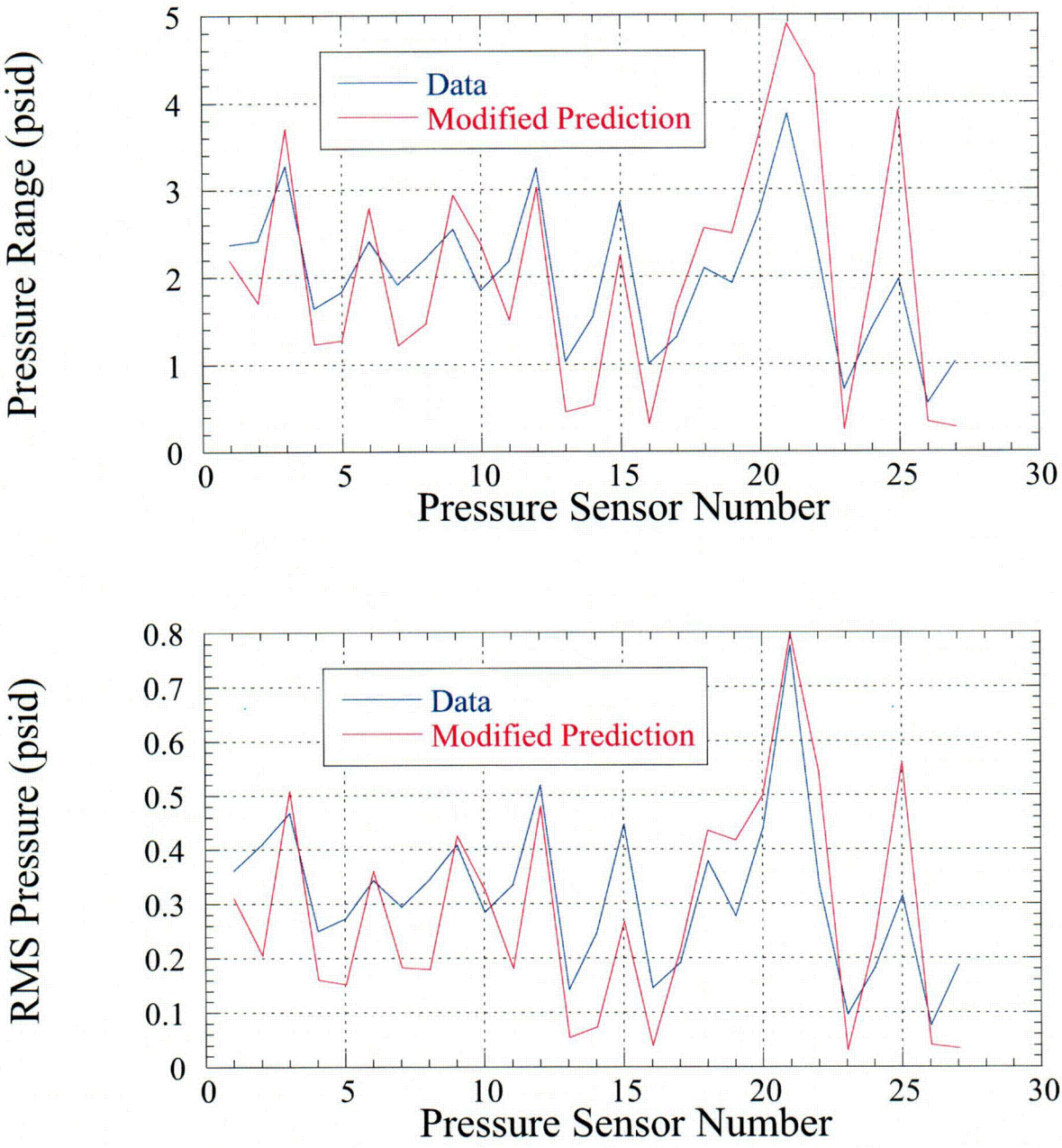

Figure 27. Modified prediction (red curves) compared against the 912 MWe data (blue curves): for pressure range (maximum minus minimum pressures) at all sensors (top) and for RMS pressures at all sensors (bottom). Pressure sensors P13, P14, P16, P23, and P27 are positioned inside the dryer; P19 is inoperative.

C14

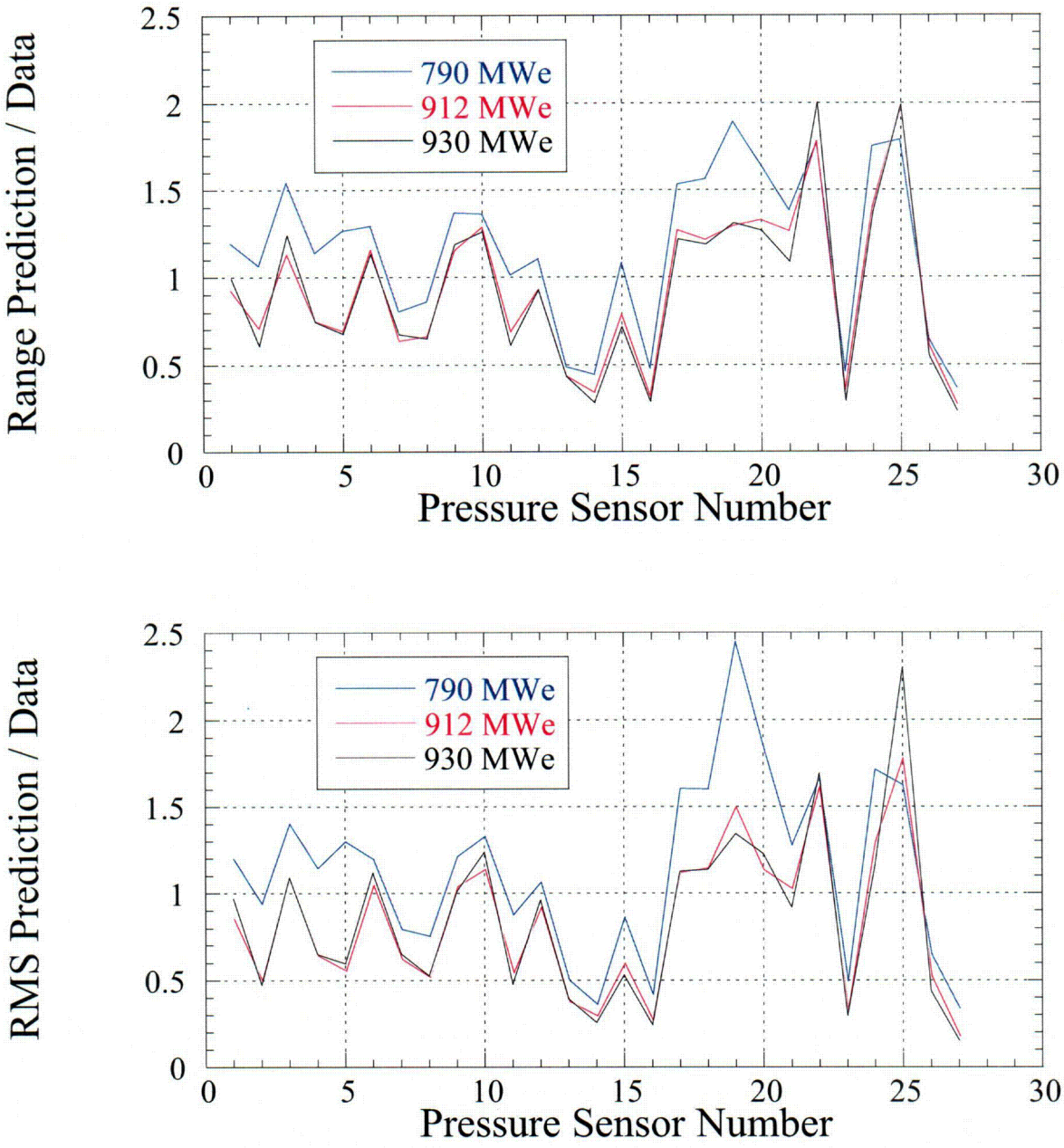

Figure 28. Comparison of the ratio of predicted pressure range divided by the pressure range from data, for all sensors (top), and the ratio of predicted RMS pressure divided by RMS pressure from data, for all sensors (bottom), for 790 MWe (blue curve), 912 MWe (red curve), and 930 MWe (black curve). Values above 1.0 are conservative. Pressure sensors P13, P14, P16, P23, and P27 are positioned inside the dryer; P19 is inoperative.

C15

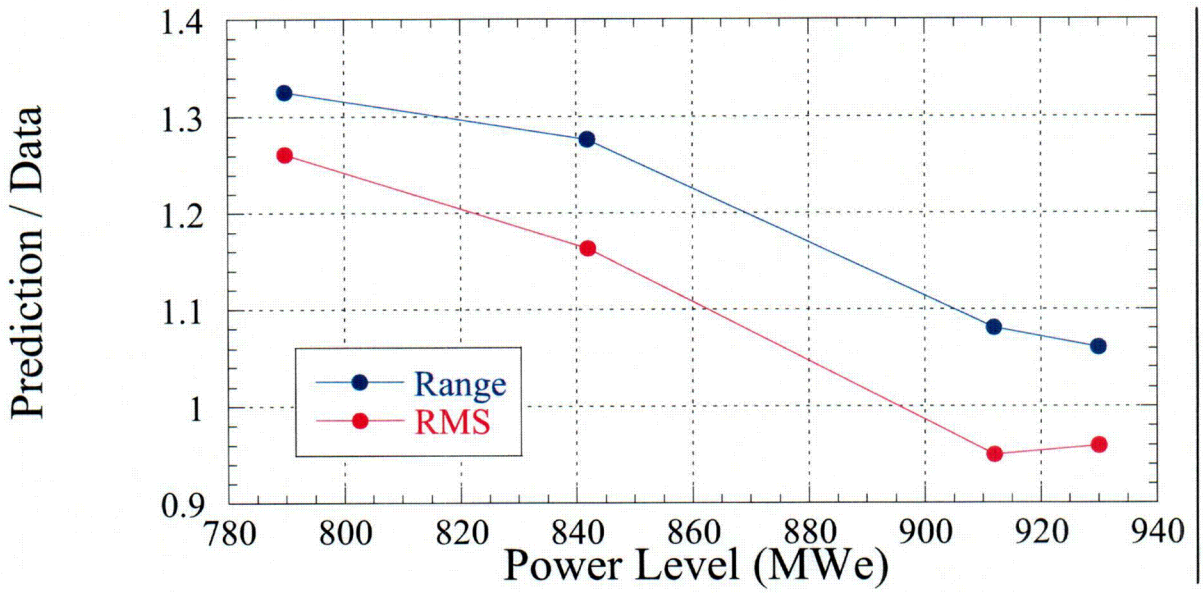

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Figure 29. Comparison of the sum of the predictions (external to the dryer) divided by the sum of the measured data (external to the dryer). Pressure range (blue curve); RMS (red curve). Values greater than 1.0 are conservative.

C16

ATTACHMENT 8

Affidavit and Exelon Report AM-2005-011, "Quantifying the Effects Associated with the Acoustic Circuit Model Omission of Low Frequency Loads," Revision 0

General Electric Company

AFFIDAVIT

I, George B. Stramback, state as follows:

(1) I am Manager, Regulatory Services, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Exelon report, AM-2005-011, *Quantifying the Effects Associated with the Acoustic Circuit Model Omission of Low Frequency Loads*, Revision 0, Contains GE Proprietary Information, dated October 12, 2005. The proprietary information is delineated by a double underline inside double square brackets. Figures and large equation objects are identified with double square brackets before and after the object. In each case, the superscript notation[3] refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, resulting in potential products to General Electric;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a., and (4)b, above.

(5) To address 10 CFR 2.390 (b) (4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains frequency mode analysis results of a BWR Steam Dryer. Development of this information and its application for the design, procurement and analyses methodologies and processes for the Steam Dryer Program was achieved at a significant cost to GE, on the order of two million dollars.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GE asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GE.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 14th day of October 2005.

George B. Stramback
General Electric Company

ATTACHMENT 5

Engineering Change (EC) Evaluation #355702, "Evaluation of Quad Cities Unit 2 Main Steam Line Vibrations at EPU Power Levels with Replacement Dryer," Revision 0

EC # 355702 Revision 0
Evaluation of Quad Cities Unit 2 Main Steam Line Vibrations
At EPU Power Levels
With Replacement Dryer

Reason For Evaluation / Scope:

Purpose

The Unit 2 Steam Dryer was replaced during Q2P03 in order to ensure adequacy for long-term operation at EPU power levels. This EC EVAL, Revision 0, provides a technical evaluation for components previously evaluated, under the referenced EC EVALS, as acceptable for power levels up to 2957 MWth (EPU licensed thermal power) for continuous operation. This review was determined to be necessary due to potential changes in vibration response from the new dryer configuration.

The components evaluated are ERVs, Target Rock Valve, HPCI Limitorque operator, and MSIVs. The steam dryer is evaluated separately. Main Steam piping, both large and small bore is not addressed here as there were no identified vulnerabilities from the original assessments that warranted further evaluation, i.e. significant margin exists and the frequency content at low power levels did not change. The result of these evaluations is that all components were found acceptable for full cycle operation. Recommendations previously made for future inspections and PM activities remain valid as they were made to ensure continuing acceptable component performance.

Approach

Vibration data throughout the range of power operation (See Attachment 2), taken during ramp up to full power, from May 17 through May 22, 2005 was compared to previously gathered in plant data in support of EC 348316 and test results documented under EC 348693 and 350691. The evaluation methodology was to ensure that the maximum values previously evaluated through analysis or testing remain bounding for validating component acceptability for full EPU power operation. Channels 1, 3, 4, 6, 7, 9, 19 & 21 were found to have bad information and were not used in these evaluations except when looking at frequencies of response. The locations on the ERV pilot valves were also discounted as the final evaluations of those components utilized data from the inlet flange location, both for in plant data assessment and for laboratory testing. The data utilized is included in Attachment 2 for the various power levels. A summary table, comparing current with historical data at maximum achieved thermal power, for the locations other than the ERVs is included here for information.

PL = parallel to MSL flow PD = Perpendicular to flow V = Vertical	Unit 1 12/30/2003 2910 MW			Unit 2 File: 0407141949 @ 912 MWe Captured on 4/7 @ 2:19 pm (approx. 2840MWt)			Unit 2 930 MWe / 2885 MWth Captured on 5/22/05			
Location	5 to 200Hz Bandwidth			Wideband Time History			Wideband Time History			
	grms	gmax	gmin	RMS	Max	Min	Channel	RMS	Max	Peak Freq
B MSL - X	*na*	*na*	*na*	0.34371	1.53900	-1.57700	22	0.03990	0.01470	151.5
B MSL - Y	*na*	*na*	*na*	1.10630	4.86440	-4.68730	23	0.462	0.0911	160.5
B MSL - Z	*na*	*na*	*na*	0.31699	1.33390	-1.44820	24	1.1775	0.16466	138.5
HPCI 4 - X	0.3951	1.2292	-1.2465	0.14495	0.62050	-0.58230	25	1.3924	0.15706	138.5
HPCI 4 - Y	0.5894	1.6807	-1.6645	0.16765	0.73290	-0.71390	26	0.20549	0.07135	151.5
HPCI 4 - Z	*na*	*na*	*na*	0.21589	0.90080	-0.82490	27	0.27185	0.0799	151.5
TR 2A - PD	0.1505	0.6191	-0.7107	0.19164	0.68960	-0.76410	28	0.3223	0.11379	151.5
TR 2A - V	0.363	2.8195	-3.2408	1.24440	4.37980	-4.70600	29	0.3483	0.1904	155.0
TR 2A - PLZ	0.218	1.0149	-0.9143	0.38299	1.28830	-1.31670	30	2.2354	1.0709	155.0
1B MSIV - X	0.1253	0.476	-0.4684	0.11846	0.52490	-0.54360	31	0.59192	0.22591	155.0
1B MSIV - Y	0.0725	0.353	-0.4046	0.08038	0.54360	-0.38150	32	0.35049	0.0428	151.5
1B MSIV - Z	0.1689	0.6616	-0.6346	0.18912	0.94020	-0.89220	33	0.17303	0.031363	151.5

Results

The data obtained from the power ascension to 2885 MWth has been assessed against the previously completed evaluations and no concerns were identified Details of the evaluation are provided below. Previous recommended actions are tracked under AR 194877 and are not changed by this current evaluation.

Detailed Evaluation:

Component Damage Summary (Quad Unit 2)

Walkdowns of MSL affected components were performed to identify any components that exhibited vibration induced degradation. These walkdowns were conducted even though the unit did not operate at EPU power levels since the last walkdown. Only one IR was initiated as a result of these walkdowns, for the MSL drain tie-back supports, IR 333168, which were found damaged. Actions and resolution for that issue can be found in the AR documentation.

Some minor discrepancies were found on other components, but were attributed as being a result of normal aging or were historical in nature. A summary of those findings is included as Attachment 3.

Acceptability of ERV Component Operation at EPU Levels

The four new ERVs have virtually identical assemblies and are identical to the Unit 1 assemblies, which consist of the main ERV valve body, pilot valve, and solenoid actuator. The pilot valve is connected to the ERV by means of a turnbuckle and a pilot valve tube. Each valve has small diameter leak off piping that is routed back to the ERV discharge line.

Details of the testing and results can be found in the documentation package supporting modification EC 343933. It was determined through testing that an independent structural mode of the actuator plunger assembly was responding to

input vibrations, causing premature wear degradation of the bushing, spring and guide rod assembly. The valve assemblies installed in Unit 2 were upgraded with hardened components of X750 material for bushings and guide rods and a modified spring, with chamfered edges. These components underwent testing prior to their use to ensure that they would perform at measured vibration levels without experiencing degradation. Comparison of the vibration values used for the modification evaluations are bounding for the Unit 2 measured values in the frequency bands of concern and therefore, these valves are acceptable for full EPU power operation, per Attachment 1.

Evaluation of HPCI 4 Valve Operator

Based on comparison of the current vibration data on channels 25, 26 & 27 to the data evaluated under EC 348316 and testing results in EC 350691, the original evaluation and testing remain bounding and there are no concerns for acceptable long term operation of this actuator and limit switch. The maximum measure grms value was in the x direction at 1.3924, from channel 25 at 930 MWe. From page 7, section 4.2.1 of Calc- QDC-0200-M-1392 the testing input used was a grms value of 3.9, which related to a plant input of 0.45 grms equated to 21567 hours of operation. For the measured 1.3924 grms this results in approximately 6970 hours of operation (or just over one year). However, since the principle component in this grms values was at the high frequency of 138 Hz, and no component response except some bolt loosening was seen after this duration, the Limitorque actuator is deemed acceptable for continuous full power operation. Also, the recommended inspections from EC 348316 (documented under ATI 194877-33) will ensure that loosened connections are detected so that appropriate repairs can be made, each outage until sufficient experience allows for extension. The next performance of this inspection on Unit 2 will occur during Q2R18 in March 2006, less than one year.

Evaluation of MSIVs

Comparison of the current measured vibration levels with the values in EC 348316 shows that the original evaluation remains valid and there are no concerns for acceptability of the MSIVs. The measured values are all below the original seismic endurance test input value of 0.75 g as referenced in GE letter DRF 0000-0023-4260 (from EC 348316).

Evaluation of Target Rock Valves

The Target Rock valve is evaluated in Attachment 1 and comparison to the original evaluation by comparing the measured data to the testing input values documented in EC 348693. Since the frequency domain of concern for valve response is between 20 – 100 HZ and the increased vibration response seen was in the domain of 100 – 200 Hz, there is no concern for long-term acceptability of the modified valve configuration. The hardened upgraded

components were used in the replacement value installed during this outage Q2P03.

Conclusions / Findings:

This EC EVAL provides an Engineering Evaluation of MSL components supporting operation up to 2957 MWth. It has been determined that this full EPU power operation will not result in imminent failure or unacceptable degradation levels of any components. The conclusion is provided by evaluation of the measured vibration data, previous evaluations and test reports from laboratory testing.

Attachments:

Attachment 1: Structural Integrity Associates Letter report: Assessment of quad Cities Unit 2 Power Ascension Main Steam Line Vibration Frequency spectra, SIR-05-192, dated May 26, 2005. (.pdf file attached)

Attachment 2: Vibration data for indicated power levels and components.

Attachment 3: Summary of walkdown findings from Q2P03.

References:

1. SIR-04-023, Rev. 0, ERV Vibration Testing Assessment.
2. QDC-0200-M-1380, Rev. 0, "Evaluation of Components for vibration Effects"
3. QC-16Q-303, Rev. 0, Quad Cities Unit 2 ERV Vibration Data Reduction
4. SIR-03-136, Rev. 3, Evaluation of Main Steam Line Vibration for Quad Cities Unit 2 PORV Replacement
5. ECs 348316, 350691, 350693, 346515.
6. SIA Letter Report SIR-05-192, May 27, 2005

R05192r0.pdf

Attachment 1 – is embedded as a 'pdf' file here.

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May 27, 2005
SIR-05-192
KJO-05-002

Mr. Robert Stachniak
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

Subject: Assessment of Quad Cities Unit 2 Power Ascension Main Steam Line Vibration Frequency Spectra

Dear Rob,

This letter report contains an assessment of the Quad Cities Unit 2 (QC2) May 2005 power ascension vibration frequency spectra and the acceleration versus power level vibration trends for the Electromatic Relief Valves (ERVs) and the Target Rock (TR) Three-Stage Safety Relief Valve.

BACKGROUND

During the April 2004 outage, the ERV solenoid and TR pilot valve internal components were inspected and found to have sustained excessive wear. All valves were overhauled and/or repaired, then put back into service. During the power ascension immediately following the April 2004 outage, several main steam valves (ERV-3B, ERV-3C, ERV-3D, ERV-3E and TR-3A) were monitored to determine their vibration characteristics (frequency content and vibration magnitudes). The resulting frequency spectra at the ERV and TR inlet flanges indicated high accelerations (1.7 grms max). Most of this energy was concentrated at two discrete frequencies, 139 and 157 Hz.

In order to assess the actuator wear and identify design features or materials which would eliminate or substantially minimize wear, vibration testing was performed at Wyle Test Laboratories (Wyle Labs) for the ERV and the TR valves.

ERV Vibration Testing – February 2004

Full-scale ERV vibration testing was conducted at Wyle Labs from February 7 through February 13, 2004. This included modal testing and extensive shaker-table vibration testing, which included sine sweep and random vibration tests. Sine sweeps were conducted from 5-200 Hz at 0.25 g's,

whereas; random vibration testing was conducted from 20-200 Hz with test profiles representative of the acceleration magnitudes observed during valve plant operation [1].

Valve random vibration testing revealed that the solenoid plunger became excited at 70-85 Hz range. This observed solenoid plunger motion was the same type of motion that would have resulted in wear marks found on field ERV solenoid guide rods. Both material and design modifications were evaluated and all ERVs were modified to incorporate the recommended design changes.

TR Vibration Testing – July-October 2004

Full-scale TR vibration testing was conducted at Wyle Labs from July 12 through October 15, 2004. This included modal testing and extensive shaker-table vibration testing, which included sine sweep and random vibration tests. Sine sweeps were conducted from 5-200 Hz at 0.25 g's, whereas; random vibration testing was conducted from 20-200 Hz with a flat-random vibration magnitude of 1.34 grms that resulted in accelerated component aging. It must be noted, that the Wyle Labs random vibration test levels were much higher than the measured plant random vibration levels [2].

Valve random vibration testing revealed that the bellows cap spring became excited at 70-90 Hz. Post test inspection, revealed wear marks consistent with the wear found on field bellows cap. The bellows cap material and spring tolerances were evaluated during the accelerated wear tests and the TR valve was modified during the May 2005 outage to incorporate the recommended design changes.

ERV and TR Vibration Monitoring – May 2005

The vibration of the four ERVs (ERV-3B, ERV-3C, ERV-3D, and ERV-3E) and TR-3A were monitored during the May 2005 power ascension. Accelerometers were mounted on the valve inlets in the x, y and z axes (tri-axial mount) for each valve. These accelerometers were in the same location for both the April 2004 and May 2005 outages (Table 1 and Figures 1 and 2). Vibration data was captured and processed by QC personnel and Structural Integrity Associates received frequency spectra for each of 17 power levels [4]. Vibration data was captured from 130 - 930 MWe and RMS acceleration trend plots were generated. May 2005 trend plots were compared to the same trend plots from April 2004 vibration data.

ASSESSMENT OF FREQUENCY SPECTRA

Acceleration trend plots are shown in Figures 3-7. These plots show the RMS accelerations versus power level. Inspection of both time history and frequency spectra revealed that several sensors had bad data or the data was questionable.

Examination of Time History Data by QC2 Engineering revealed the following:

- ERV 3B Inlet, z-axis, Ch 7 and 9 is bad above 700 MWe.
- ERV 3C Inlet, x-axis, Ch 13 is bad above 700 MWe.
- ERV 3D Inlet, x-axis, Ch 16 is bad above 700 MWe.
- ERV 3E Inlet, z-axis, Ch 3 is bad above 700 MWe.

Examination of Frequency Spectra revealed the following:

- ERV 3B Inlet, x-axis, Ch 7 is bad; no frequency content.
- ERV 3B Inlet, y-axis, Ch 8 has limited frequency content and has a moderate noise floor.
- ERV 3C Inlet, y-axis, Ch 14 is bad; no frequency content.
- ERV 3E Inlet, x-axis, Ch 1 is bad; no frequency content.

Based on the above channel quality assessments, only channels 2, 14, 15, 17, 18, 28, 29, and 30 have good quality data.

Further inspection of all frequency spectra revealed the following:

- 3B ERV Inlet Flange (ch 7-9), all channels have questionable data based on spectra and time history assessments. Graphs showed similar amplitudes as 2004 vibration data, low-to-moderate amplitude (0.56 grms max), but all data is questionable. Channel 9, 3B ERV Inlet Flange, z-axis had the highest amplitude, which seemed to jump up between 920 and 930 MWe (during the last power ascension the y-axis amplitude was highest). Frequency spectra show two discrete frequencies: 139 and 160.5 Hz (similar amplitudes, when compared to the April 2004 power ascension data). There are also two lower discrete frequencies at 151.5 and 156 Hz. There are multiple peaks in the 150-160 Hz range, as if the frequencies were fluctuating within the main steam line; this may indicate a shifting forcing function as the power level is increasing.

- 3C ERV Inlet Flange (ch 13-15), channels 13 and 14 have questionable data based on spectra and time history assessments. Graphs showed similar amplitudes as 2004 vibration data, low-to-moderate amplitudes (0.8 grms max). Channel 15, 3C ERV Inlet Flange, z-axis had the highest amplitude, which rapidly increased in amplitude after 700 MWe to a peak at 930 MWe (the y-axis amplitude was highest during the April 2004 power ascension). Frequency spectra show two discrete frequencies (dependent upon channel): 139 and 151.5 Hz (similar in amplitude, when compared to the April 2004 power ascension data).

- 3D ERV Inlet Flange (ch 16-18), channel 16 has questionable data based on time history assessments. Graphs showed similar amplitudes as 2004 vibration data, moderate-to-high amplitudes (1.83 grms max). Channels 17 and 18, 3D ERV Inlet Flange, y and z-axes, respectively, have the highest amplitude, which rapidly increased in amplitude after 700 MWe to a peak at 930 MWe (April 2004 power ascension showed the y-axis amplitude was highest). Frequency spectra show two discrete frequencies (dependent on channel): 139 and 151.5 Hz (similar amplitudes, when compared to the April 2004 power ascension data).

- 3E ERV Inlet Flange (ch 1-3), channels 1 and 3 have questionable data based on time history and spectra assessments. Graphs showed similar amplitudes as 2004 vibration data, low-to-moderate amplitudes (1.0 grms max). Channel 2, 3E ERV Inlet Flange, y-axis had substantially lower amplitudes than the same channel in April 2004. The highest amplitude

was observed on channel 3 (questionable data, based on time history), which rapidly increased in amplitude after 700 MWe to a peak at 930 MWe (last power ascension the y-axis amplitude was highest). Channels 2 and 3 frequency spectra had three discrete frequencies (dependent upon channel): 139, 151.5 and 160.5 Hz. Except for the 151.5 Hz frequency, amplitudes are 30-50% lower when compared to the April 2004 power ascension data. There are multiple peaks in the 150-160 Hz, as if the frequencies are fluctuating within the main steam line; this may indicate a shifting forcing function as the power level is increasing.

- Target Rock Valve Inlet Flange (ch 28-30) has 3 channels of good data. The 2005 vibration data showed much higher amplitudes (2.60 grms) than the 2004 vibration data. Channel 30, TR Inlet Flange, z-axis had the highest amplitude of 2.6 grms (considered high), which rapidly increased in amplitude after 700 MWe to its peak at 930 MWe (the y-axis amplitude was highest during the 2004 power ascension). The z-axis vibration level was 80% higher than the 2004 vibration data. Frequency spectra show two discrete frequencies (dependent on channel): 151.5 and 155 Hz (the TR Inlet flange, z-axis vibration amplitudes exceeded the 2004 vibration data).

Inspection of Figures 6 and 7 indicate that the 2004 and 2005 plant RMS vibration levels exceed the RMS test levels used in the Wyle Lab testing for ERV 3E and the TR valves. This required a further assessment of each frequency spectrum at the higher power levels.

ERV ASSESSMENT

ERV 3B, 3C, 3D and 3E, May 2005 spectra (Figures 8 and 9) show vibration responses at several discrete frequencies, 139, 151.5 and 160 Hz, but vibration amplitudes are low at frequencies below 120 Hz. Vibration magnitudes in the 70-90 Hz frequency range do not exceed $\leq$0.015 grms (considered very low). Therefore, most of the vibration energy is concentrated at the three discrete frequencies.

Based on the ERV testing performed at Wyle Labs, the largest response of the actuator occurred at a frequency of ~85 Hz. From the Wyle Labs test results, the X-axis testing resulted in the largest contributor to actuator wear. Figure 10 of Reference [1] contains a frequency spectrum of the ERV actuator response to an input that consisted of a flat random vibration (20-200 Hz) with superimposed sine sweeps at 138–142 Hz and 154–158 Hz. The two sine sweep frequency ranges correspond to the acoustic frequency response that was observed in the plant data [5]. While the plant data (Figures 8 and 9) shows significant acoustic response between 139 and 160 Hz, the Wyle Test results show that the largest actuator response occurs at frequencies below 100 Hz.

The frequency spectra for ERVs 3B and 3E contain responses at discrete frequencies between 150-160 Hz, which would have no effect on either valve or solenoid components of concern. Two types of Wyle vibration tests confirmed this:

1) A sine sweep test from 5-200 Hz (Tests 2.A.X, 2.A.Y, and 2.A.Z; ERV valve with no tie-back support and with the actuator cover on); gave no response in the 150-160 Hz range on any axis. Sine sweep responses were at 35, 70, and 85 Hz only.

2) A flat random vibration from 20-200 Hz (Tests 2.B.X, 2.B.Y, and 2.B.Z; ERV valve with no tie-back support and with the actuator cover on); gave no response in the 150-160 Hz range on any axis. Random vibration responses were at 70 and 85 Hz.

The results of these tests confirm that ERV discrete frequencies between 150-160 Hz have no effect on either valve or solenoid components of concern, since these valve components do not respond to this frequency range. Thus, the current vibration levels are acceptable and should not cause excessive actuator component wear.

TARGET ROCK ASSESSMENT

TR 3A, May 2005 spectra (Figures 11-13) show vibration responses at two discrete frequencies, 151.5 and 155 Hz, but vibration amplitudes are low at frequencies below 130 Hz. Vibration magnitudes in the 70-90 Hz frequency range do not exceed $\leq$0.03 grms. Therefore, most of the vibration energy is concentrated at the two discrete frequencies.

Based on the TR testing performed at Wyle Labs, the largest response of the actuator (bellows cap and spring) occurred at a frequency of 79 Hz. Figure 14 of Reference [2] contains a frequency spectrum of the TR actuator response to an input that consisted of a flat random vibration from 20-200 Hz. While the plant data (Figures 11 and 13) shows high acoustic response at 151 and 155 Hz, the Wyle Test results shows that the largest actuator response occurs at frequencies below 100 Hz.

TR 3A discrete frequencies of 151.5 and 155 Hz would have no effect on the valve or solenoid components of concern. Four types of Wyle vibration tests confirmed this:

1) A flat random vibration from 20-100 Hz (Test run 2) had a response in the 70-90 Hz range.
2) A flat random vibration from 100-200 Hz (Test run 3), where there was no real response for either valve or solenoid.
3) Sine sweep tests from 5-200 Hz (Test runs 21 and 23; baseline cap with field spring); gave no response in the 150-160 Hz range on any axis. Sine sweep responses were at 79 Hz only.
4) A flat random vibration from 20-200 Hz (Test runs 22 and 24; baseline cap with field spring); gave no response in the 150-160 Hz range on any axis. Random vibration responses were at 70-90 Hz range.

The results of these tests confirm that TR discrete frequencies between 150-155 Hz have no effect on the pilot valve components of concern, since these valves components do not respond to this frequency range. Thus, the current vibration levels are acceptable and should not cause excessive bellows cap wear.

CONCLUSIONS

Based on the May 2005 frequency spectra and acceleration trend plots, the April 2004 vibration data, and the Wyle shake table test results, all valve 'problem components' responded only to frequencies below 100 Hz. Thus, the ERV solenoid spring guides and TR pilot valve bellows cap should not have sustained any significant wear during the May 2005 power ascension, since most of the vibration energy (80-90%) was in the 150-160 Hz frequency range at the maximum power

(930 MWe). Amplitudes in the 70-90 Hz range were less than 0.03 grms (at 930 MWe), which was well below the Wyle Labs testing. Therefore, continued operation at the current vibration level should not result in excessive wear of these valve components.

If you have any questions, please do not hesitate to contact me at (303) 792-0077.

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Reviewed By:

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Approved By:

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kjo

REFERENCES:

1. Wyle Test Report No. 50584-01, dated 2/23/04, "Test Report – Vibration Endurance Test Program for a Dresser Electromatic Relief Valve Type 6" 1525-VX for Exelon Nuclear," SI File No. QC-16Q-202.
2. Wyle Test Report No. 50947R02 Revision 0, dated 11/04/04, "Test Report for a vibration aging Test Program for a Pilot/Base Assembly of a Target Rock Three-Stage Safety Relief Valve for Exelon Nuclear," SI File No. QC-25Q-204.
3. Structural Integrity Associates Report No. SIR-04-023, Revision 0, Quad Cities ERV Vibration Testing Assessment," SI File No. QC-16Q-401.
4. Frequency spectra received from Exelon via ibackup.com, SI File No. QC-28Q-201.
5. Structural Integrity Associates Calculation No. QC-16Q-303, Revision 0, Quad Cities ERV Vibration Testing Assessment."

cc: QC-28Q-401

Table 1: Accelerometer Location Summary - Quad Cities, Unit 2

Channel Number	Type	Direction	Location
1	Accelerometer	Parallel to MS flow (X)	Inlet Flange ERV 3E
2	Accelerometer	Vertical (Y)	Inlet Flange ERV 3E
3	Accelerometer	Perpendicular to MS flow (Z)	Inlet Flange ERV 3E
4	Accelerometer	Perpendicular to channel 6 (X)	ERV 3E pilot valve
5	Accelerometer	Vertical (Y)	ERV 3E pilot valve
6	Accelerometer	Parallel to Turnbuckle (Z)	ERV 3E pilot valve
7	Accelerometer	Parallel to MS flow (X)	Inlet Flange ERV 3B
8	Accelerometer	Vertical (Y)	Inlet Flange ERV 3B
9	Accelerometer	Perpendicular to MS flow (Z)	Inlet Flange ERV 3B
10	Accelerometer	Perpendicular to channel 12 (X)	ERV 3B pilot valve
11	Accelerometer	Vertical (Y)	ERV 3B pilot valve
12	Accelerometer	Parallel to Turnbuckle (Z)	ERV 3B pilot valve
13	Accelerometer	Parallel to MS flow (X)	Inlet Flange ERV 3C
14	Accelerometer	Vertical (Y)	Inlet Flange ERV 3C
15	Accelerometer	Perpendicular to MS flow (Z)	Inlet Flange ERV 3C
16	Accelerometer	Parallel to MS flow (X)	Inlet Flange ERV 3D
17	Accelerometer	Vertical (Y)	Inlet Flange ERV 3D
18	Accelerometer	Perpendicular to MS flow (Z)	Inlet Flange ERV 3D
19	Accelerometer	Perpendicular to channel 21 (X)	ERV 3D pilot valve
20	Accelerometer	Vertical (Y)	ERV 3D pilot valve
21	Accelerometer	Parallel to Turnbuckle (Z)	ERV 3D pilot valve

28	Accelerometer	Perpendicular to MS flow (X)	Inlet Flange Target Rock 3A
29	Accelerometer	Vertical (Y)	Inlet Flange Target Rock 3A
30	Accelerometer	Parallel to MS flow (Z)	Inlet Flange Target Rock 3A

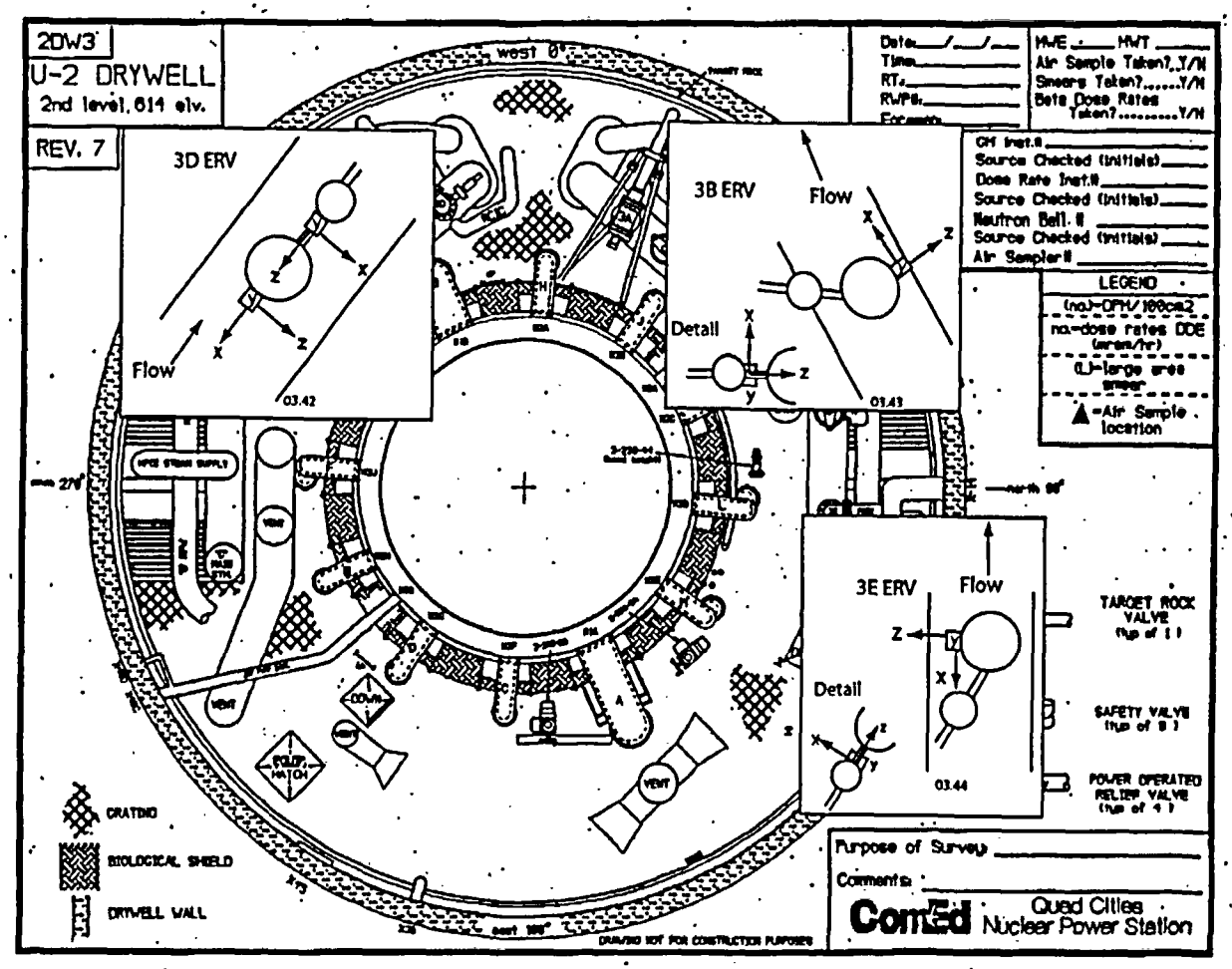


Figure 1: ERVs 3B, 3D, and 3E Inlet Flange and Pilot Valve

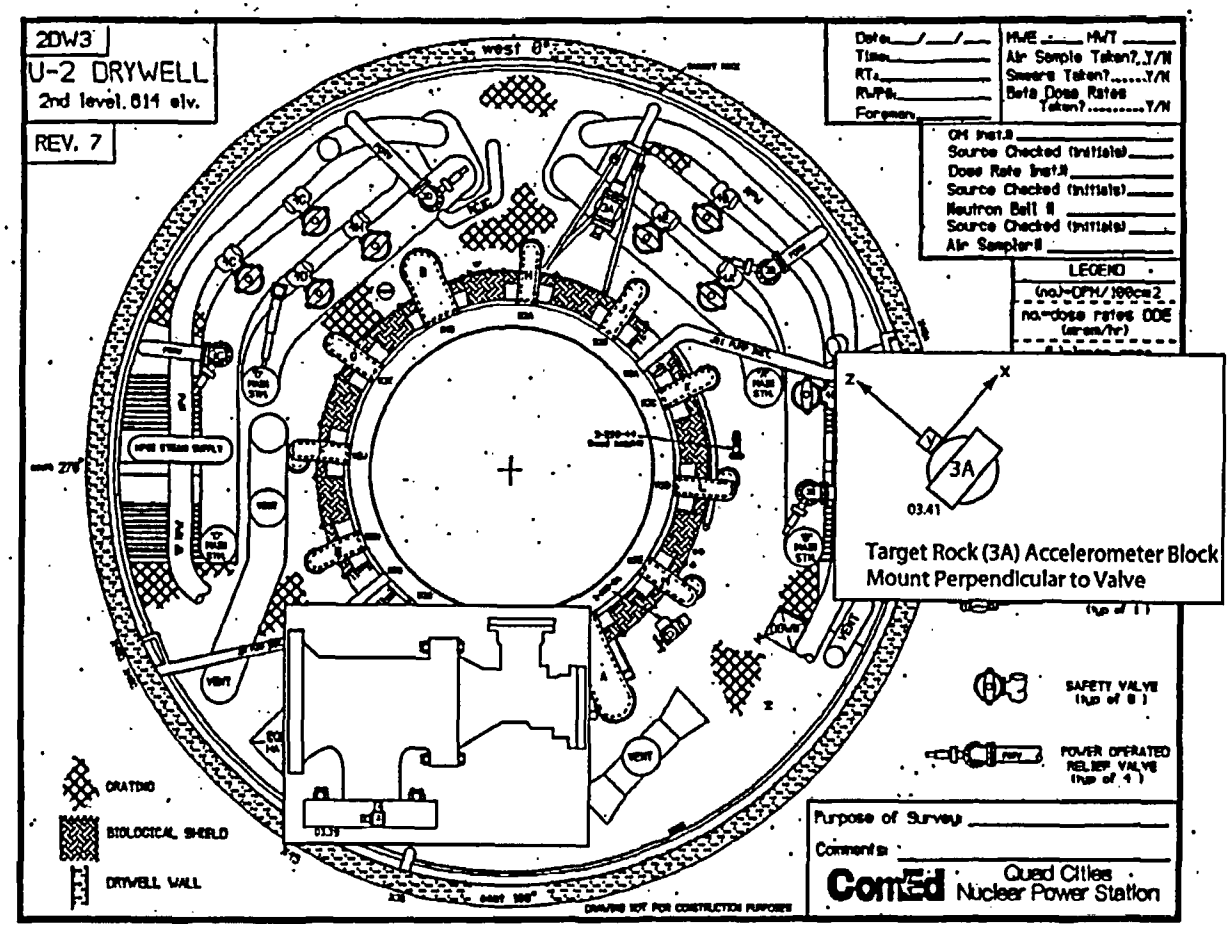


Figure 2: Target Rock Valve 3A

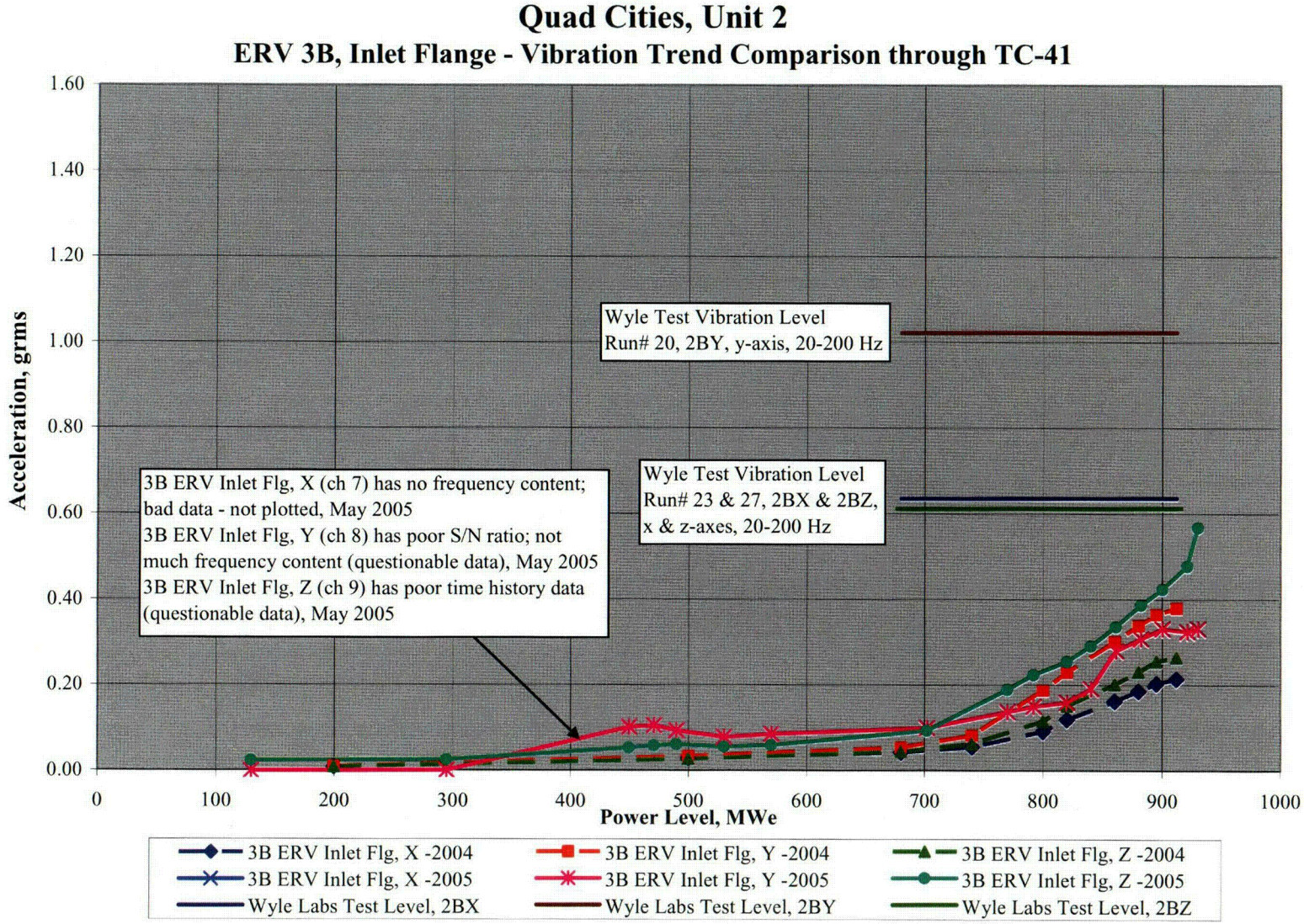


Figure 3: ERV 3B, Inlet Flange RMS Trend Plots

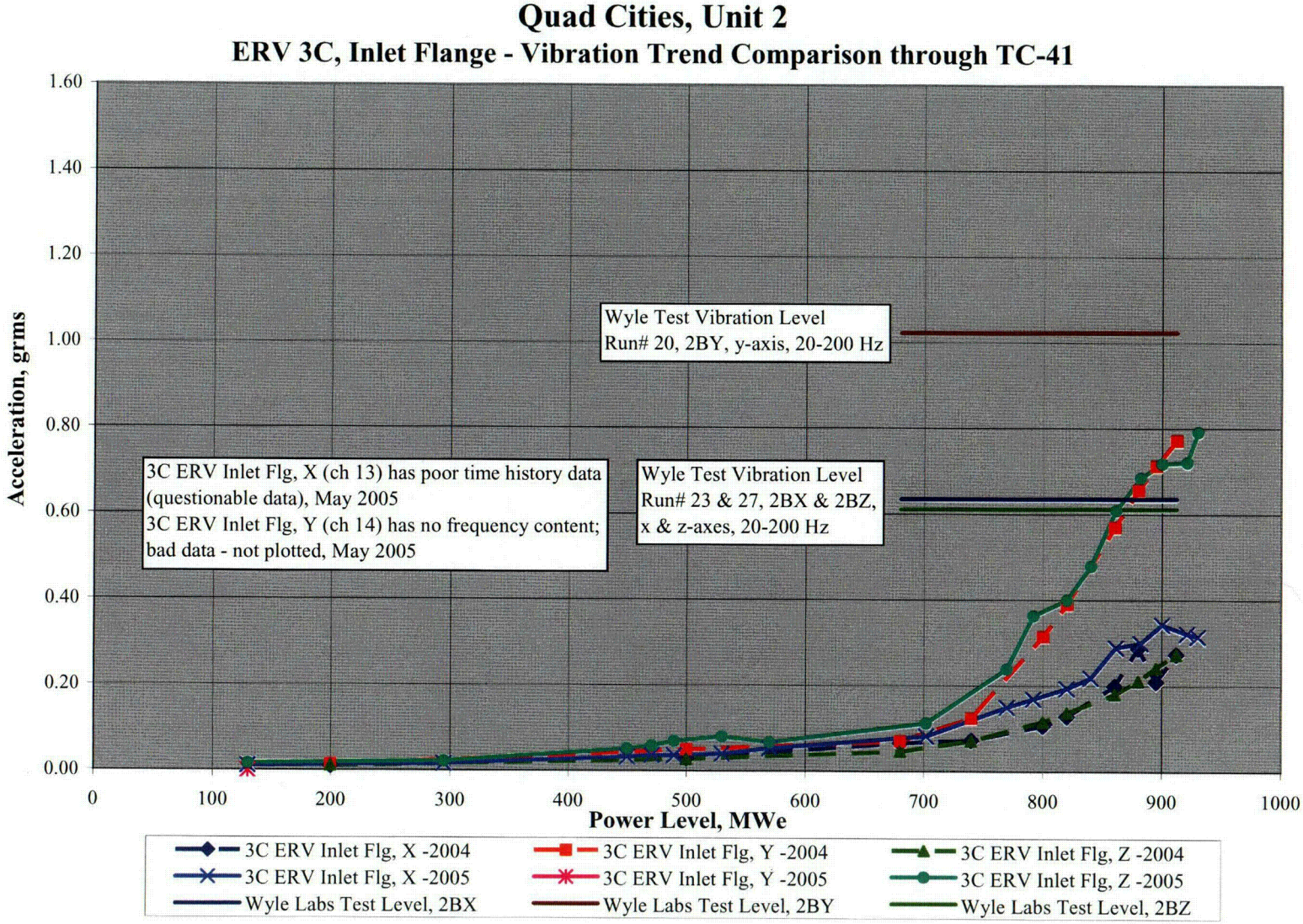


Figure 4: ERV 3C, Inlet Flange RMS Trend Plots

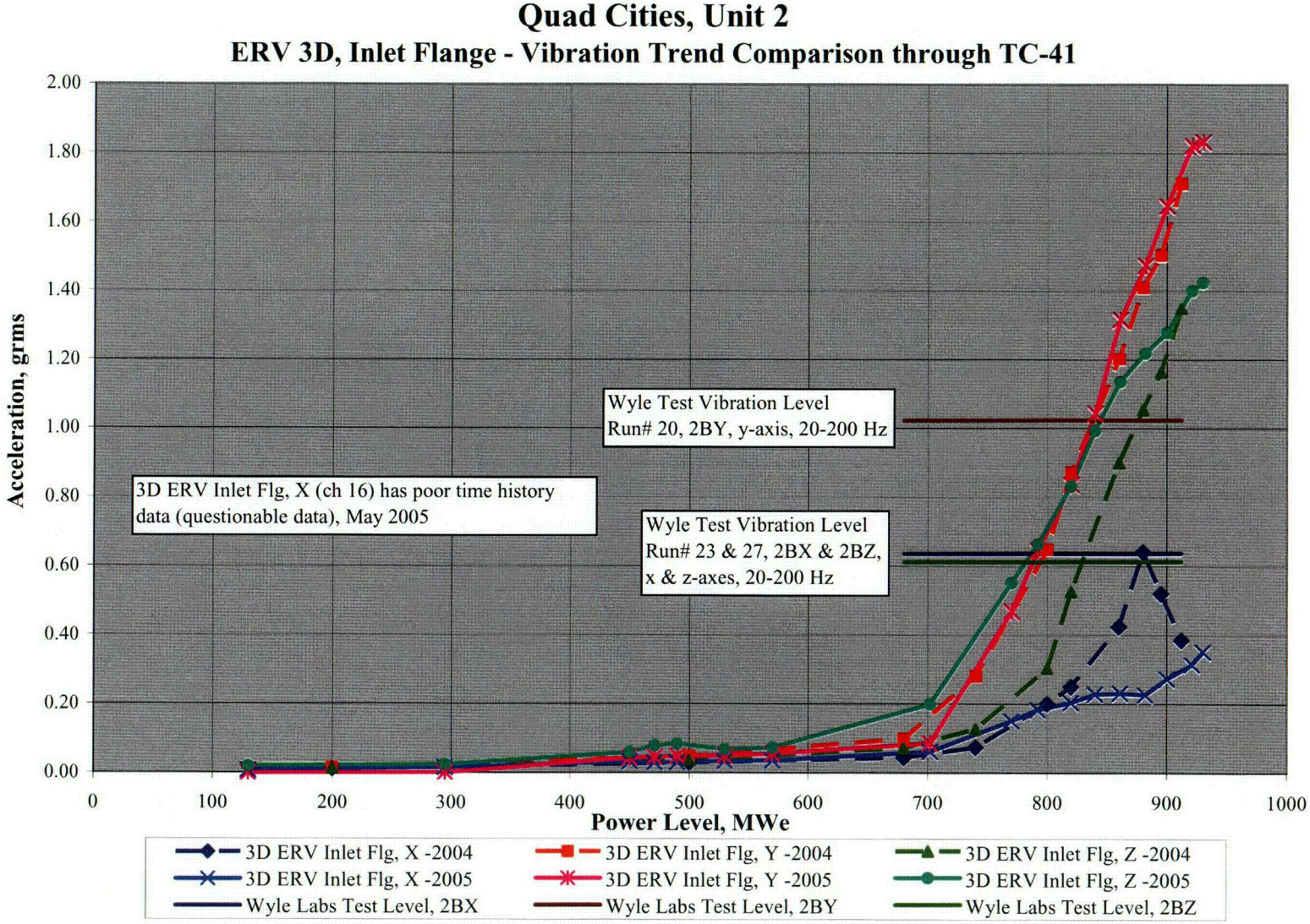


Figure 5: ERV 3D, Inlet Flange RMS Trend Plots

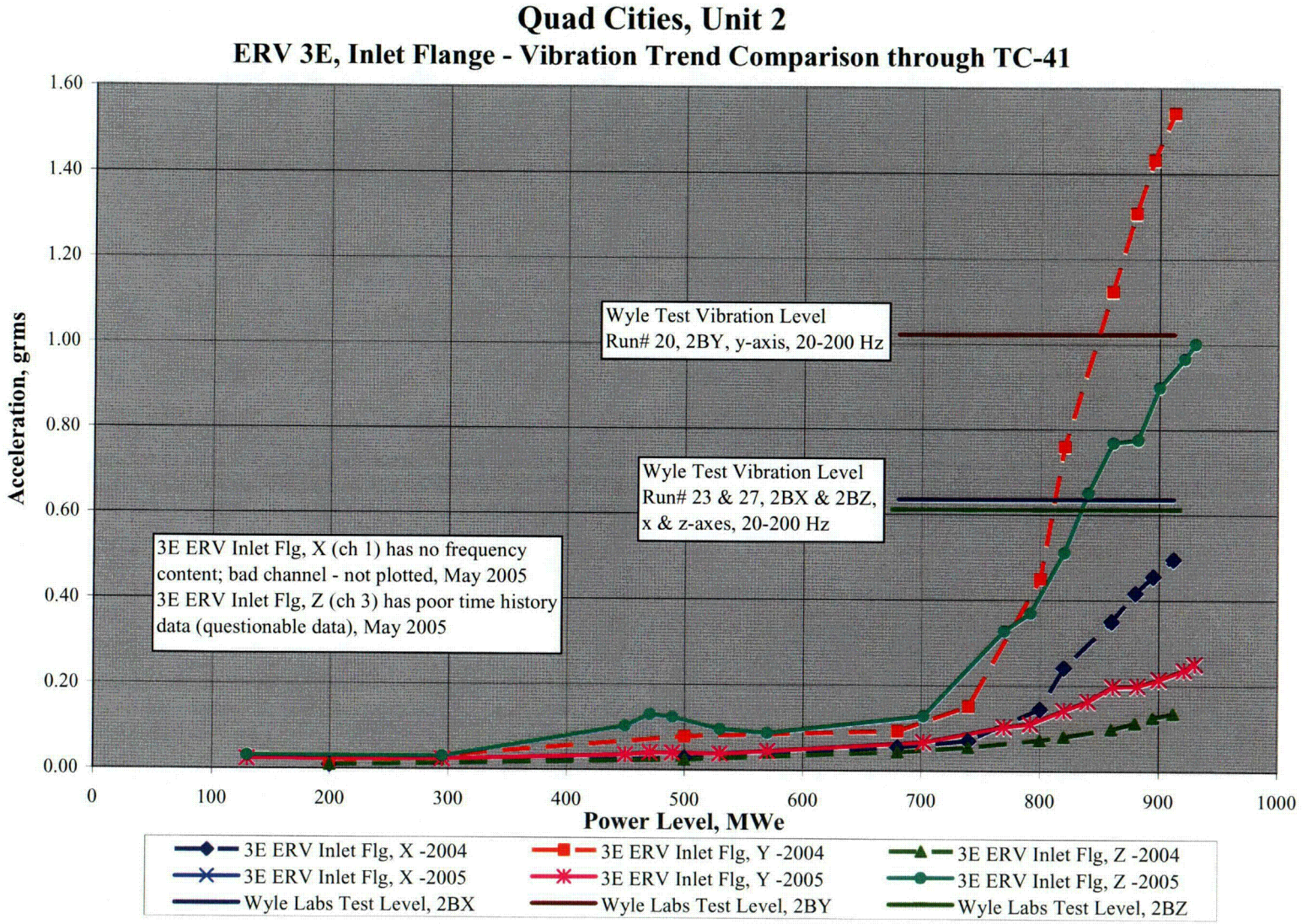


Figure 6: ERV 3E, Inlet Flange RMS Trend Plots

C20

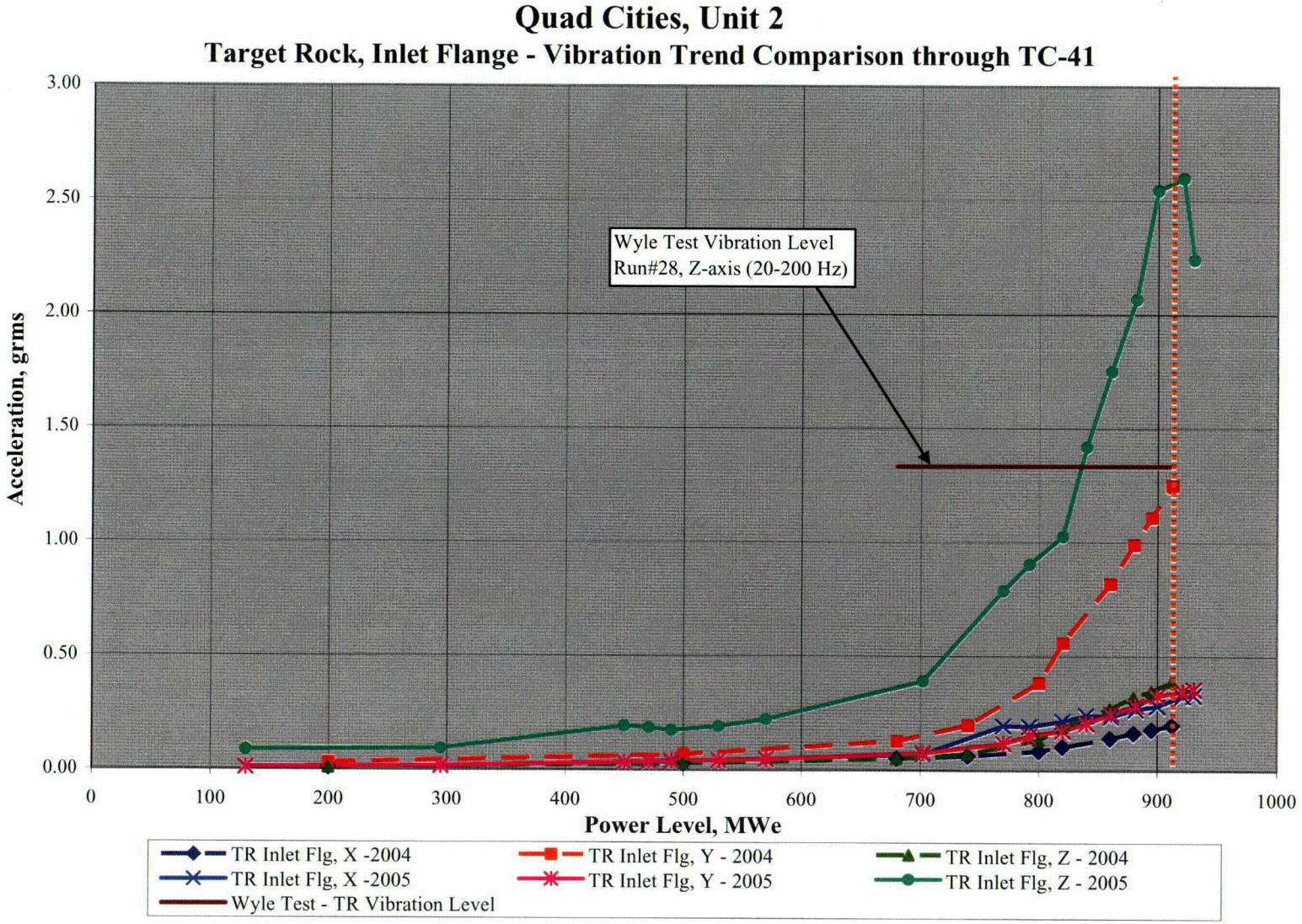


Figure 7: TR 3A, Inlet Flange RMS Trend Plots

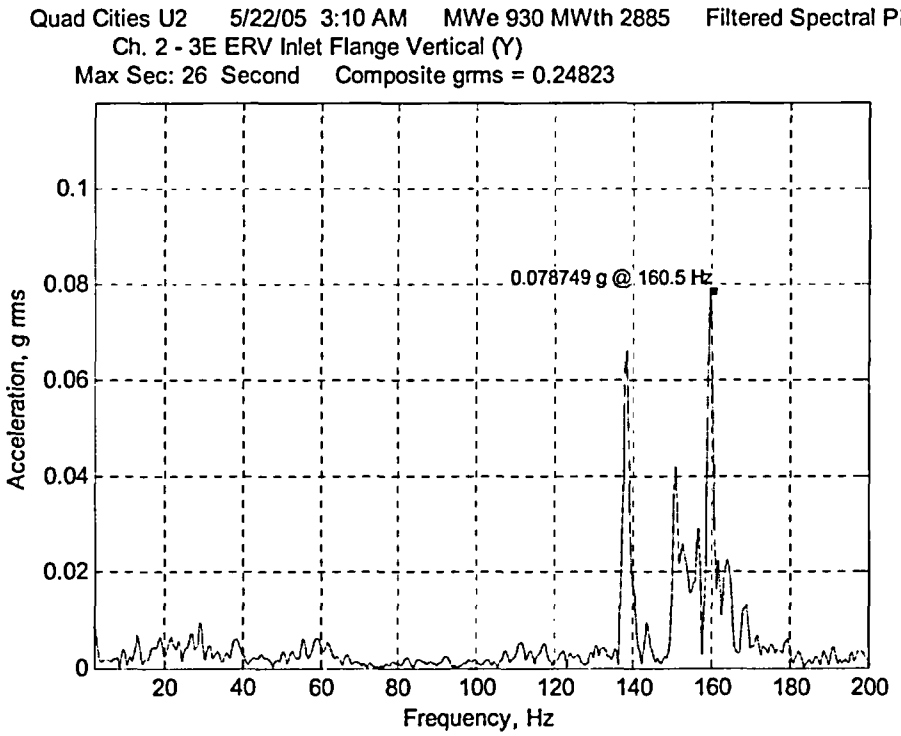


Figure 8: ERV 3E, Inlet Flange, y-axis

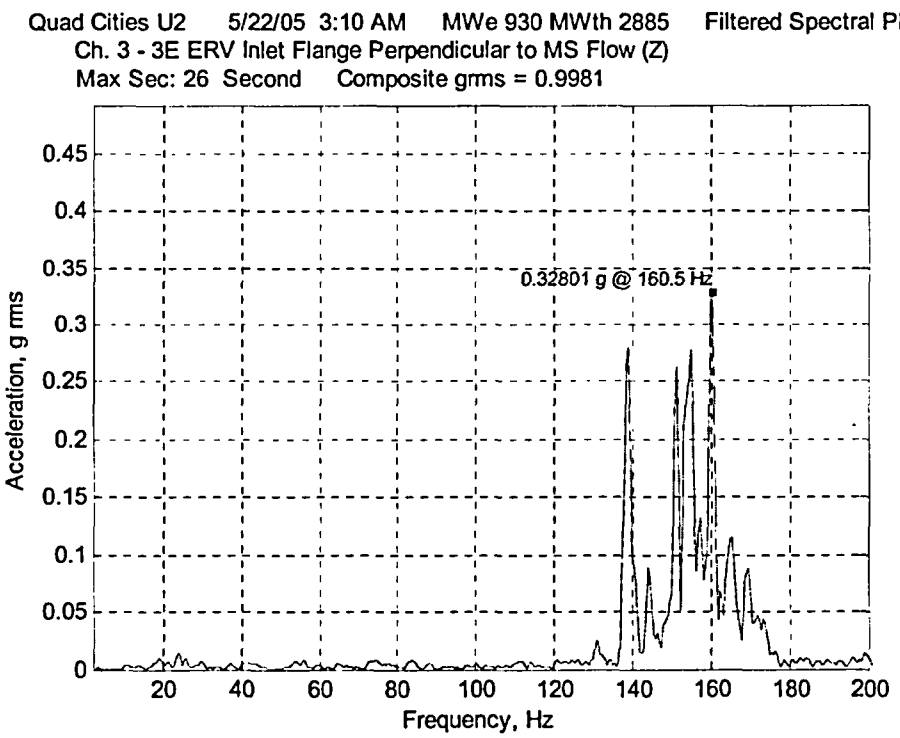


Figure 9: ERV 3E, Inlet Flange, z-axis

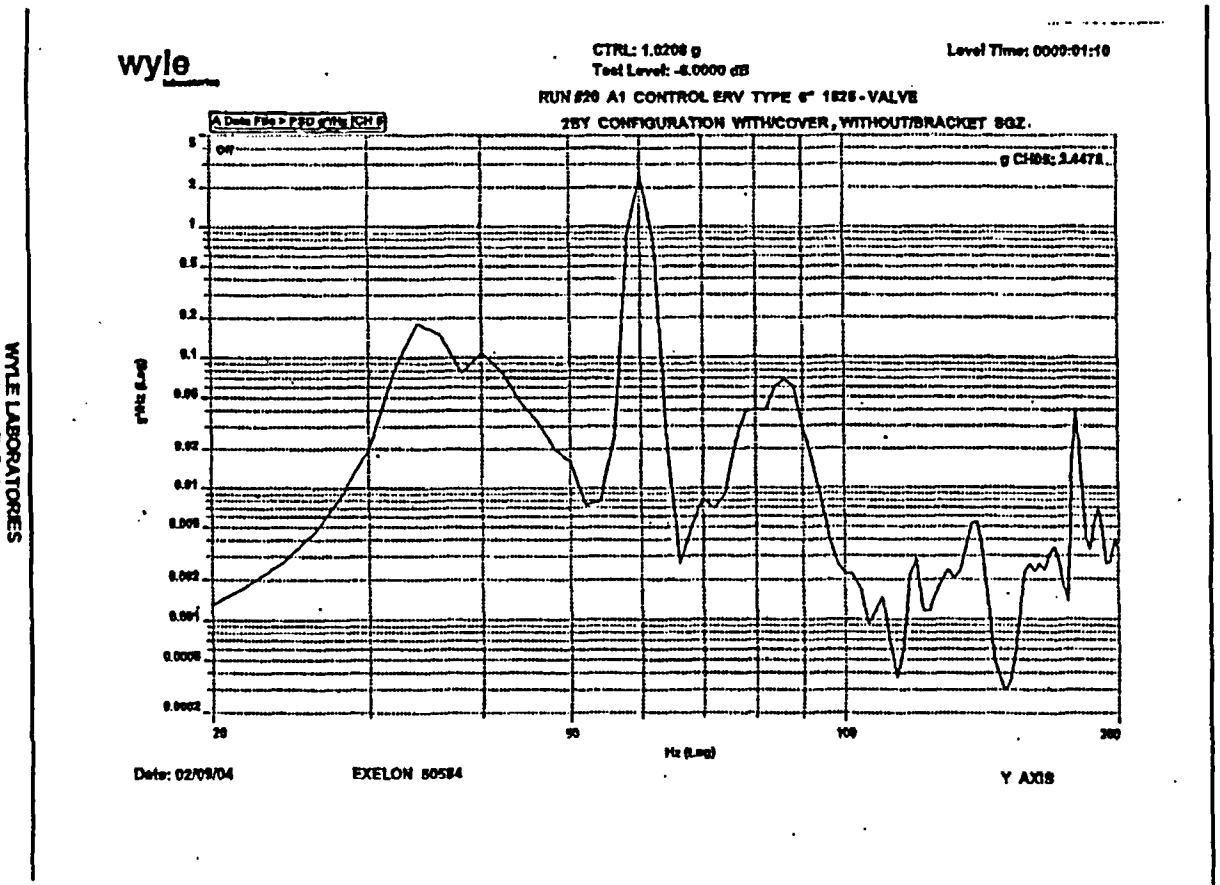


Figure 10: Wyle Labs ERV Actuator Aging Test

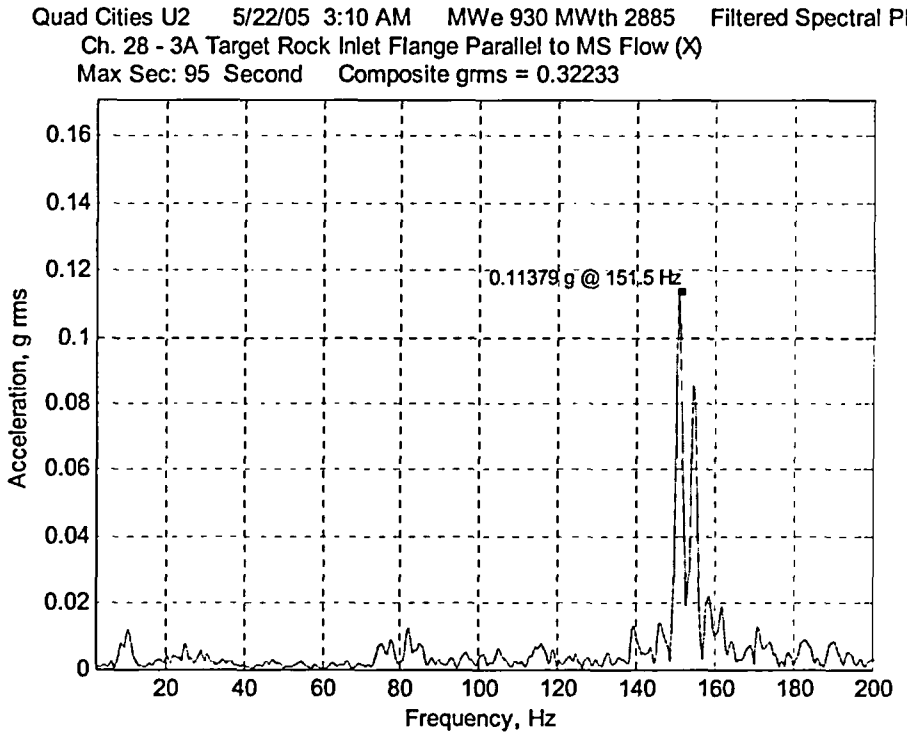


Figure 11: Target Rock, Inlet Flange, x-axis

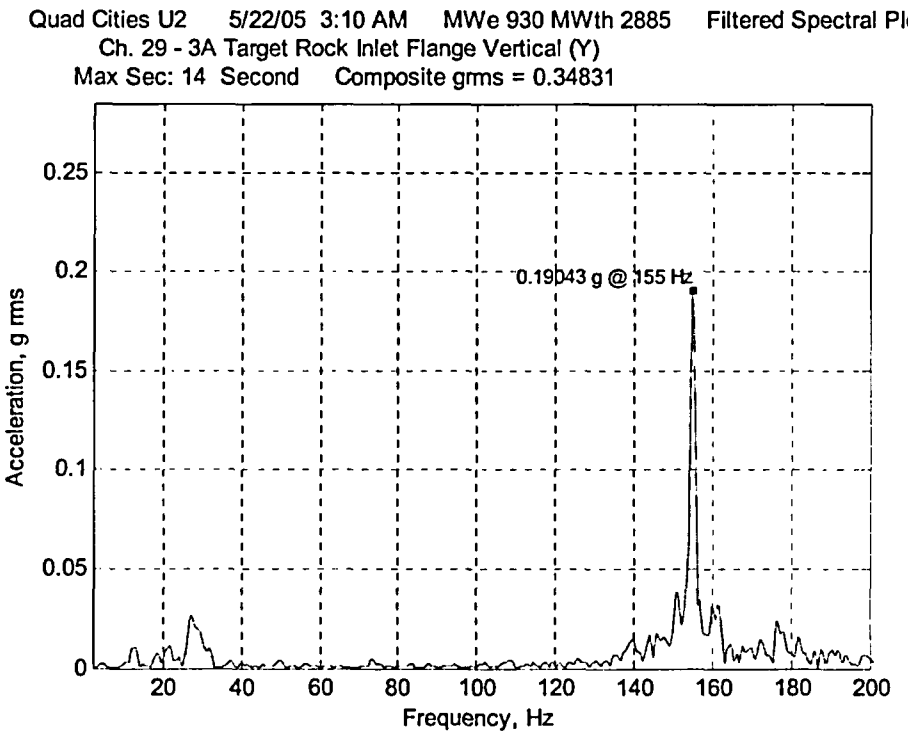


Figure 12: Target Rock, Inlet Flange, y-axis

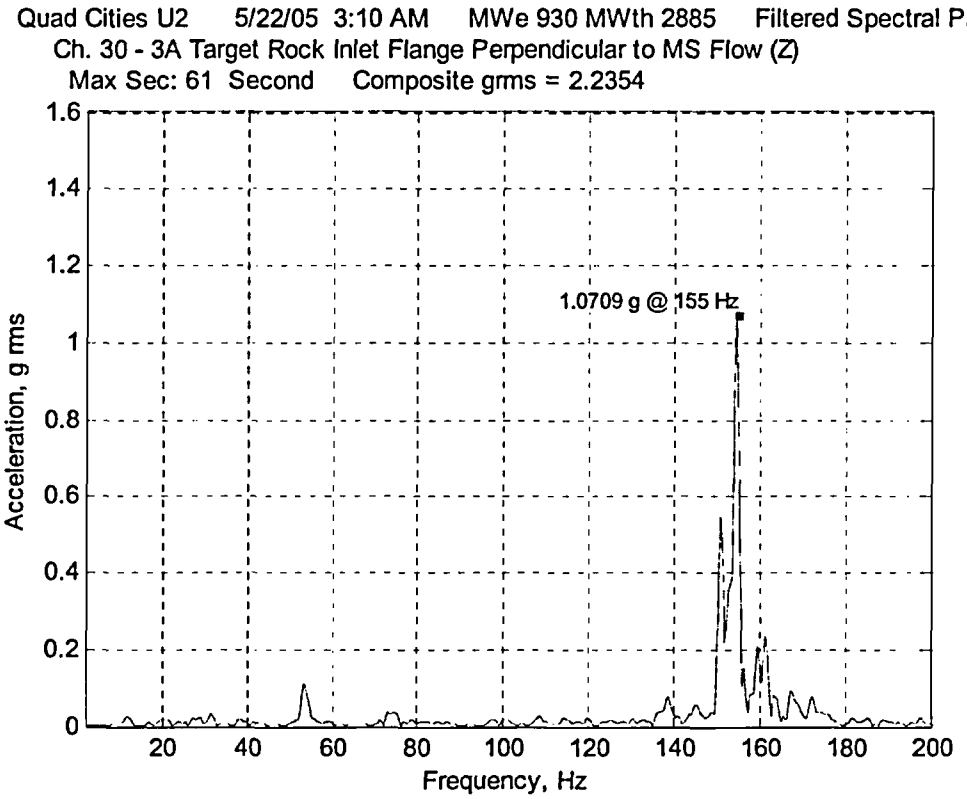


Figure 13: Target Rock, Inlet Flange, y-axis

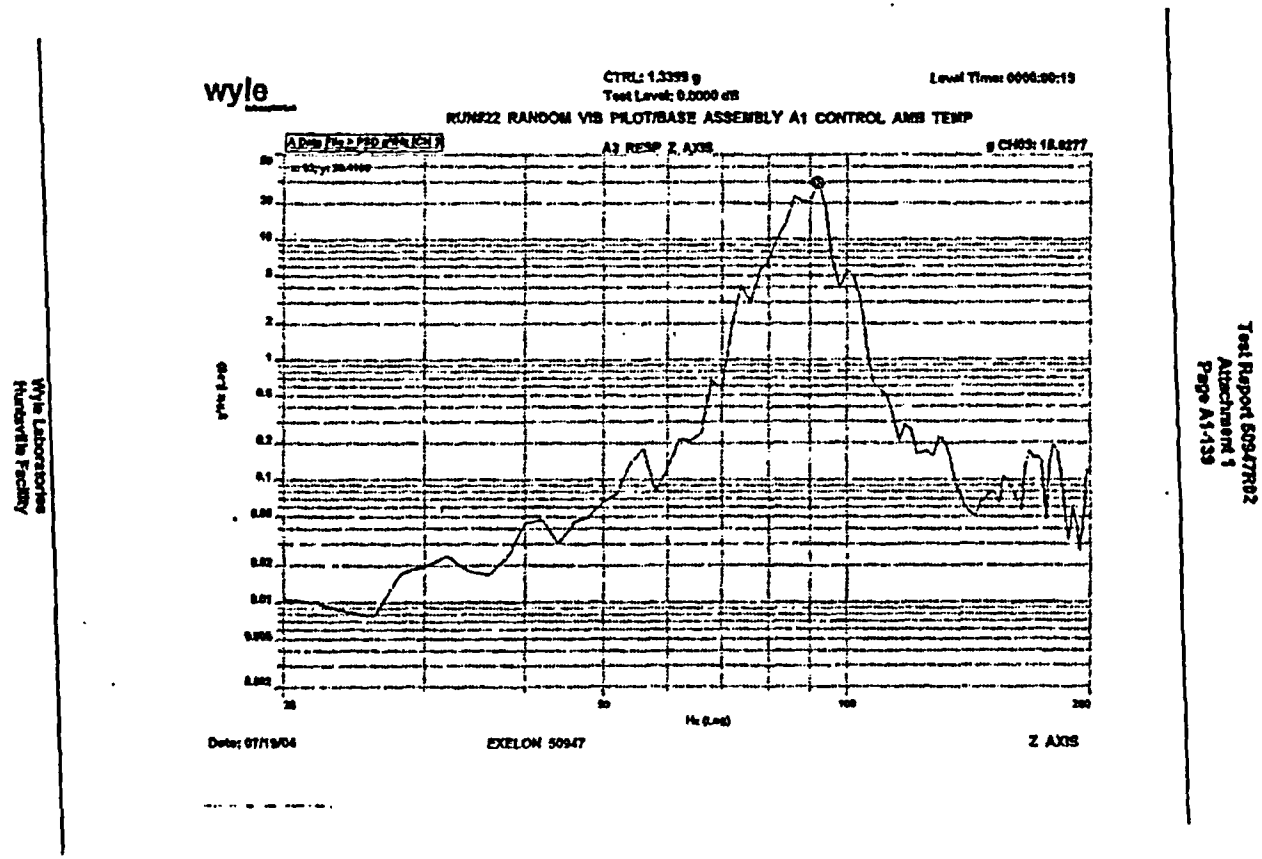
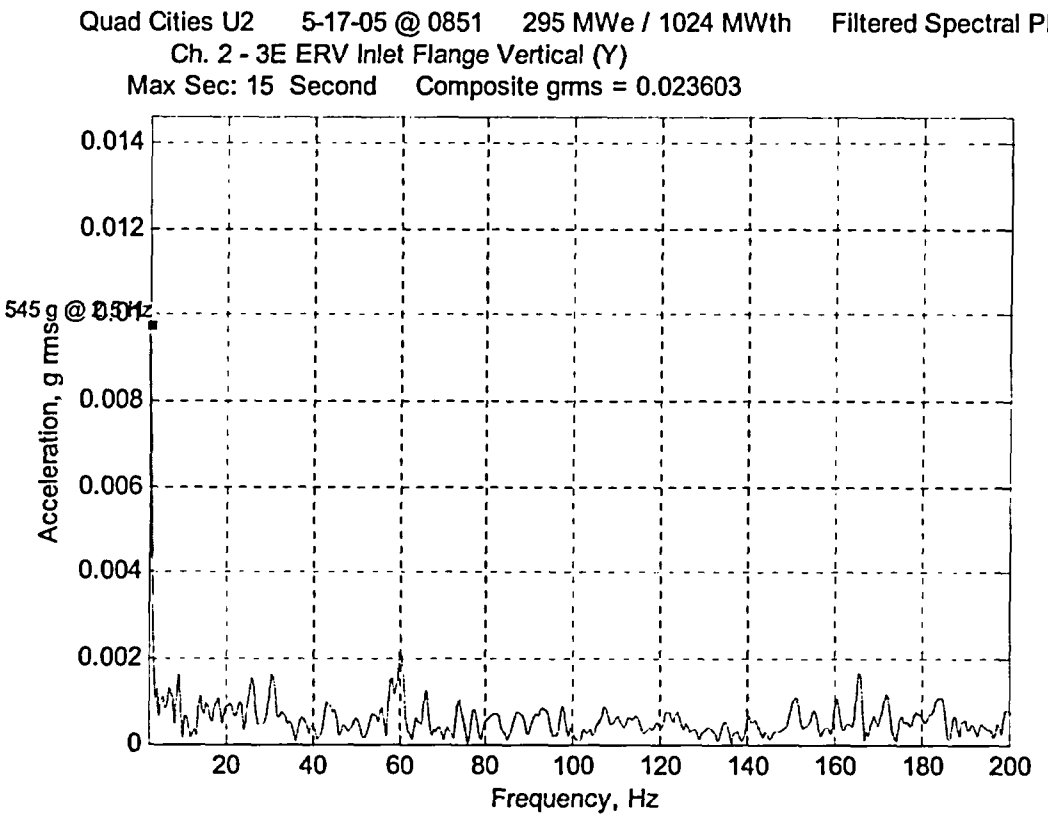


Figure 14: Wyle Labs Target Rock Actuator Aging Test

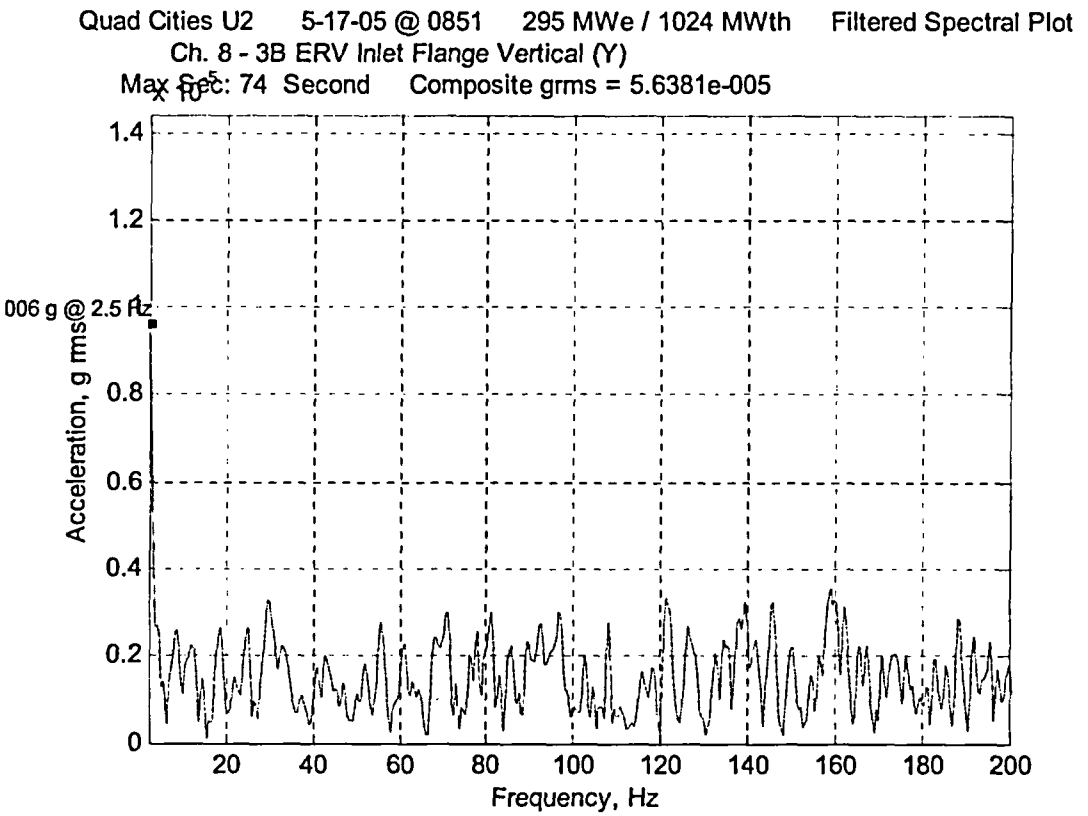
ATTACHMENT 2

EC 355702
Data at 295 MWe / 1024 MWth

EC 355702
Attachment 2
Data at 295 MWe / 1024 MWth



EC 355702
Attachment 2
Data at 295 MWe / 1024 MWth



EC 355702
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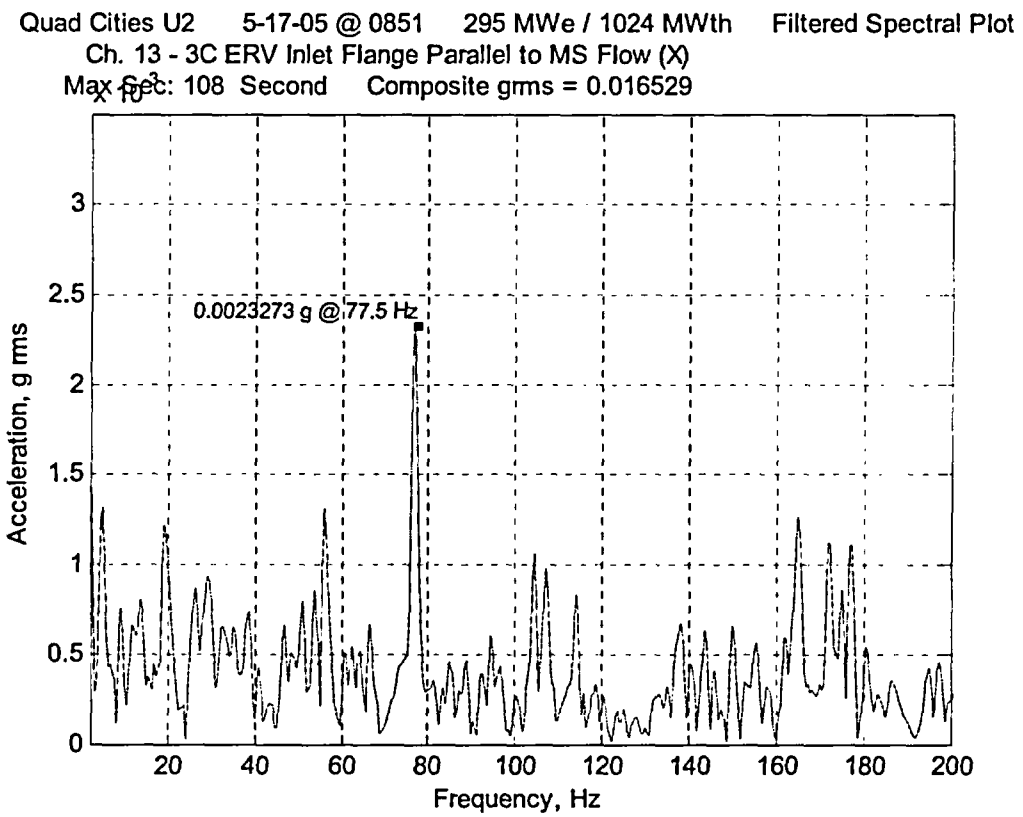
Data at 295 MWe / 1024 MWth



EC 355702
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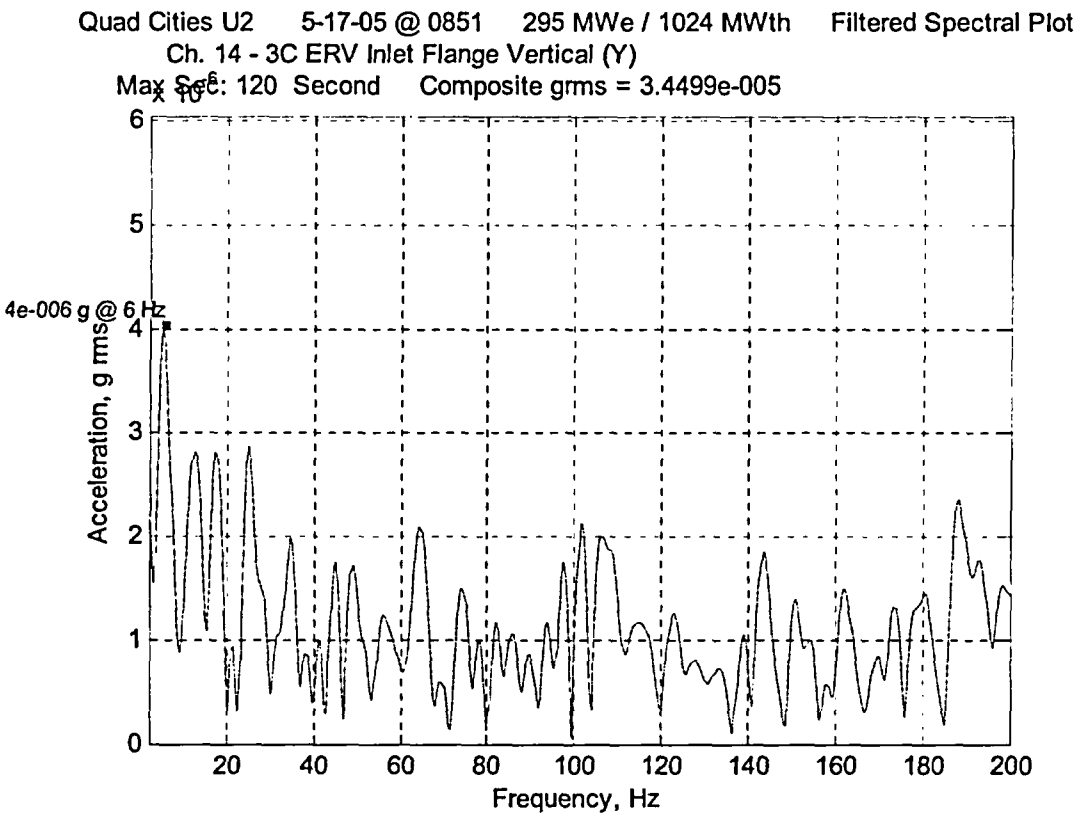
Data at 295 MWe / 1024 MWth



EC 355702
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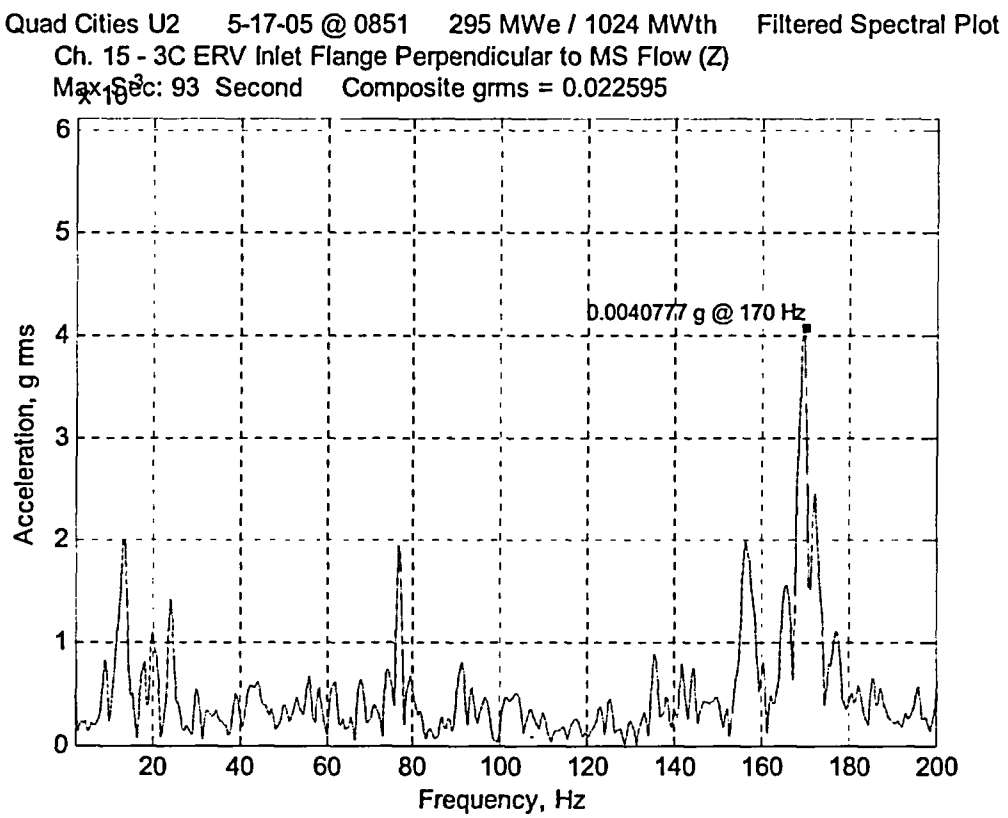
Data at 295 MWe / 1024 MWth



EC 355702
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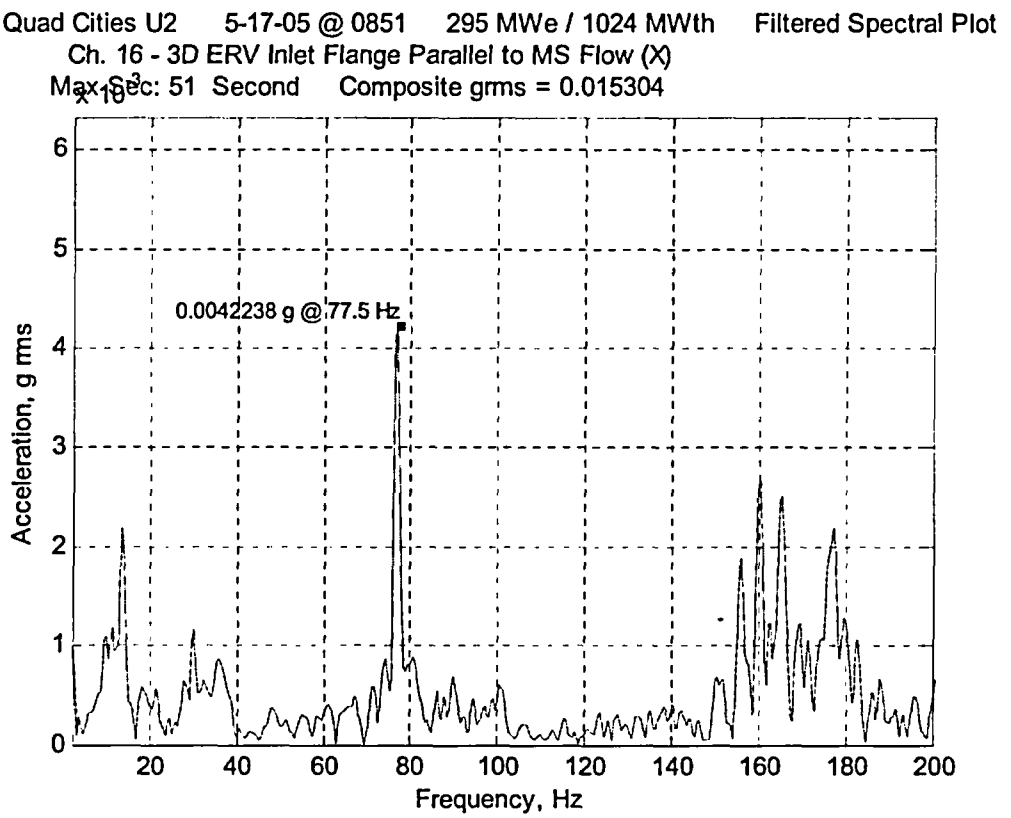
Data at 295 MWe / 1024 MWth



EC 355702
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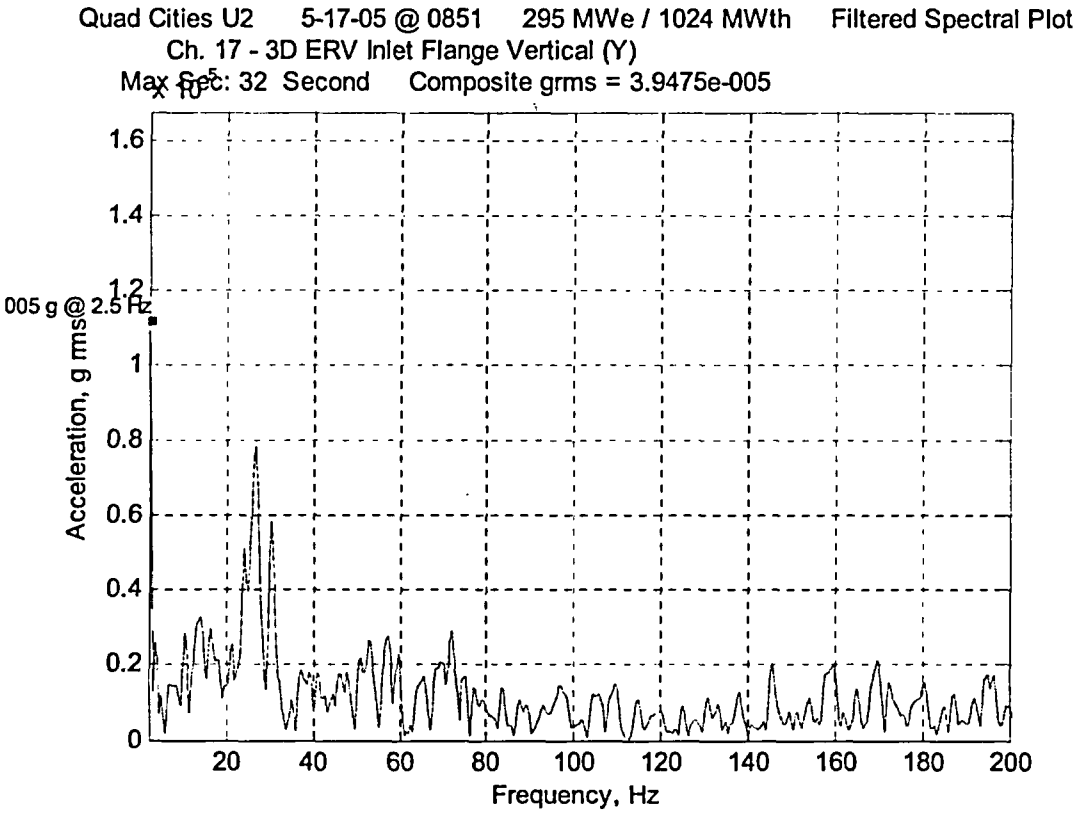
Data at 295 MWe / 1024 MWth



EC 355702
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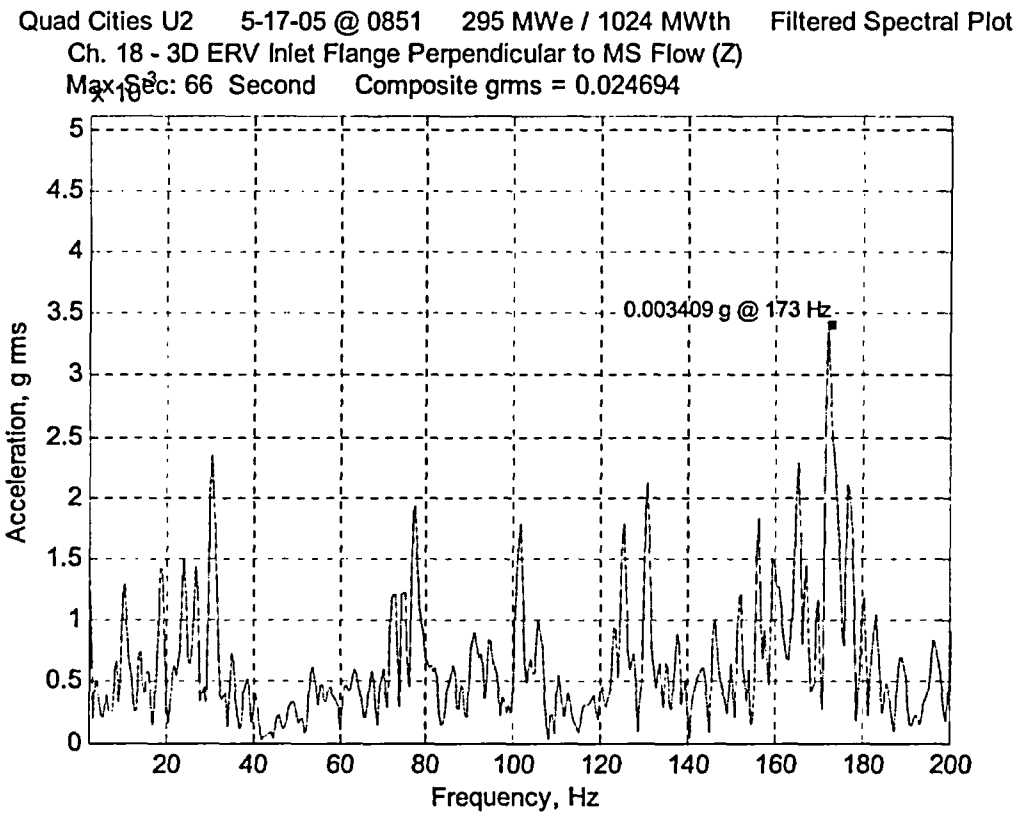
Data at 295 MWe / 1024 MWth



EC 355702
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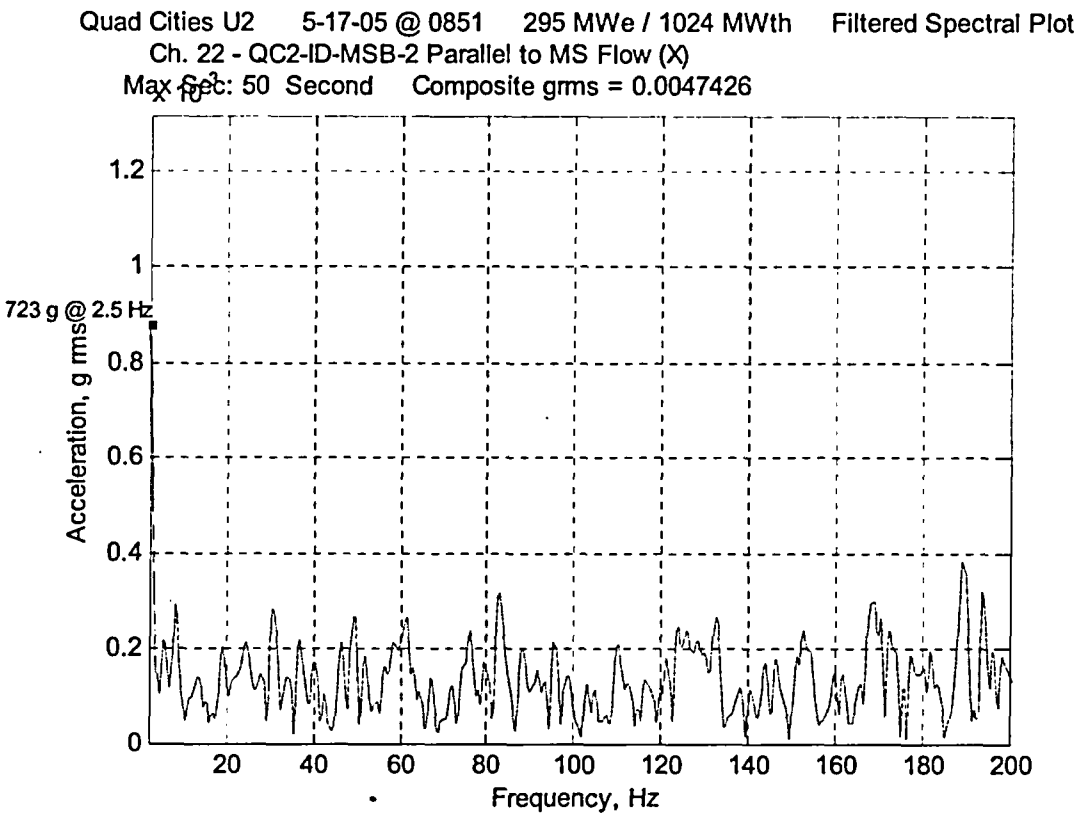

EC 355702
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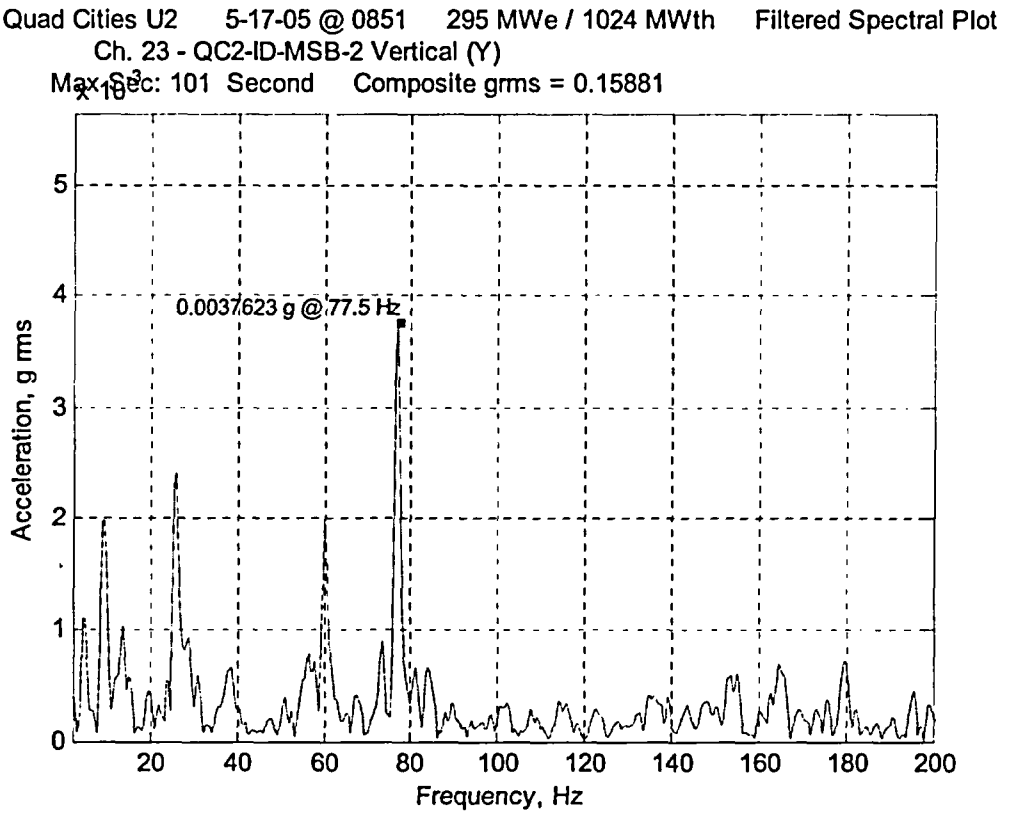

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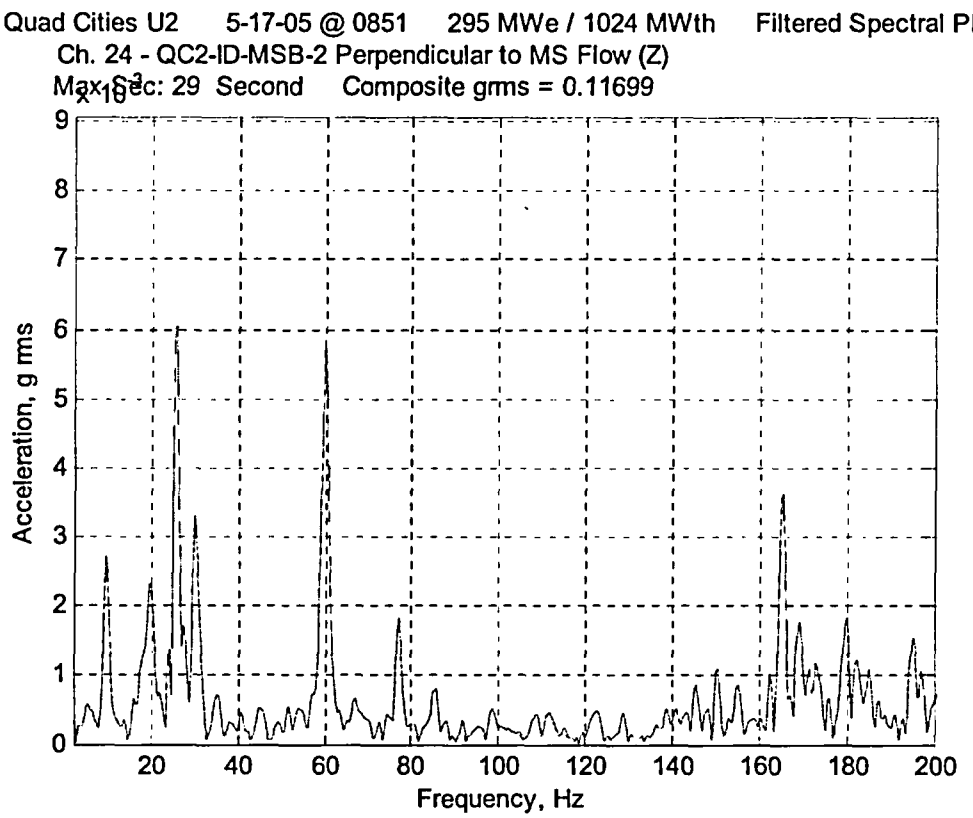
Data at 295 MWe / 1024 MWth



EC 355702
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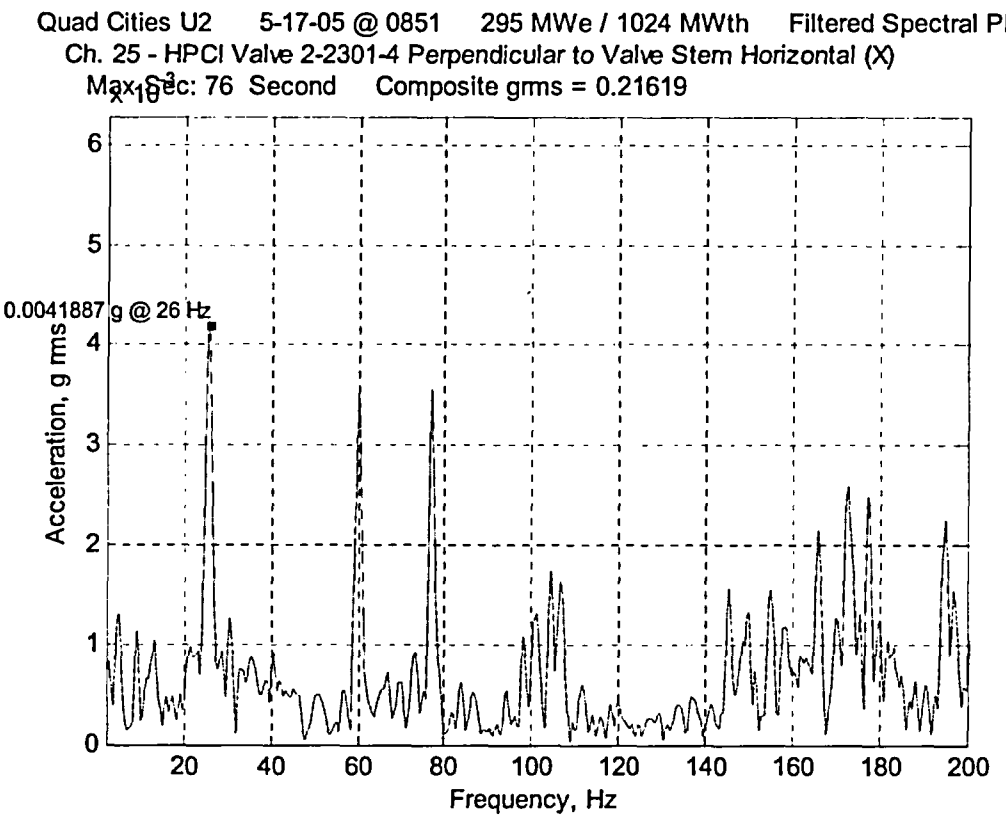
Data at 295 MWe / 1024 MWth



EC 355702
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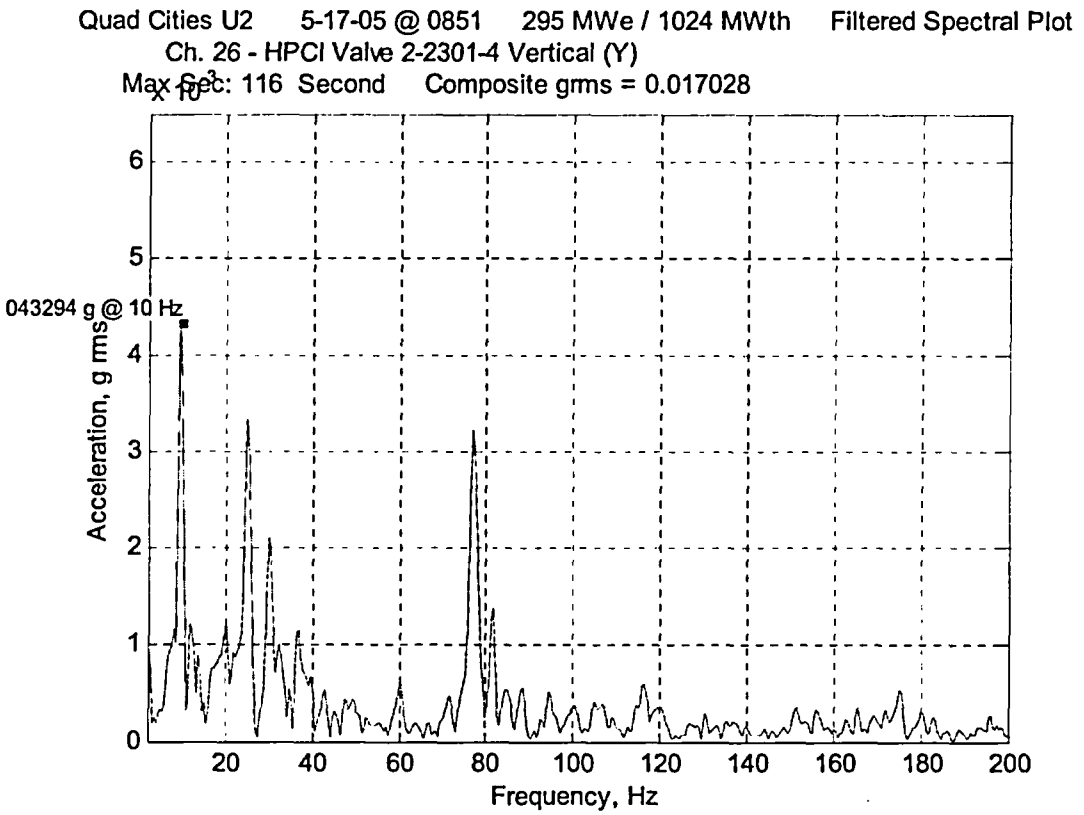
Data at 295 MWe / 1024 MWth



EC 355702
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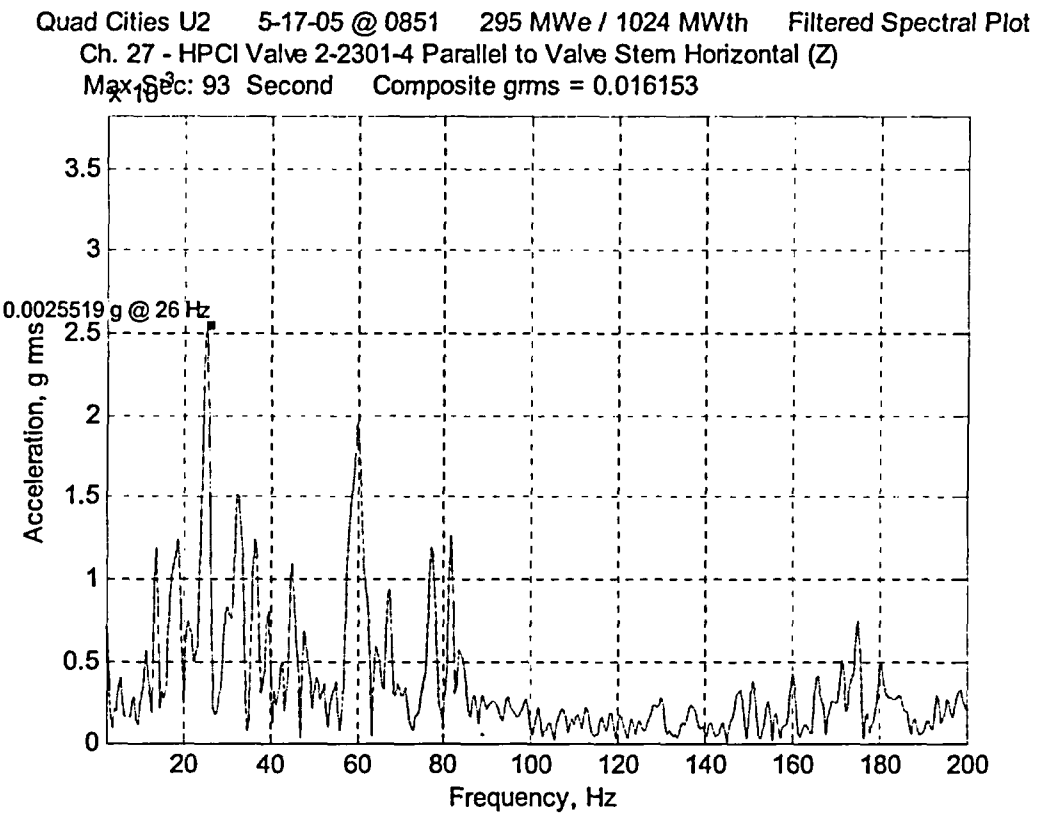
Data at 295 MWe / 1024 MWth



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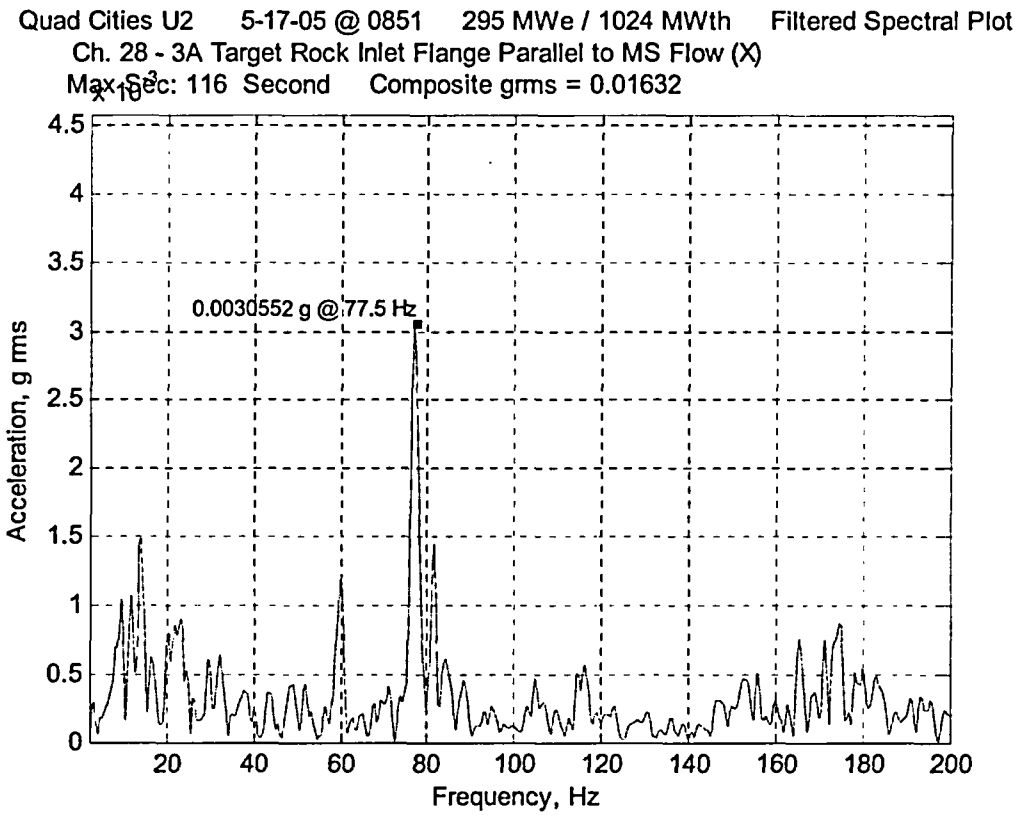

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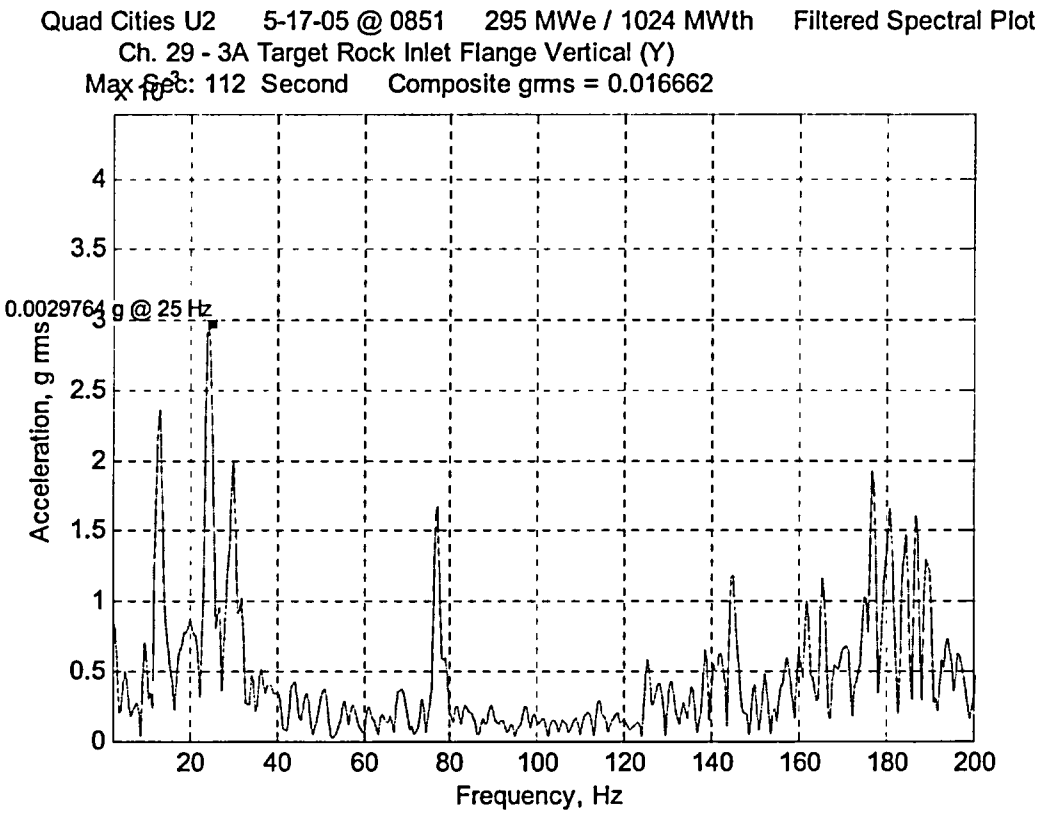

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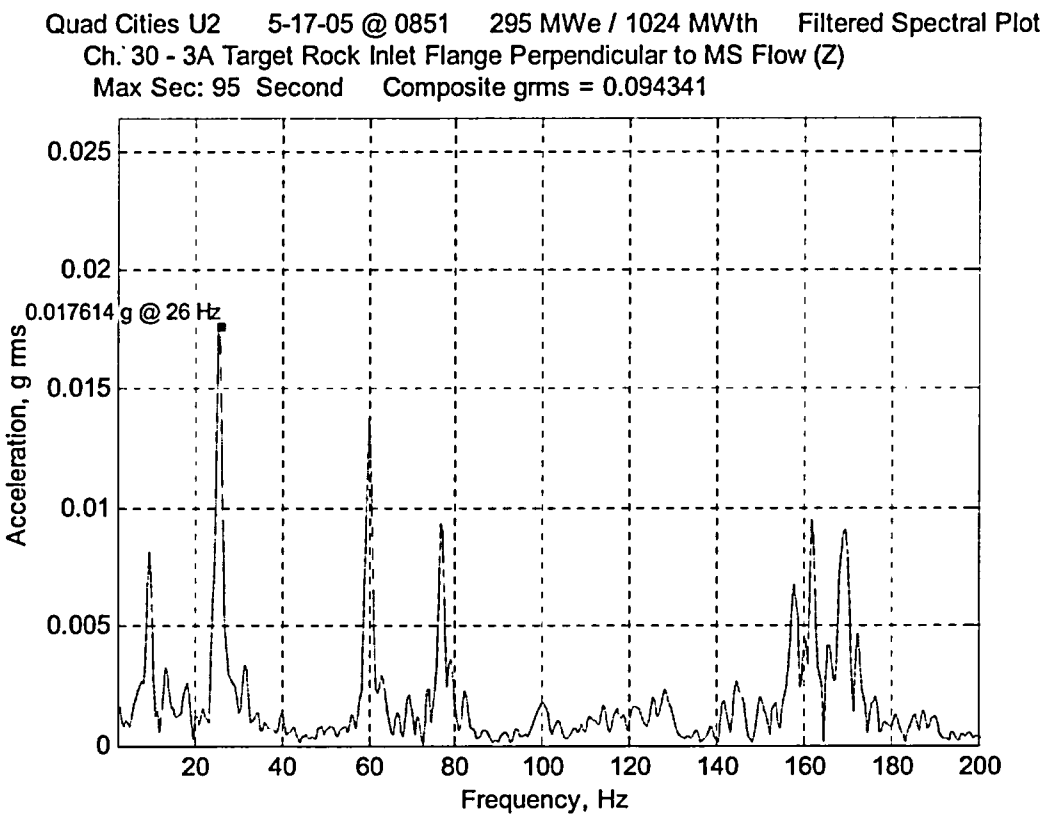

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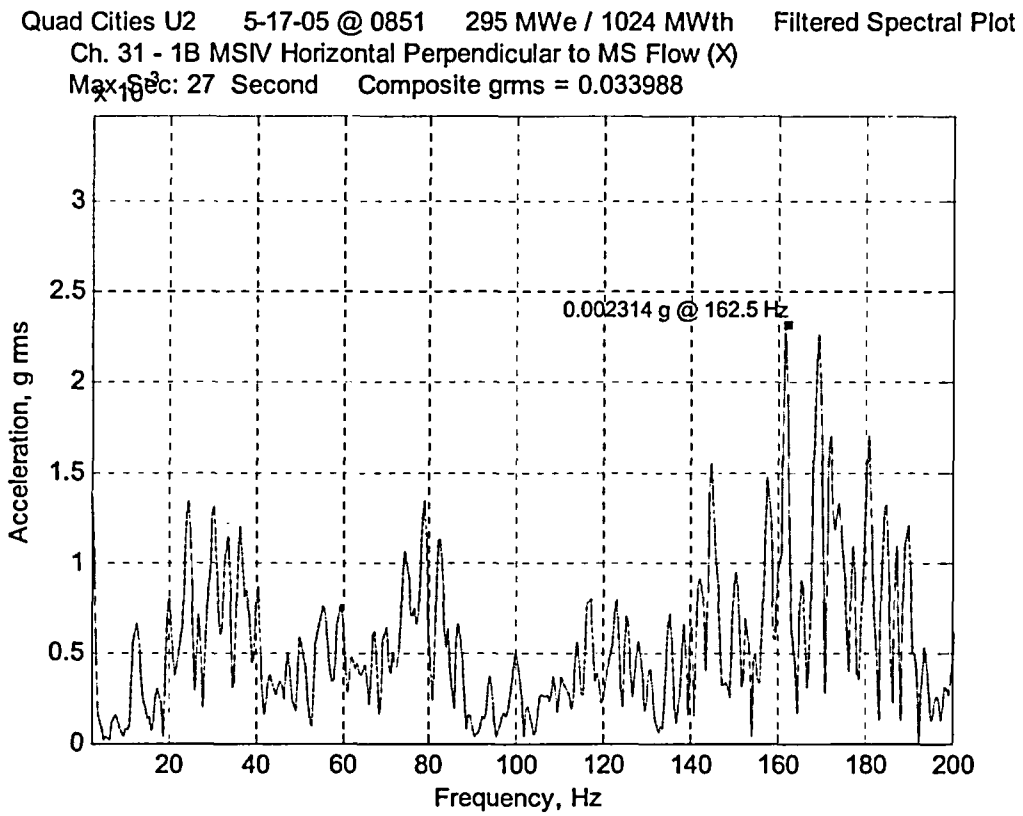

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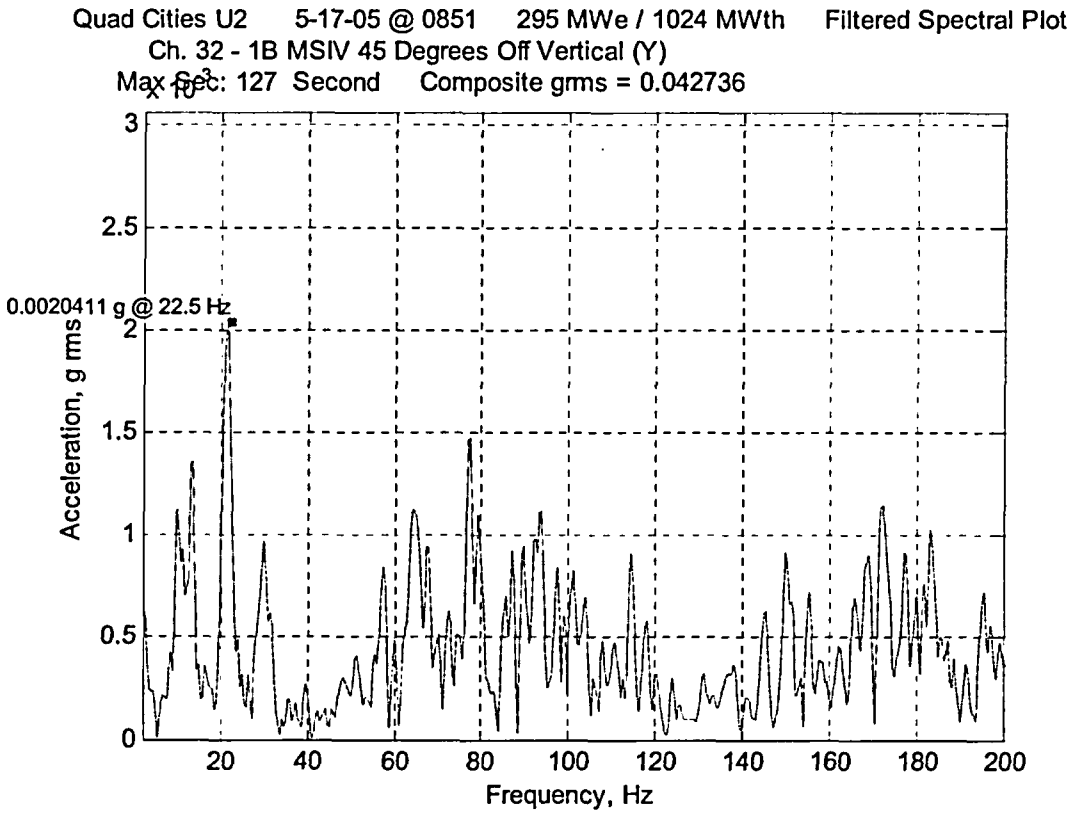
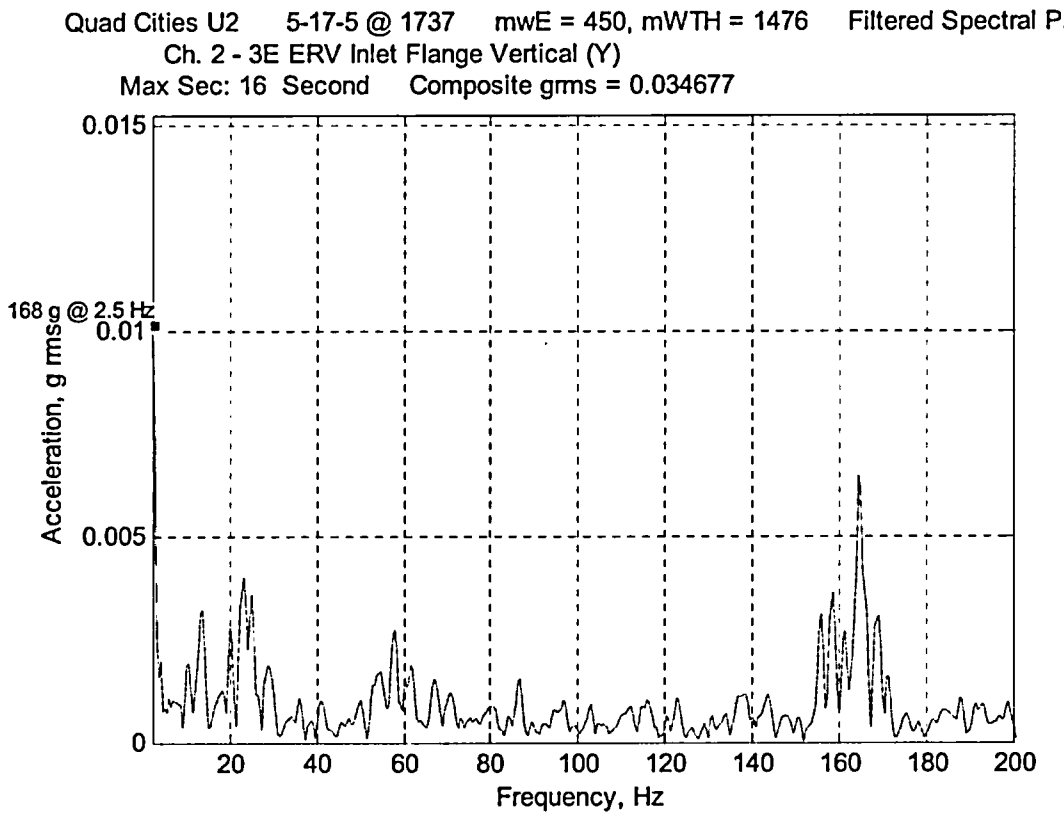
Data at 295 MWe / 1024 MWth



EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth



EC 355702
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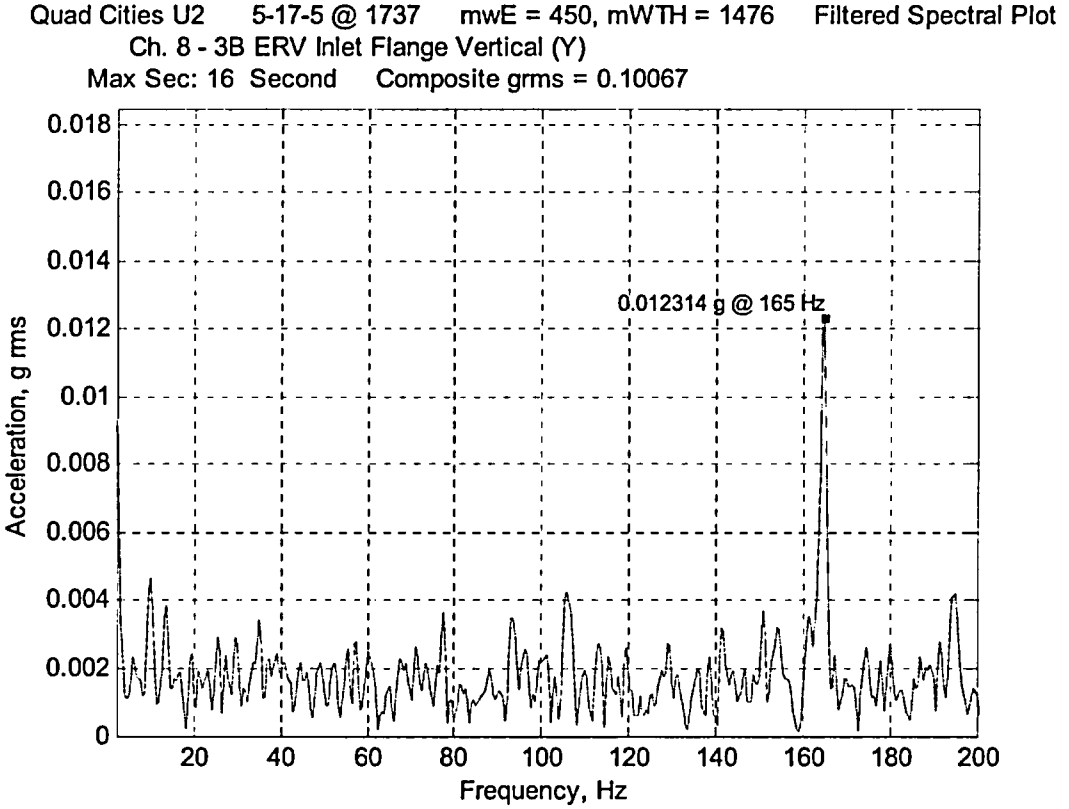
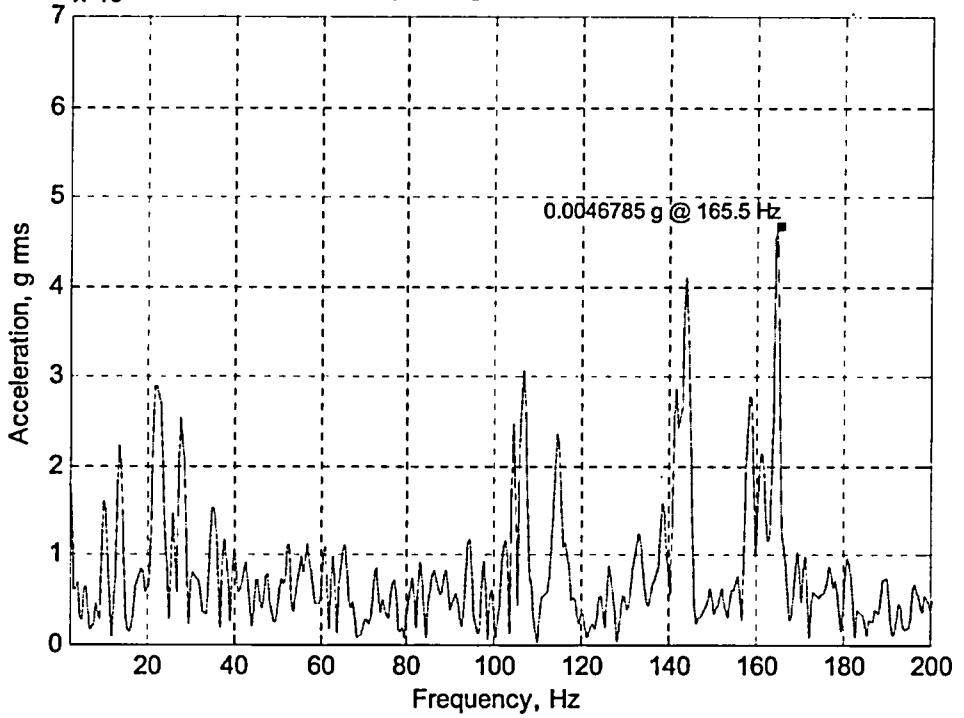
Data at 450 MWe / 1476 MWth

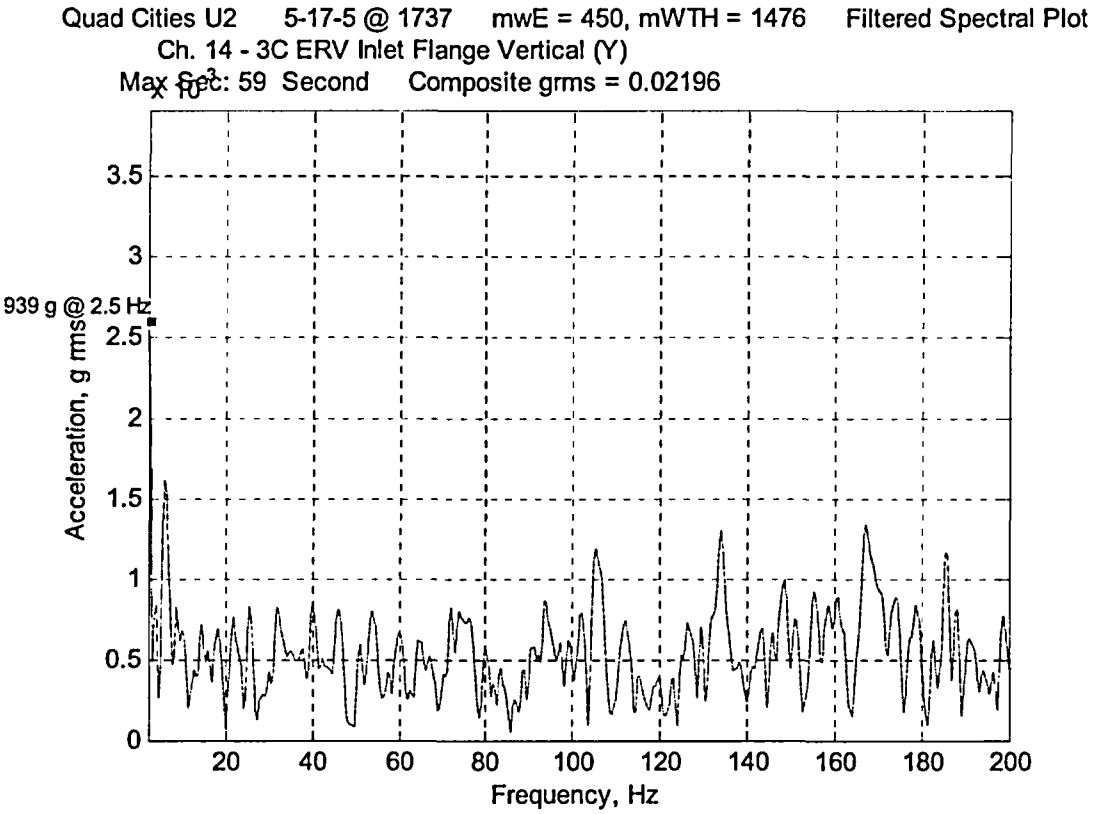


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

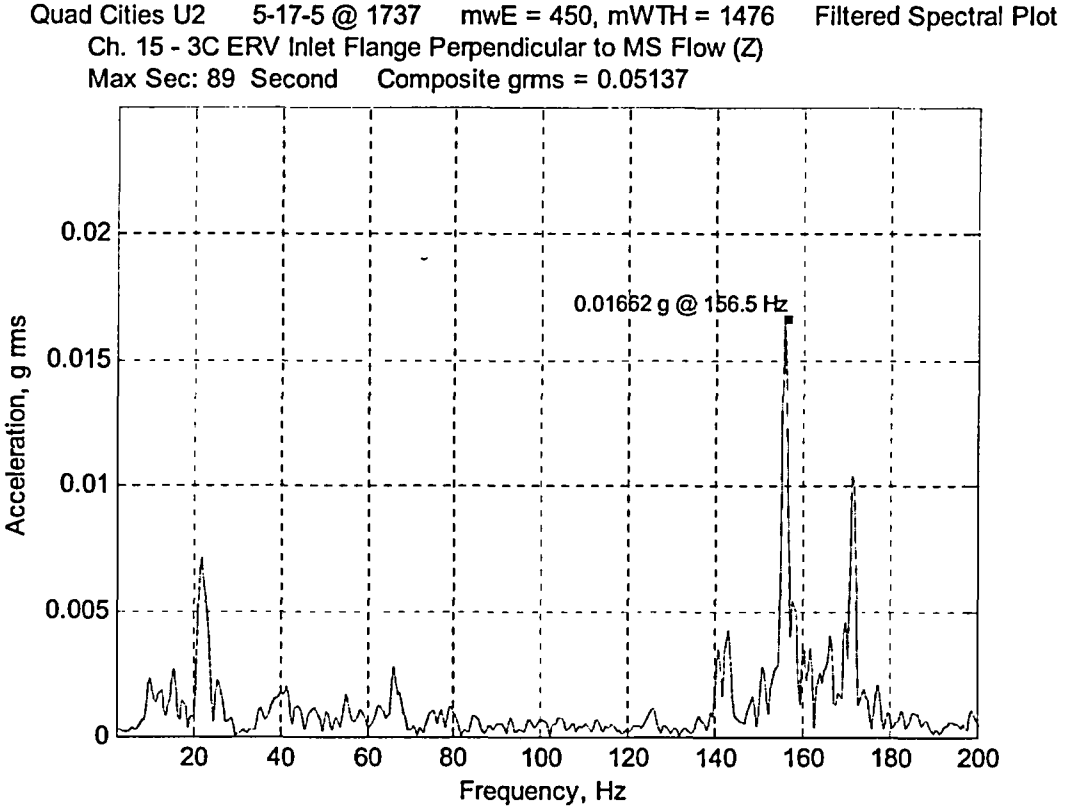
Quad Cities U2 5-17-5 @ 1737 mwE = 450, mWTH = 1476 Filtered Spectral Plot
Ch. 13 - 3C ERV Inlet Flange Parallel to MS Flow (X)
Max Spec: 144 Second Composite grms = 0.032153



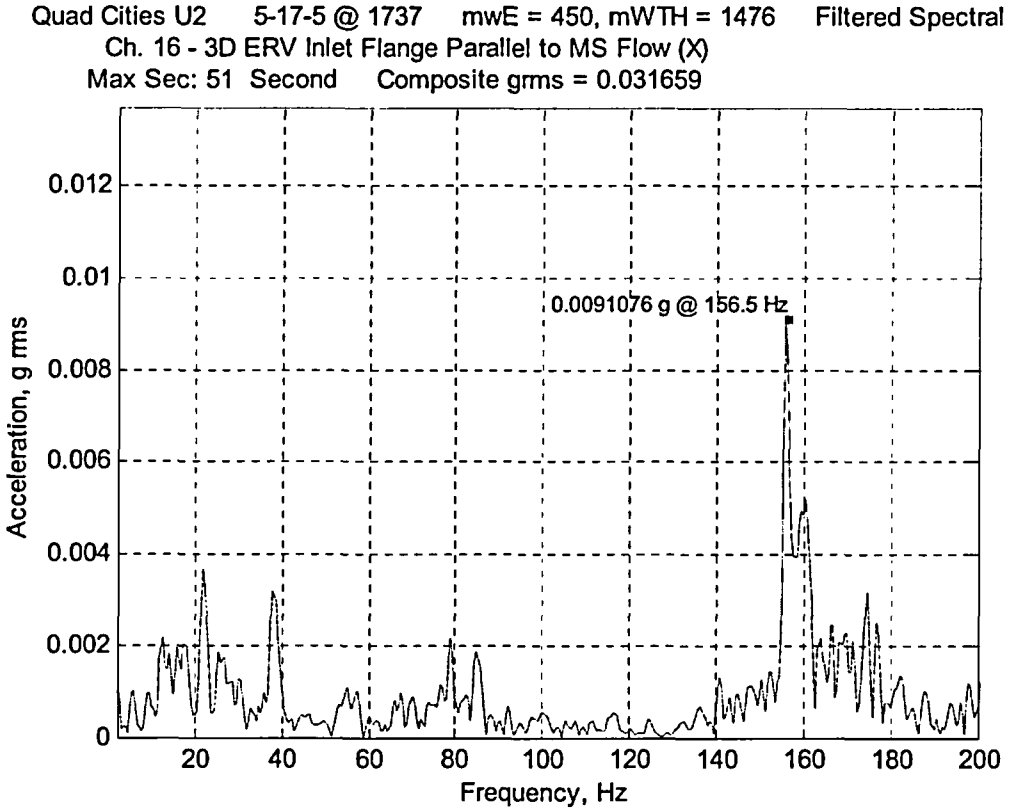
EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth



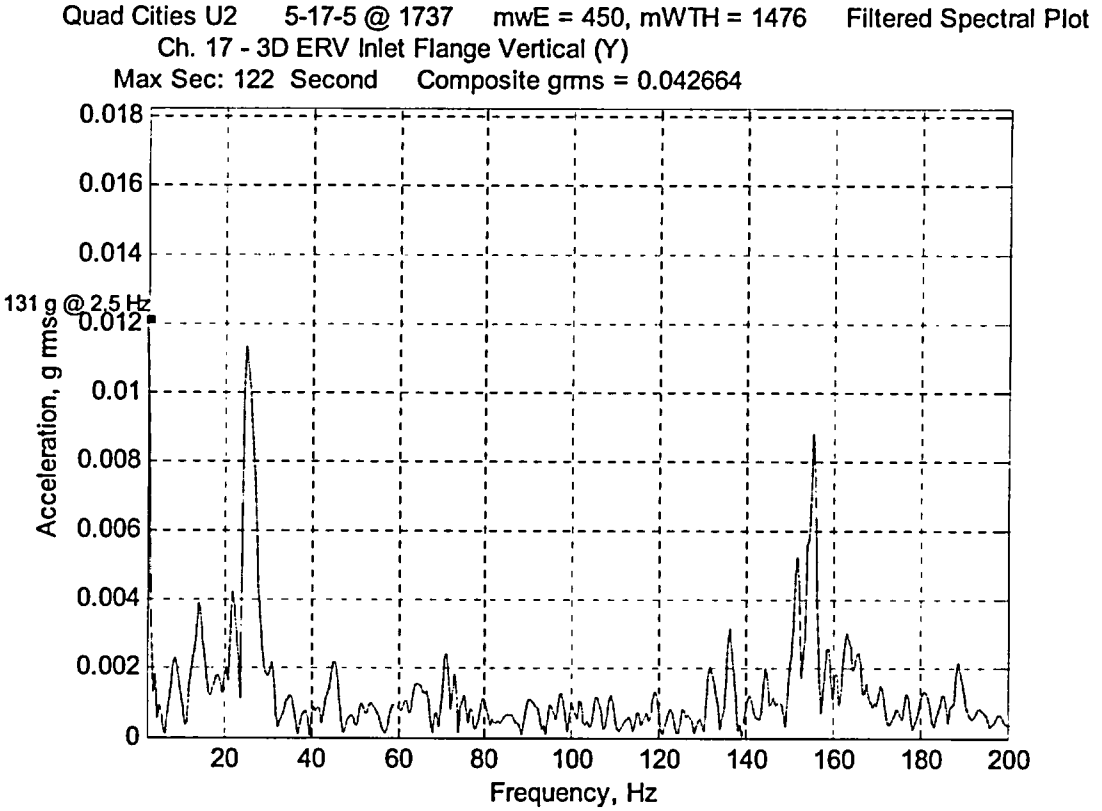
EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth



EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

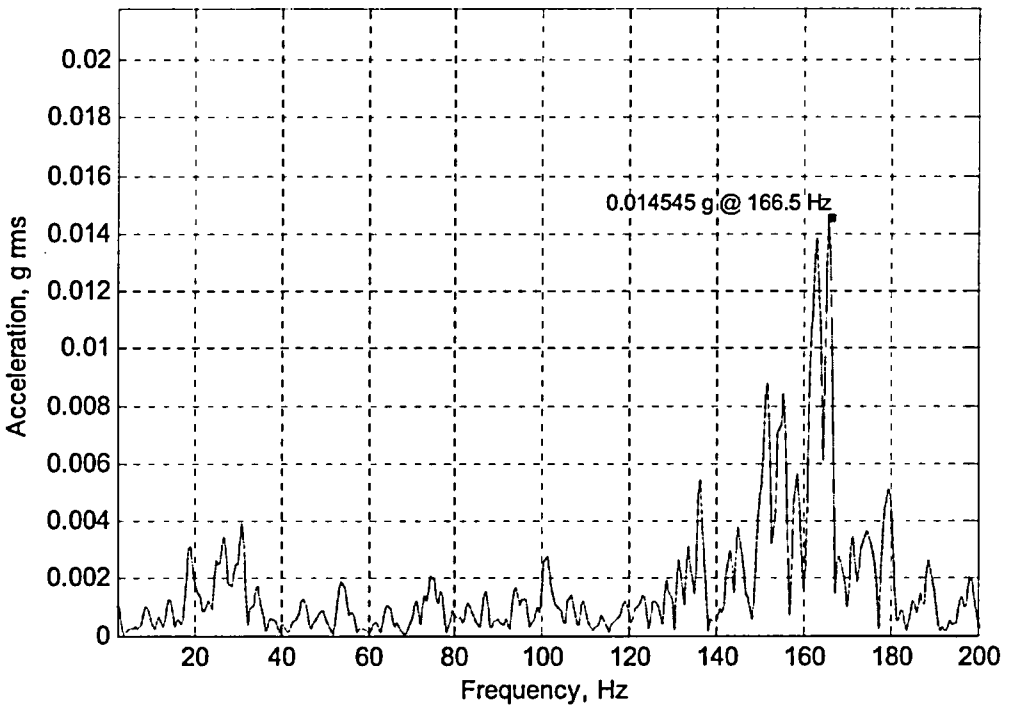


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

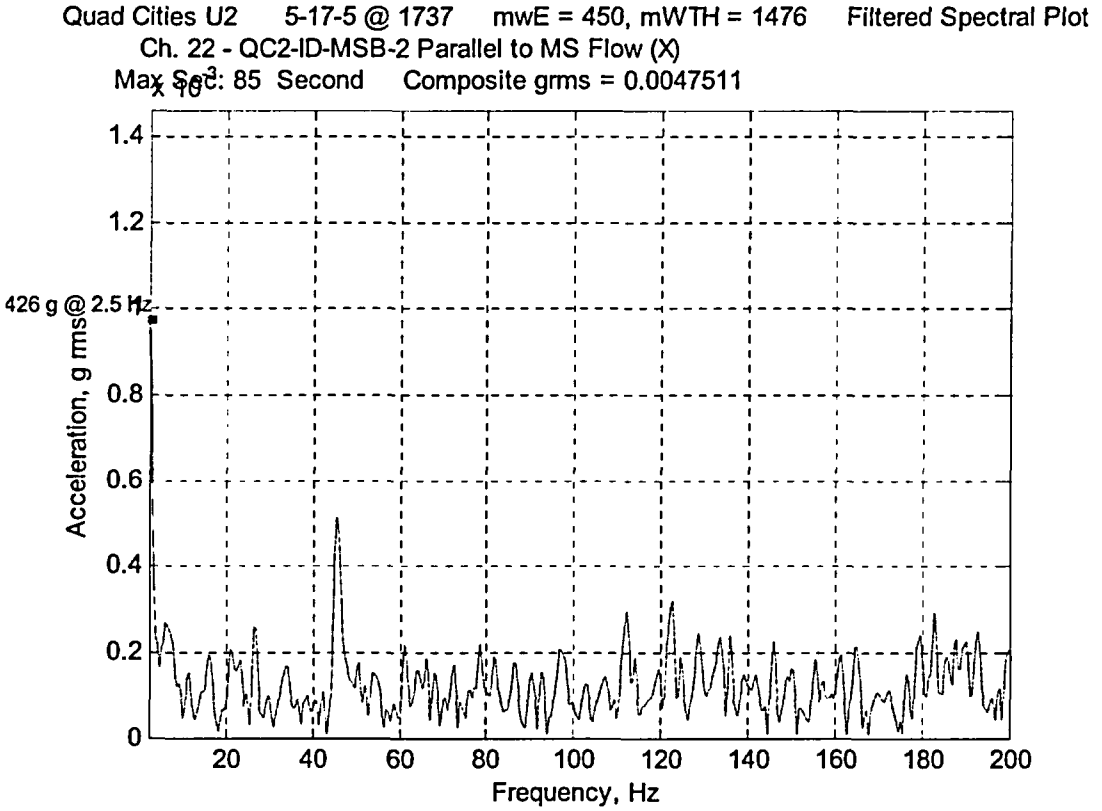


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

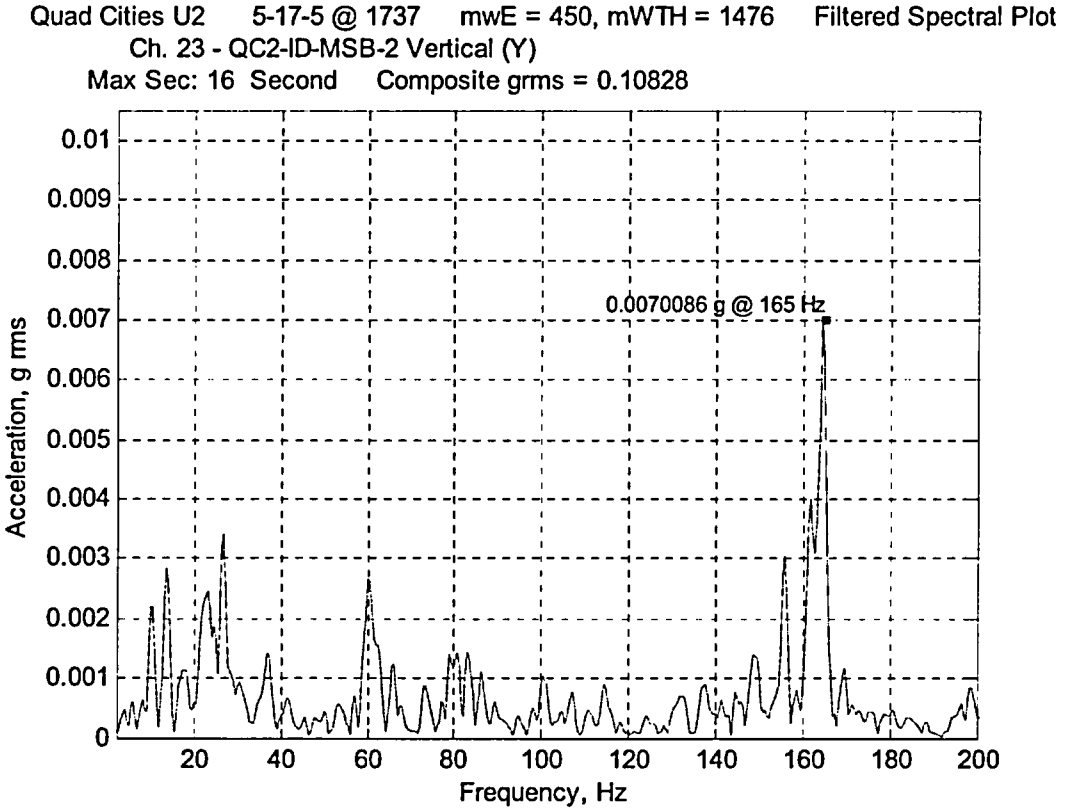
Quad Cities U2 5-17-5 @ 1737 mwE = 450, mWTH = 1476 Filtered Spectral Plot
Ch. 18 - 3D ERV Inlet Flange Perpendicular to MS Flow (Z)
Max Sec: 6 Second Composite grms = 0.05915



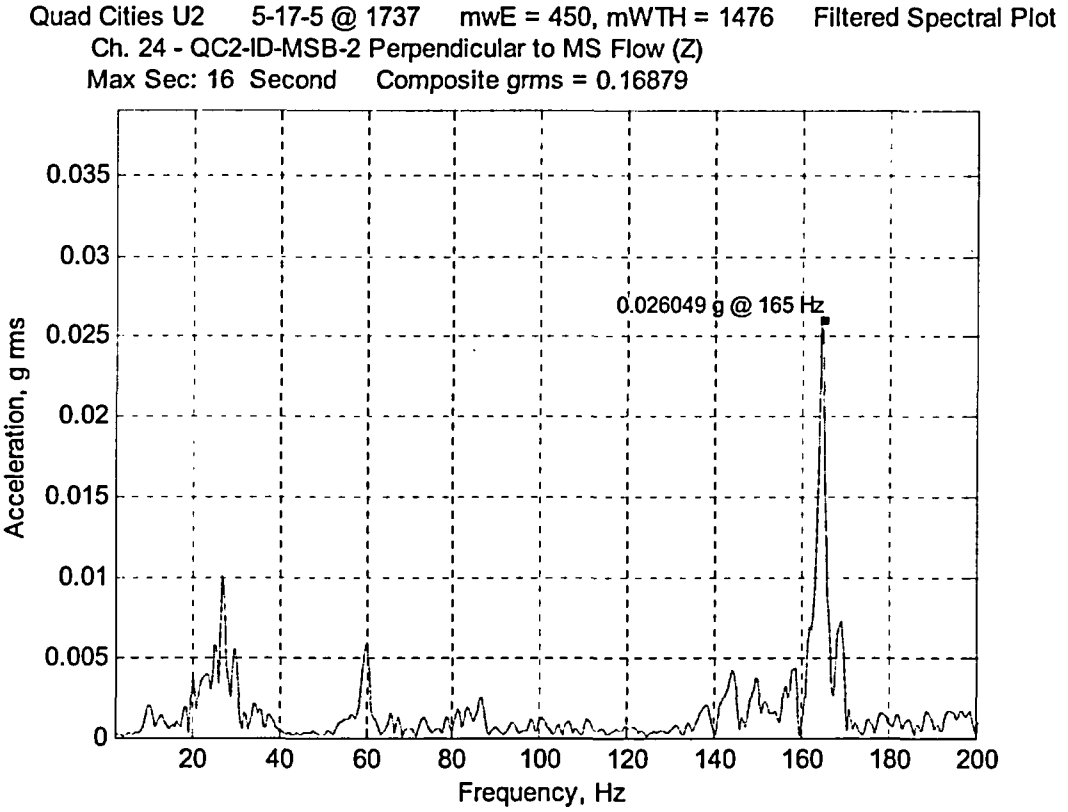
EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth



EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

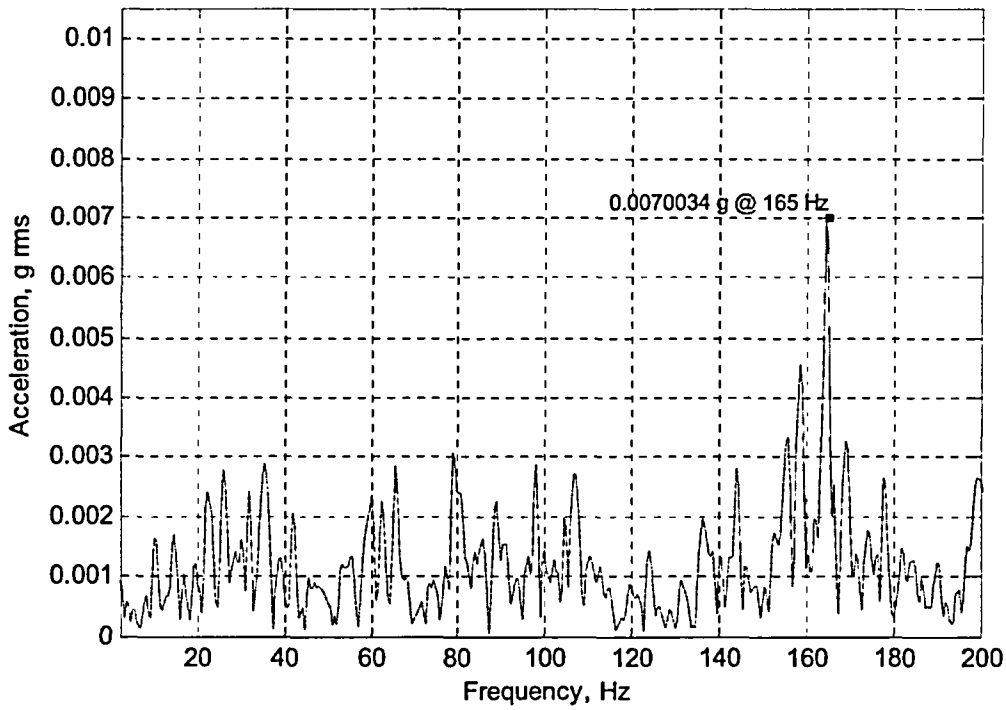


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

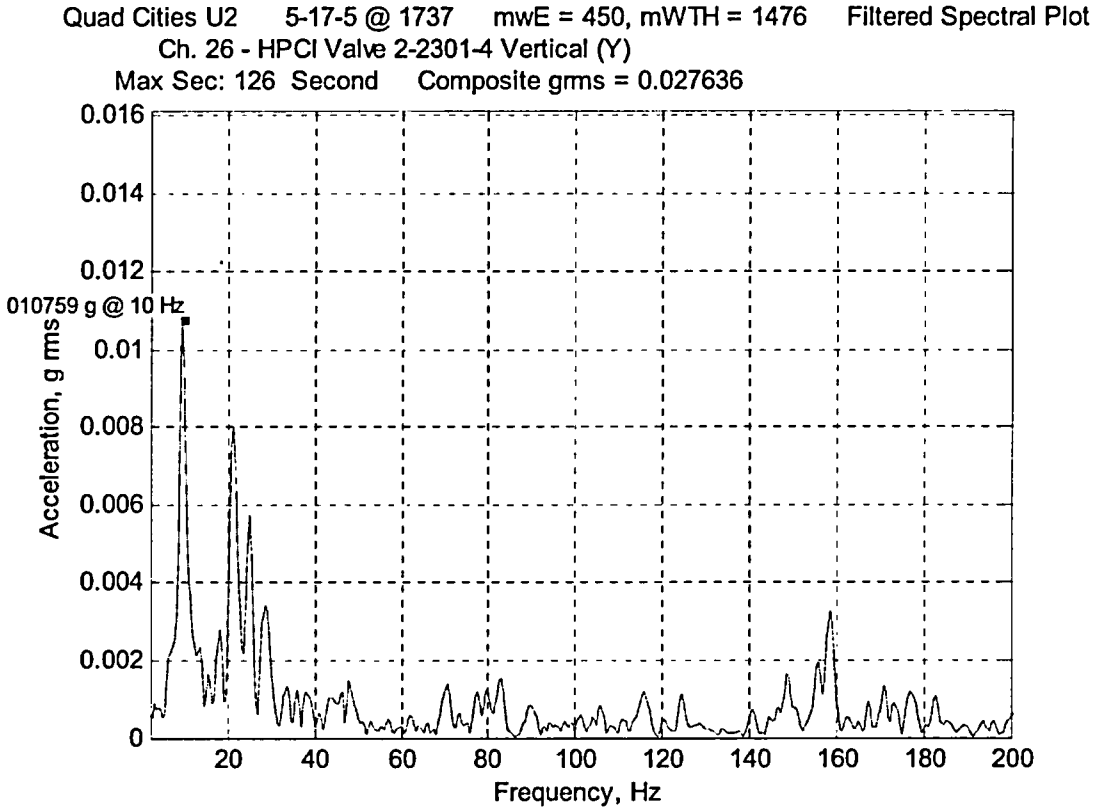


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

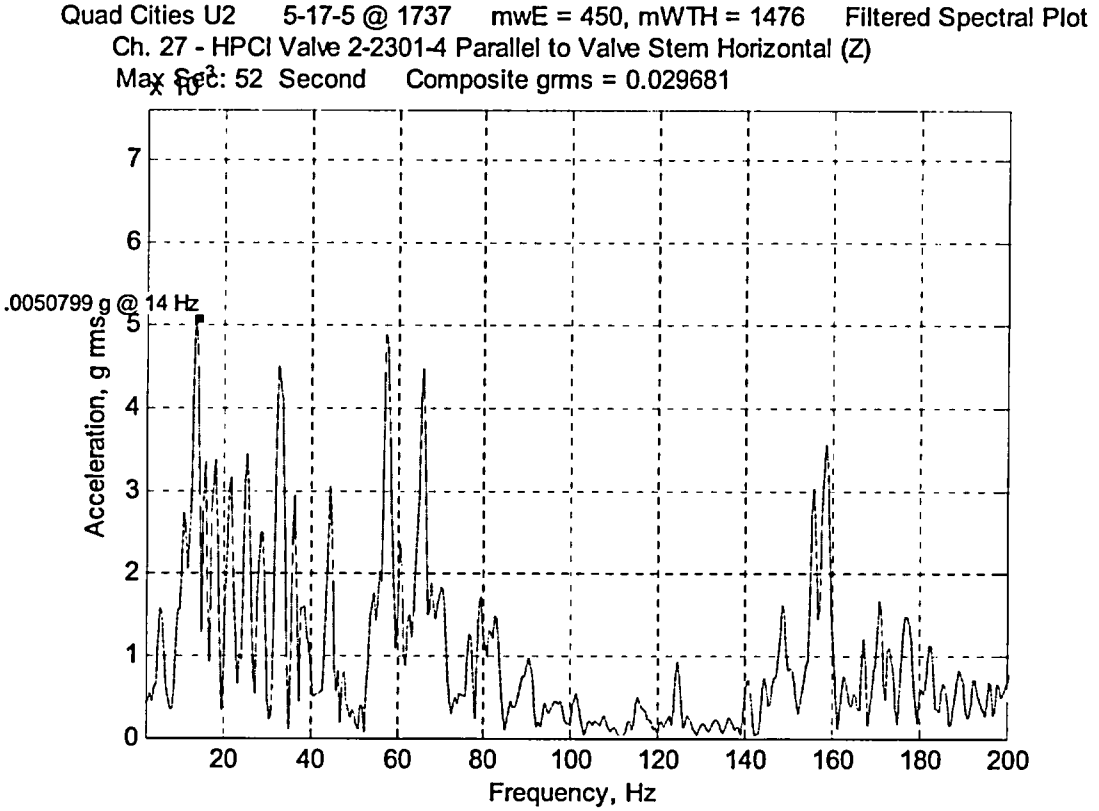
Quad Cities U2 5-17-5 @ 1737 mwE = 450, mWTH = 1476 Filtered Spectral Plot
Ch. 25 - HPCI Valve 2-2301-4 Perpendicular to Valve Stem Horizontal (X)
Max Sec: 16 Second Composite grms = 0.26157



EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

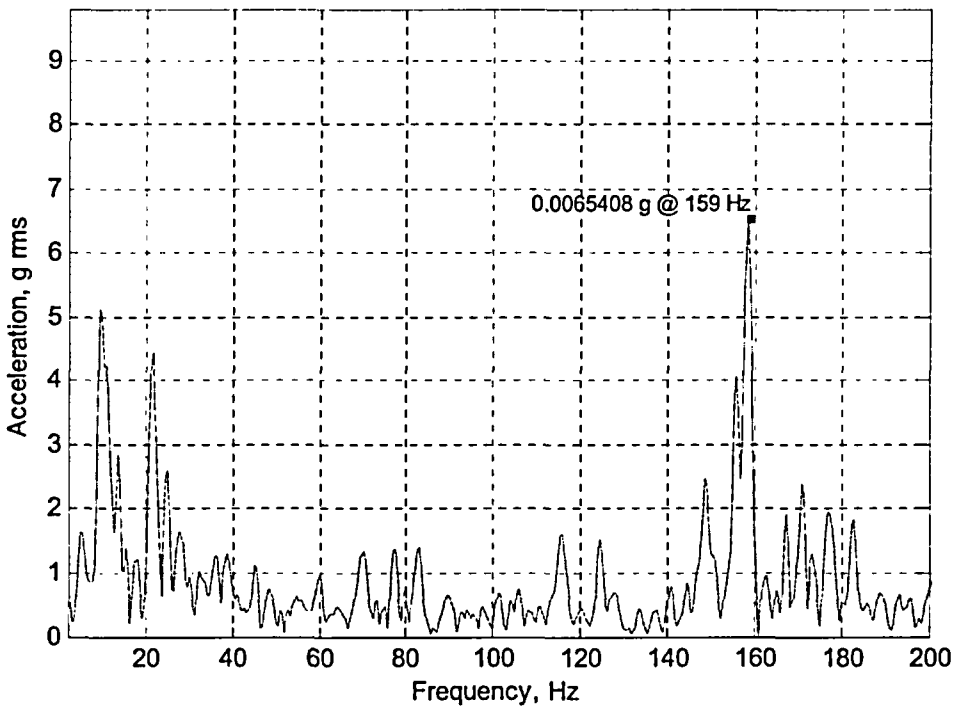


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

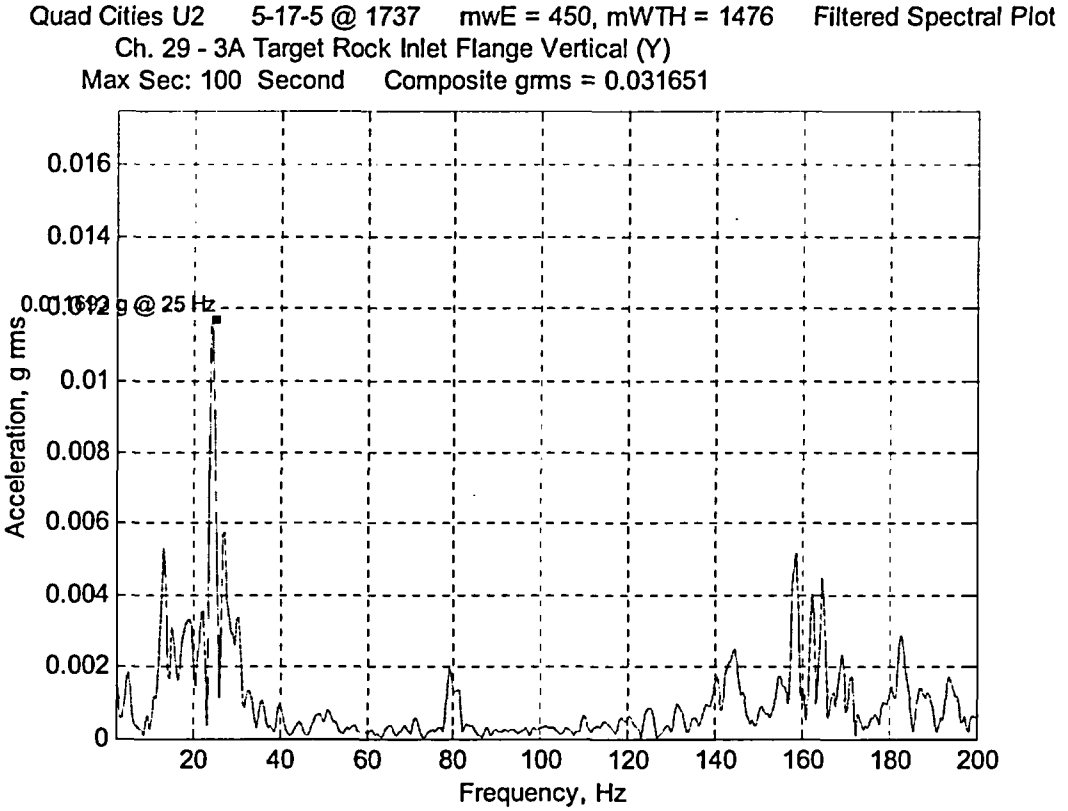


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

Quad Cities U2 5-17-5 @ 1737 mwE = 450, mWTH = 1476 Filtered Spectral Plot
Ch. 28 - 3A Target Rock Inlet Flange Parallel to MS Flow (X)
Max Spec: 8 Second Composite grms = 0.029993

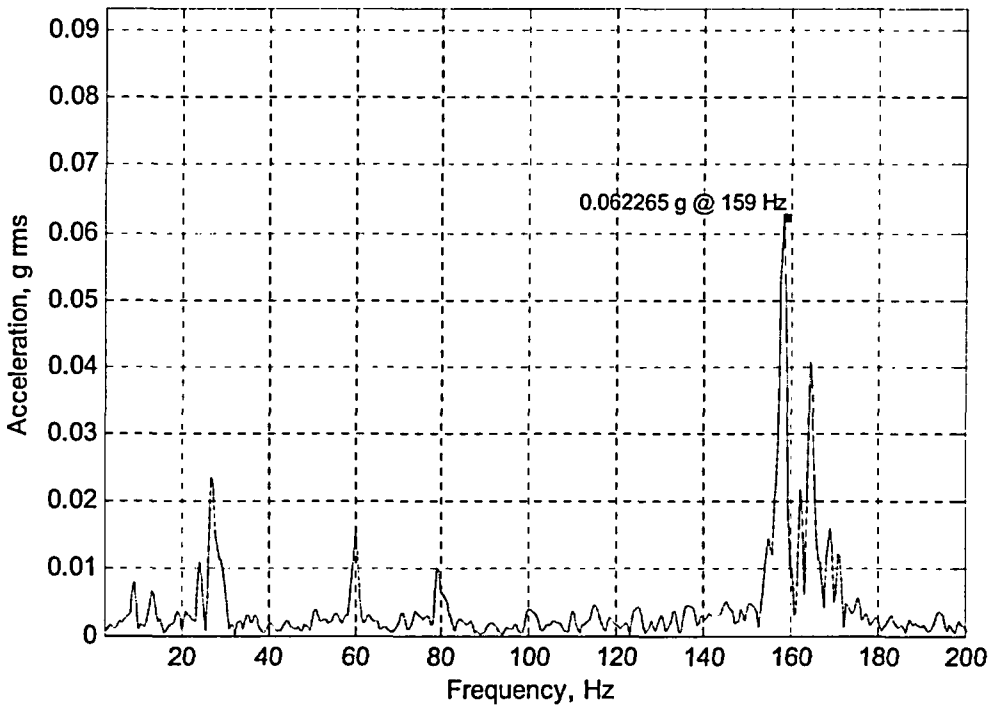


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth



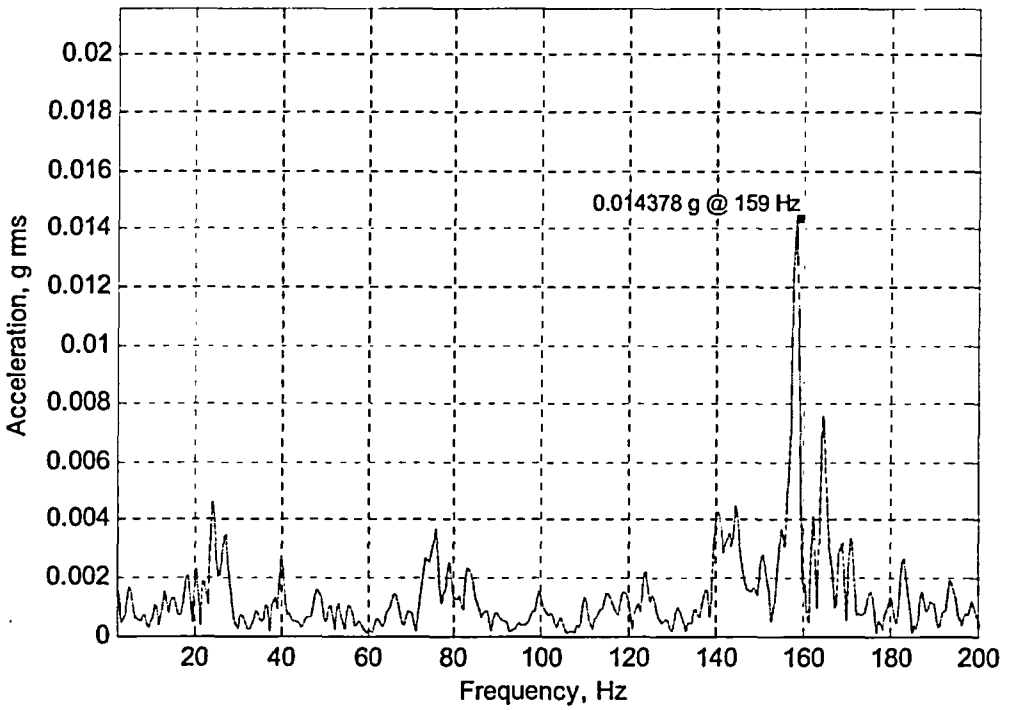
EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

Quad Cities U2 5-17-5 @ 1737 mwE = 450, mWTH = 1476 Filtered Spectral Plot
Ch. 30 - 3A Target Rock Inlet Flange Perpendicular to MS Flow (Z)
Max Sec: 142 Second Composite grms = 0.19176

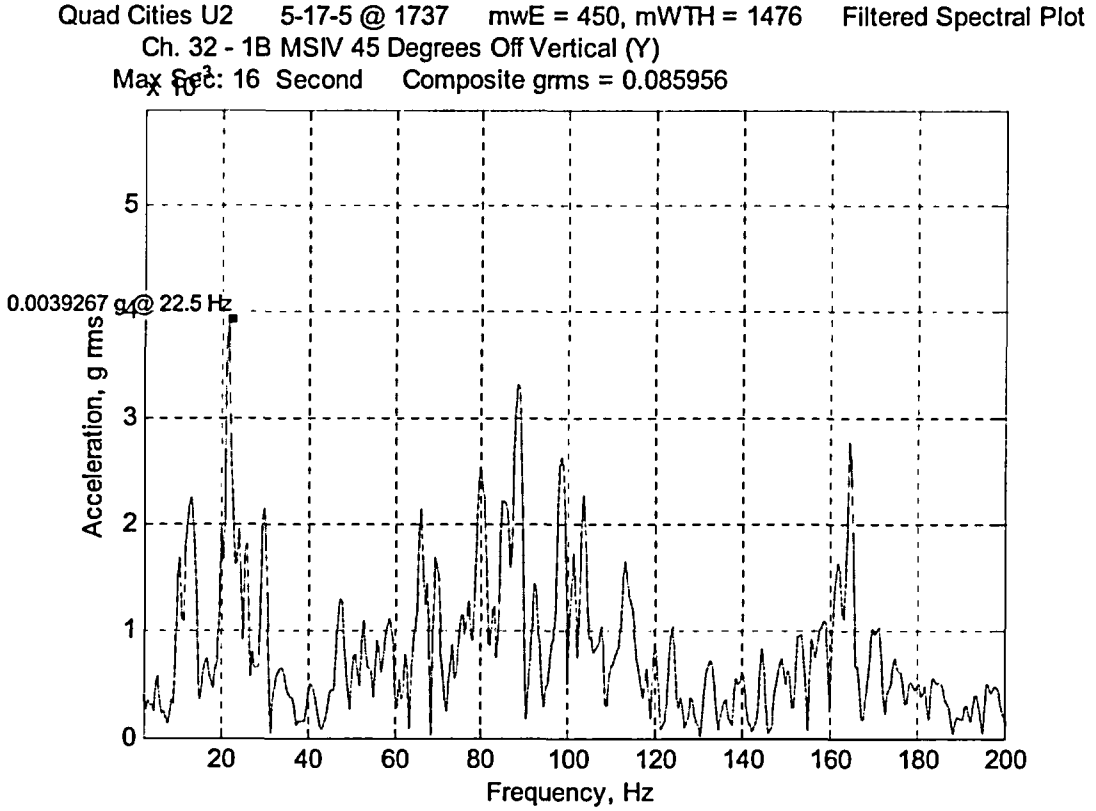


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

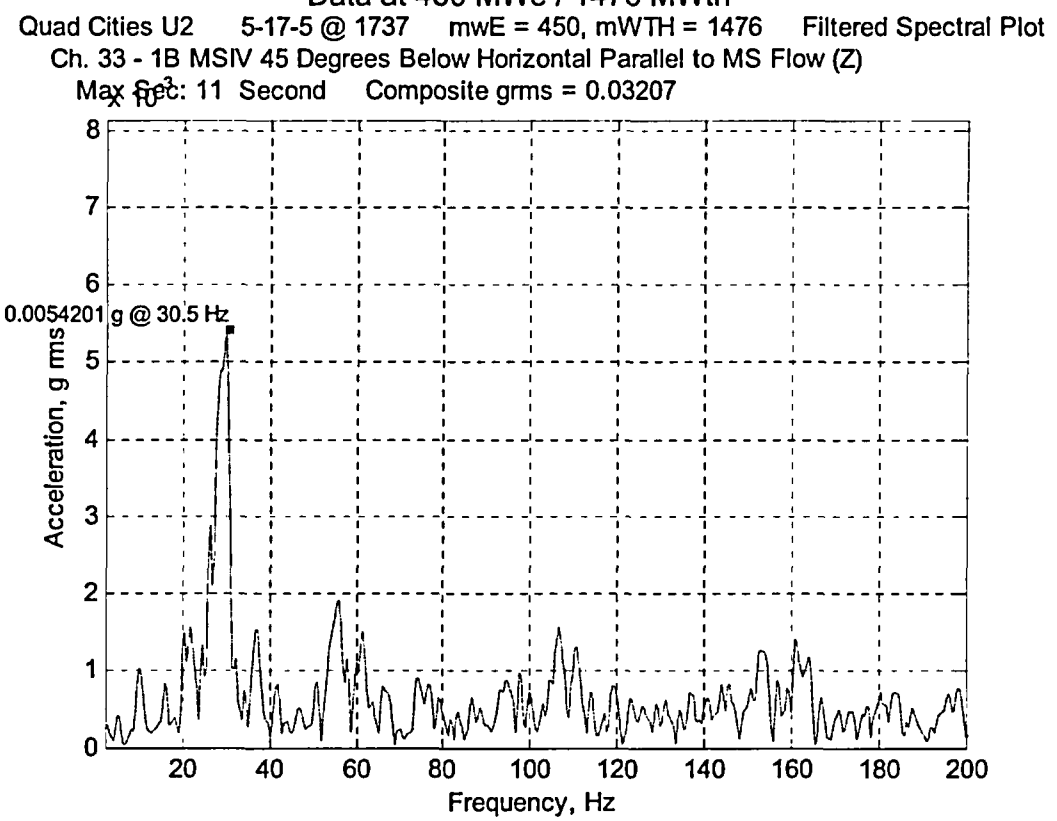
Quad Cities U2 5-17-5 @ 1737 mwE = 450, mWTH = 1476 Filtered Spectral Plot
Ch. 31 - 1B MSIV Horizontal Perpendicular to MS Flow (X)
Max Sec: 142 Second Composite grms = 0.063146



EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

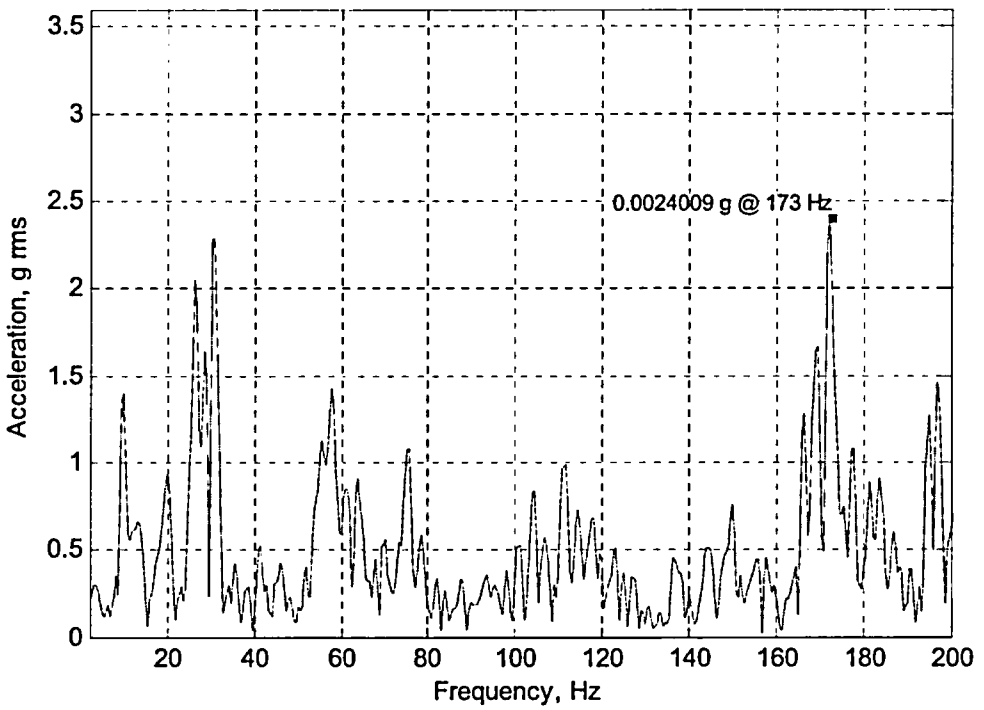


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

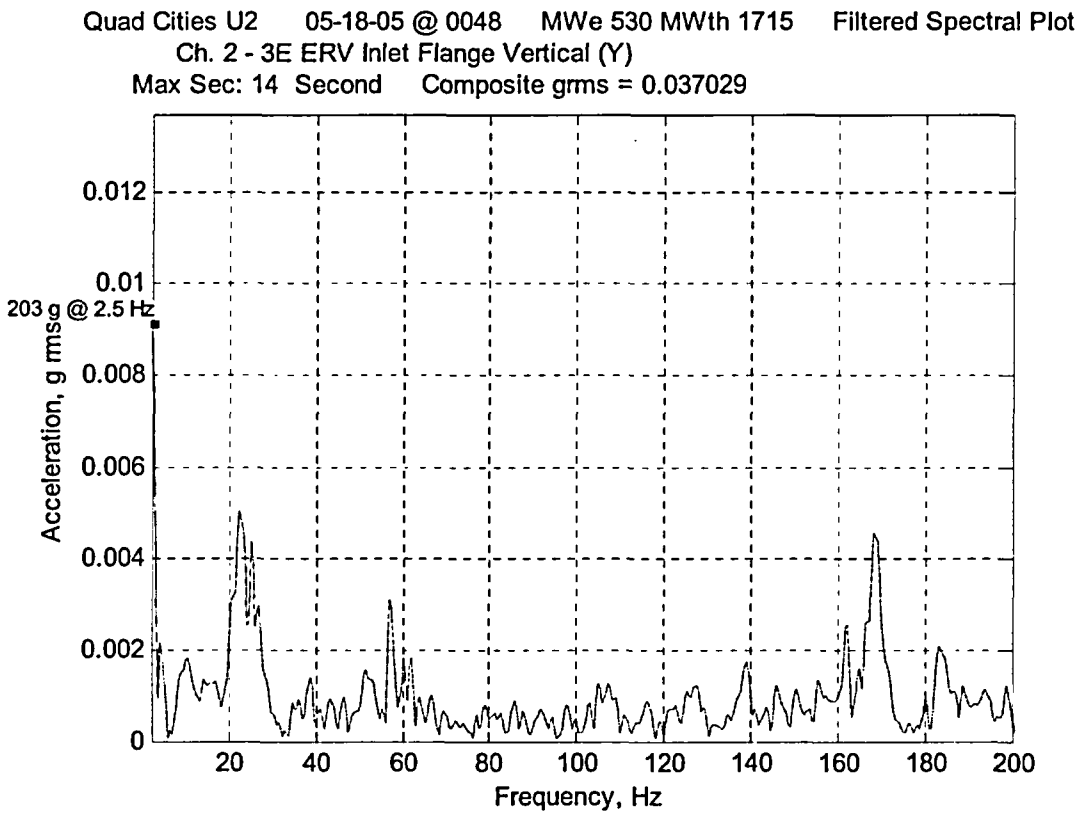


EC 355702
Attachment 2
Data at 450 MWe / 1476 MWth

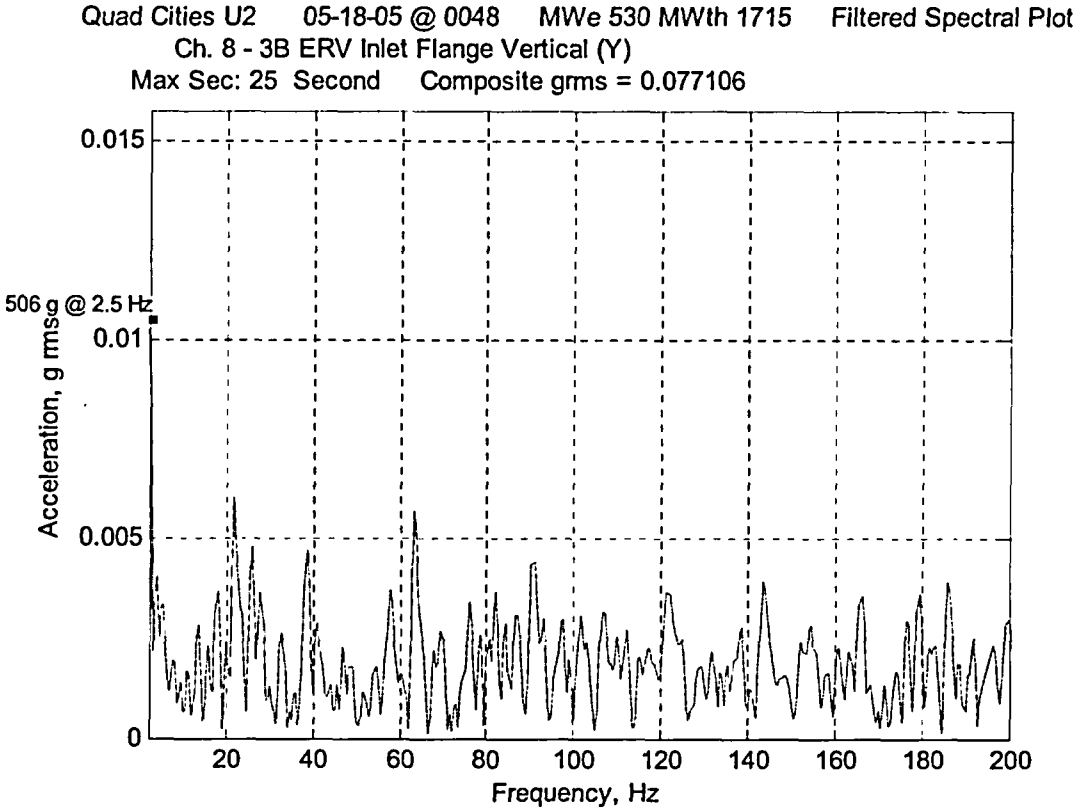
Quad Cities U2 5-17-05 @ 0851 295 MWe / 1024 MWth Filtered Spectral Plot
Ch. 33 - 1B MSIV 45 Degrees Below Horizontal Parallel to MS Flow (Z)
Max Sec: 99 Second Composite grms = 0.022286



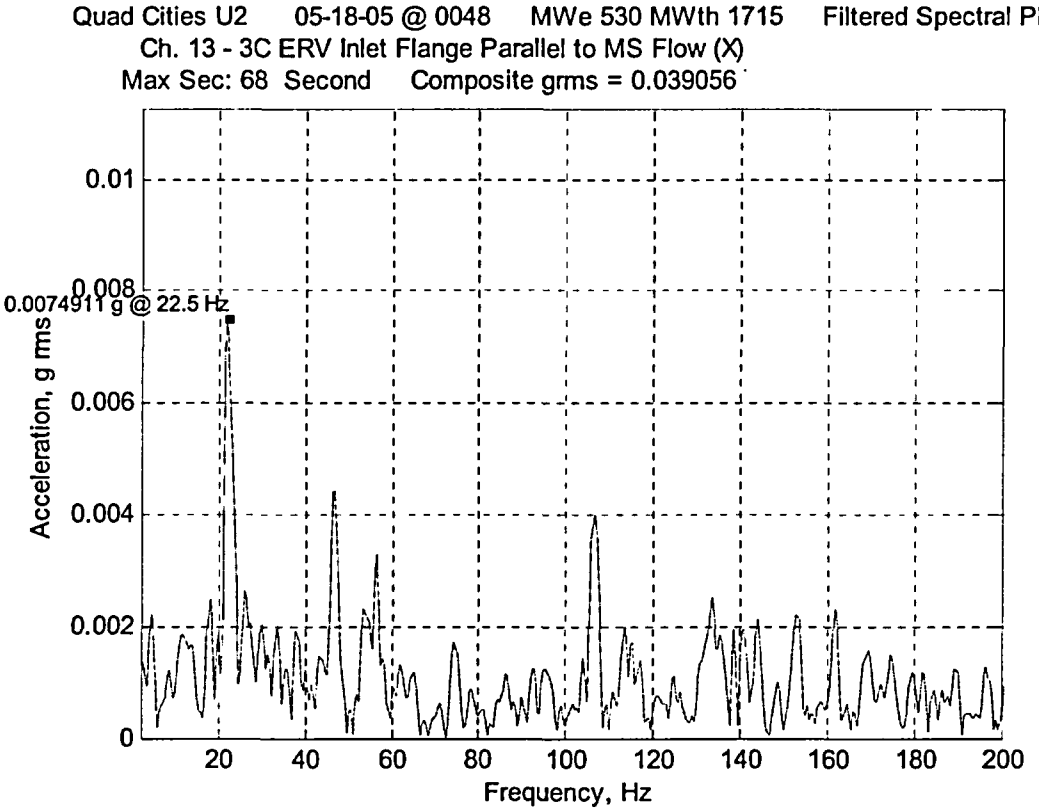
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



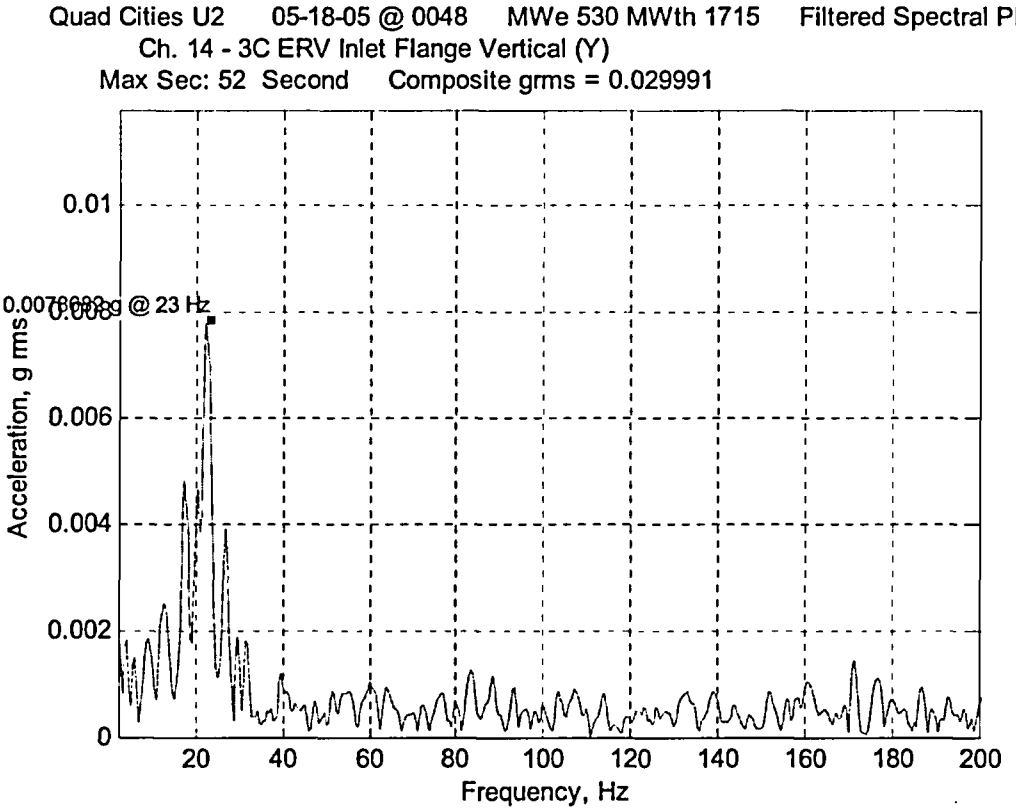
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



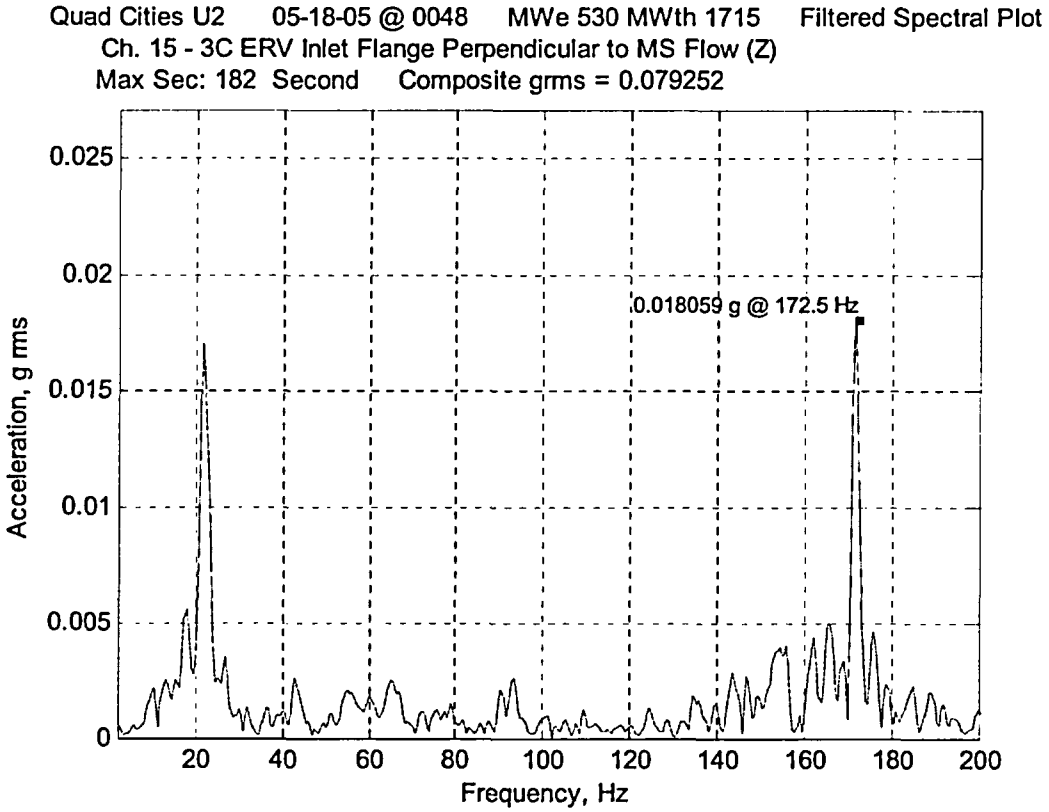
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



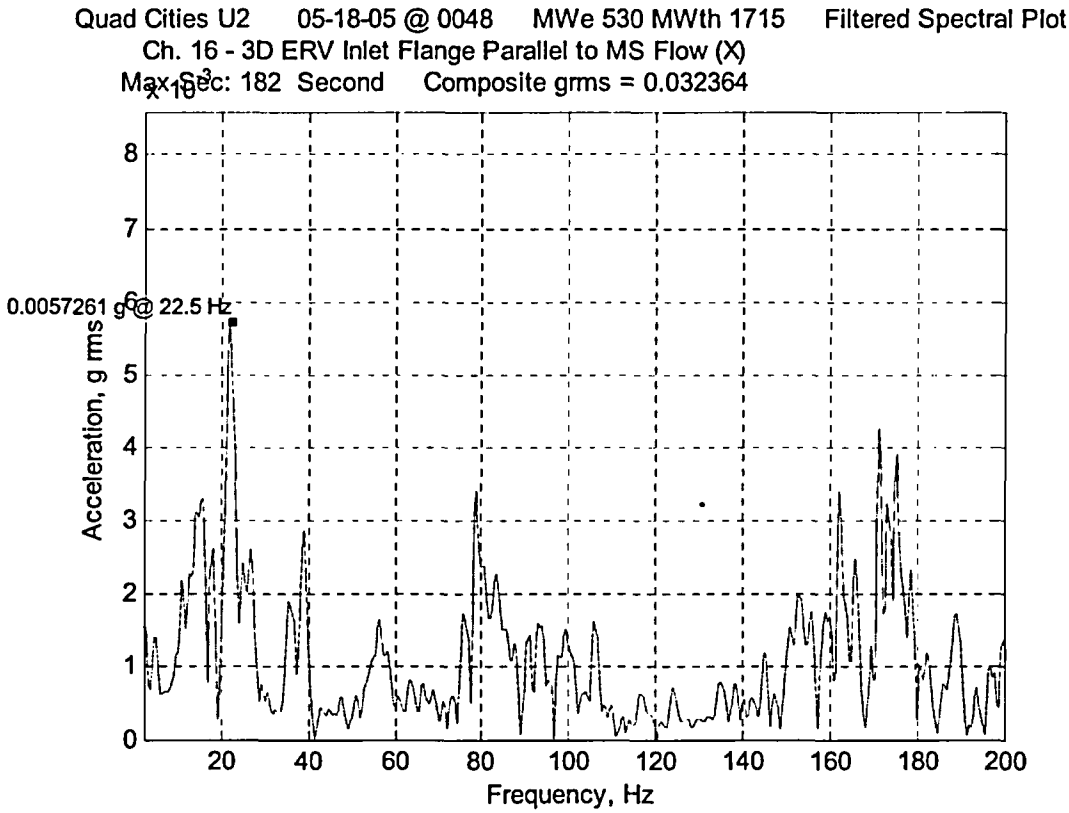
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



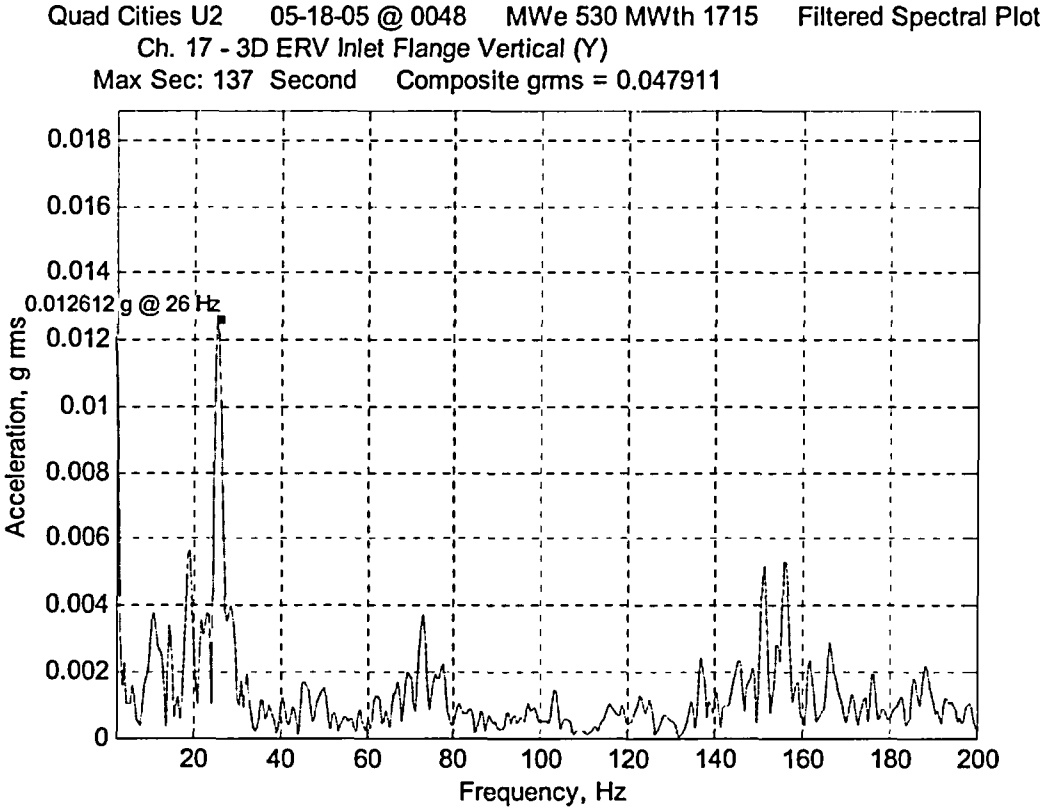
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



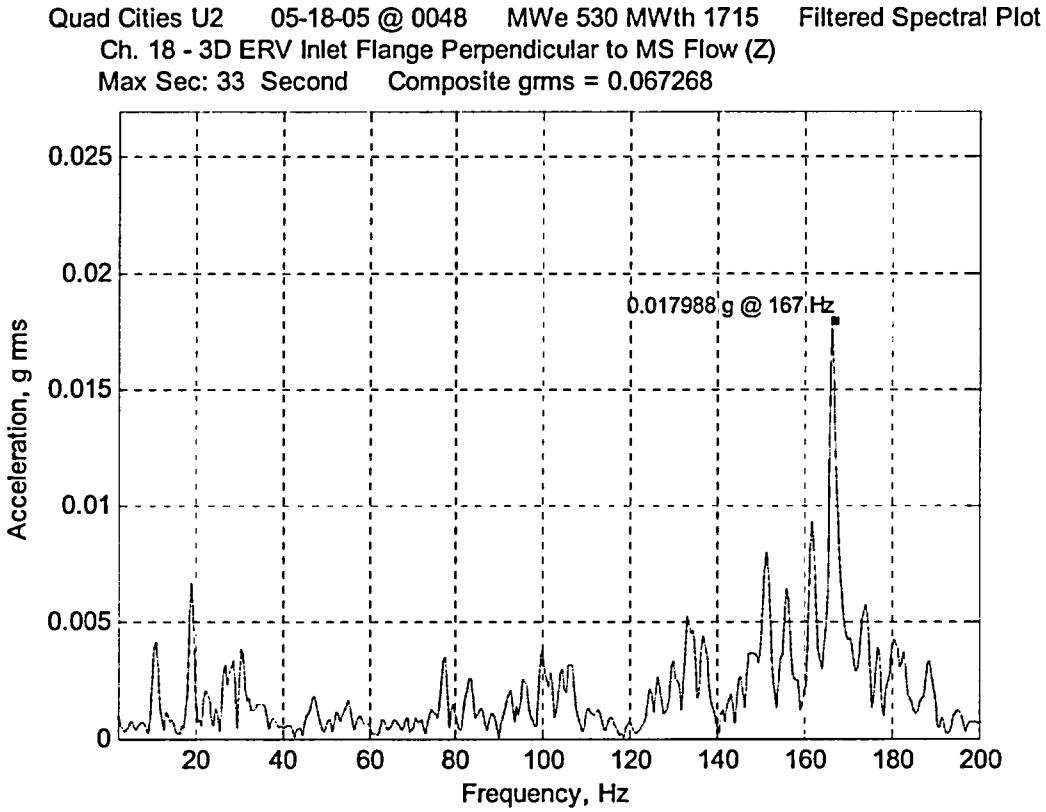
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



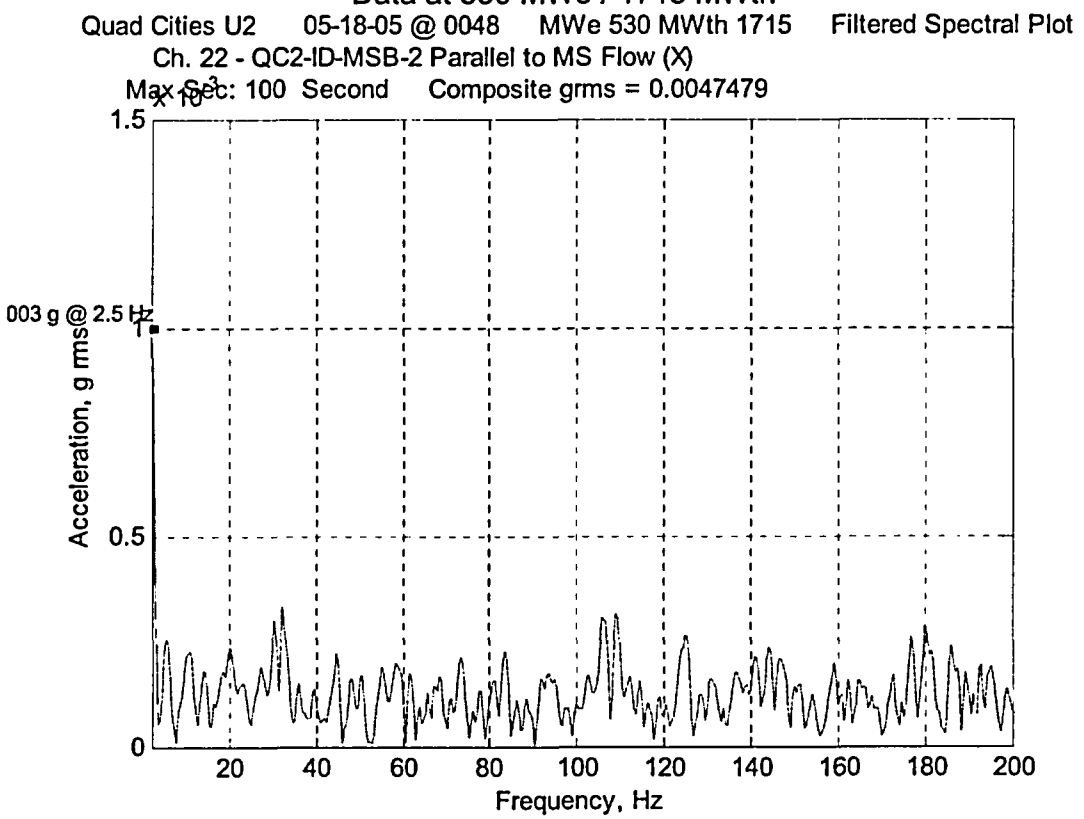
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



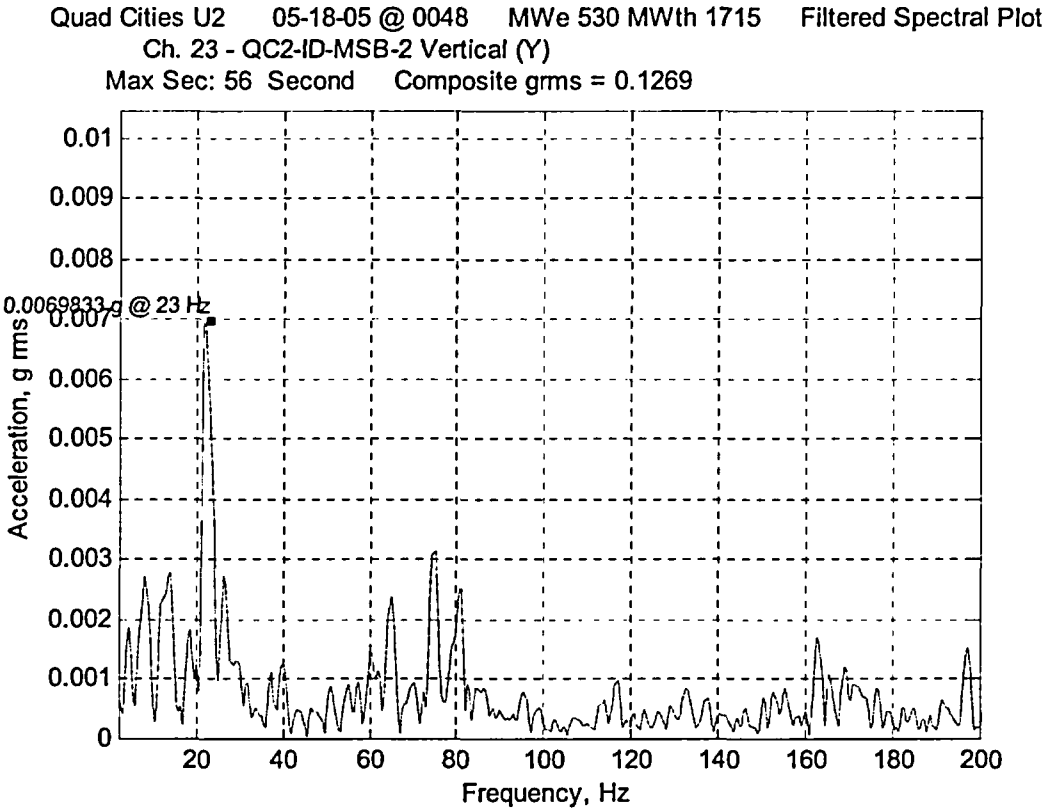
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



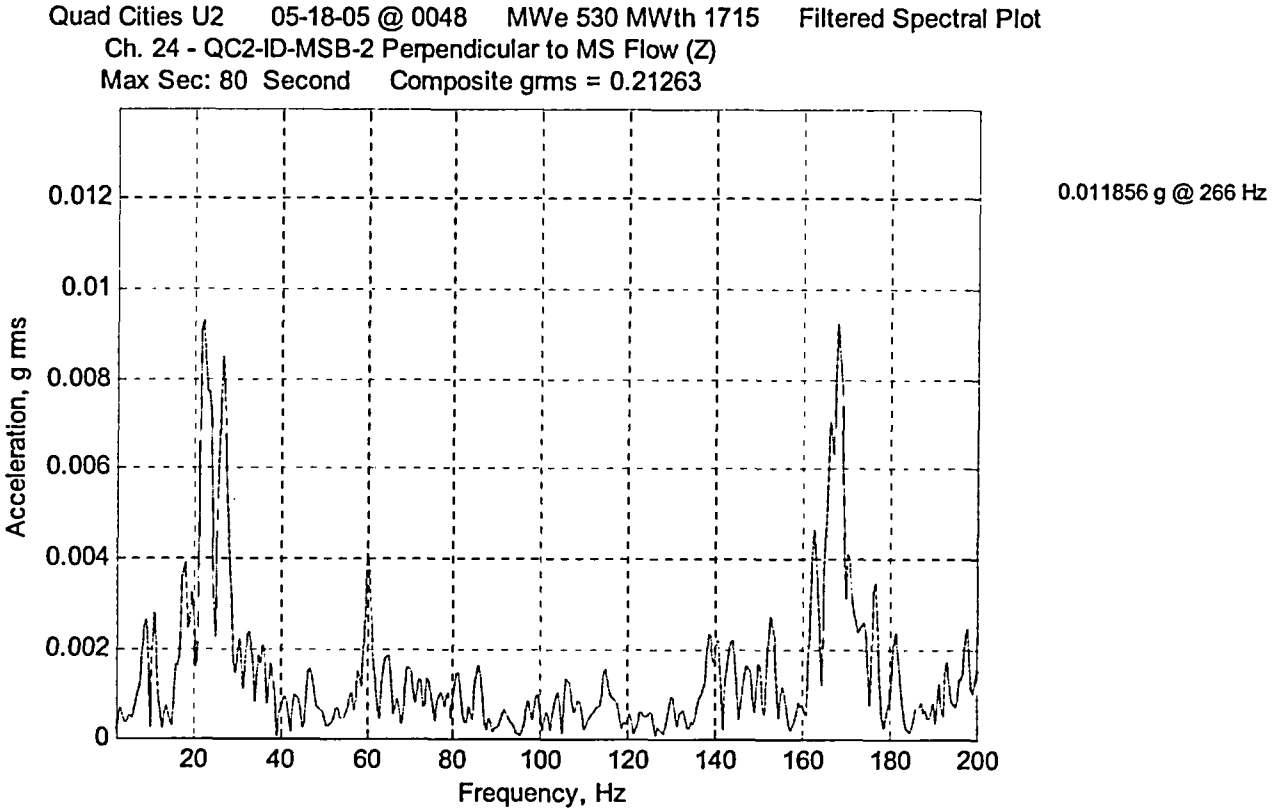
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



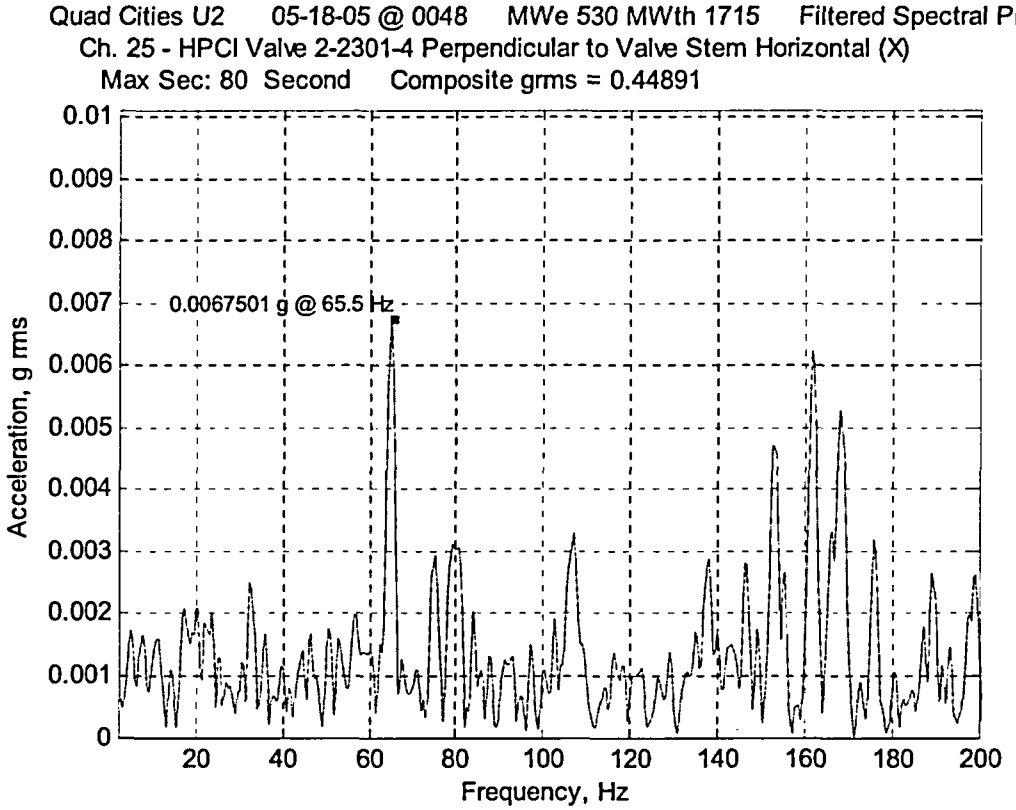
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



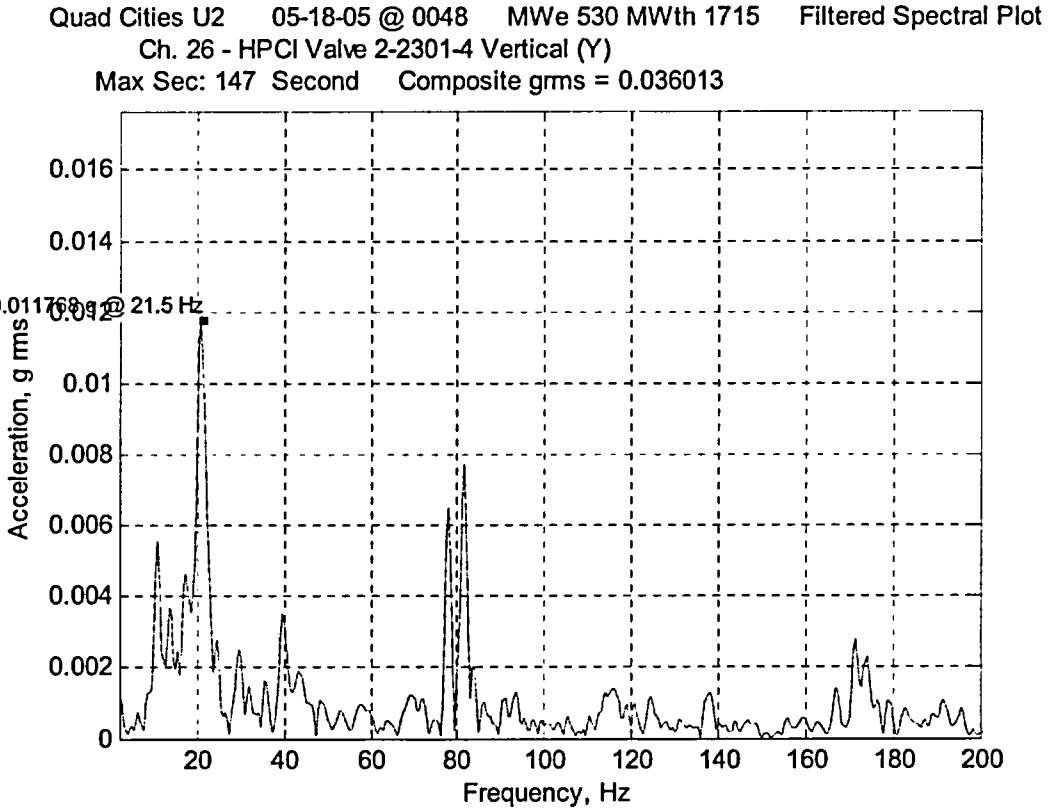
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



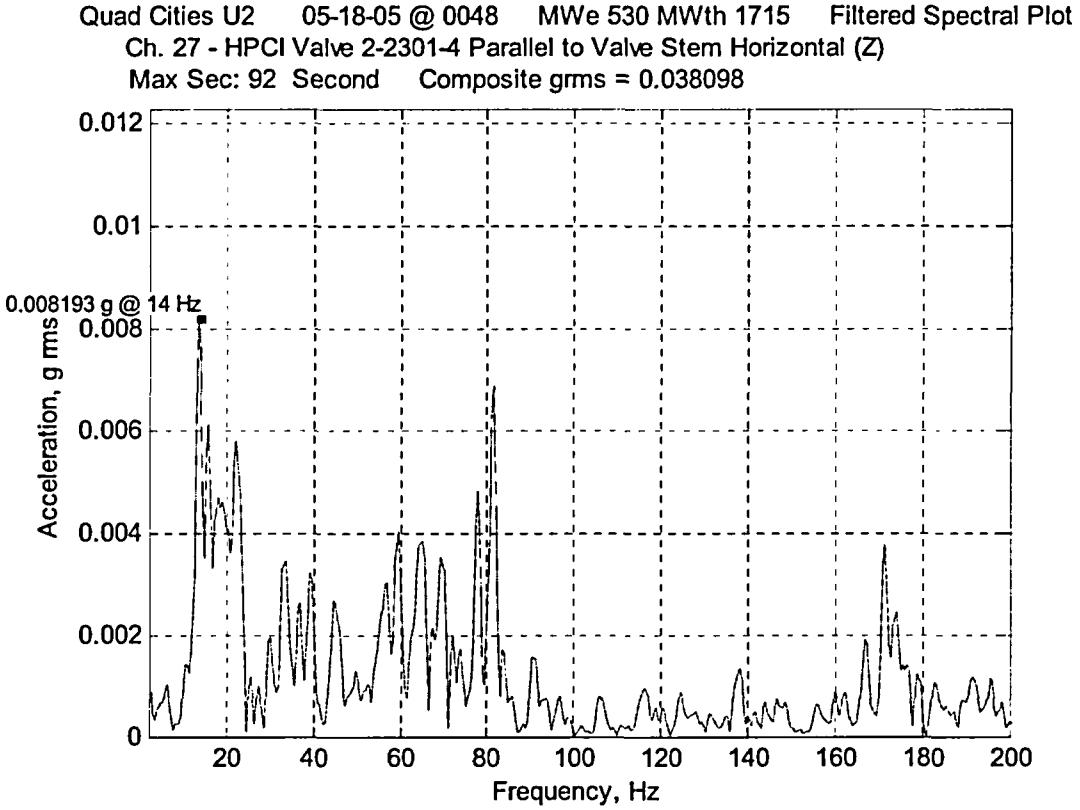
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



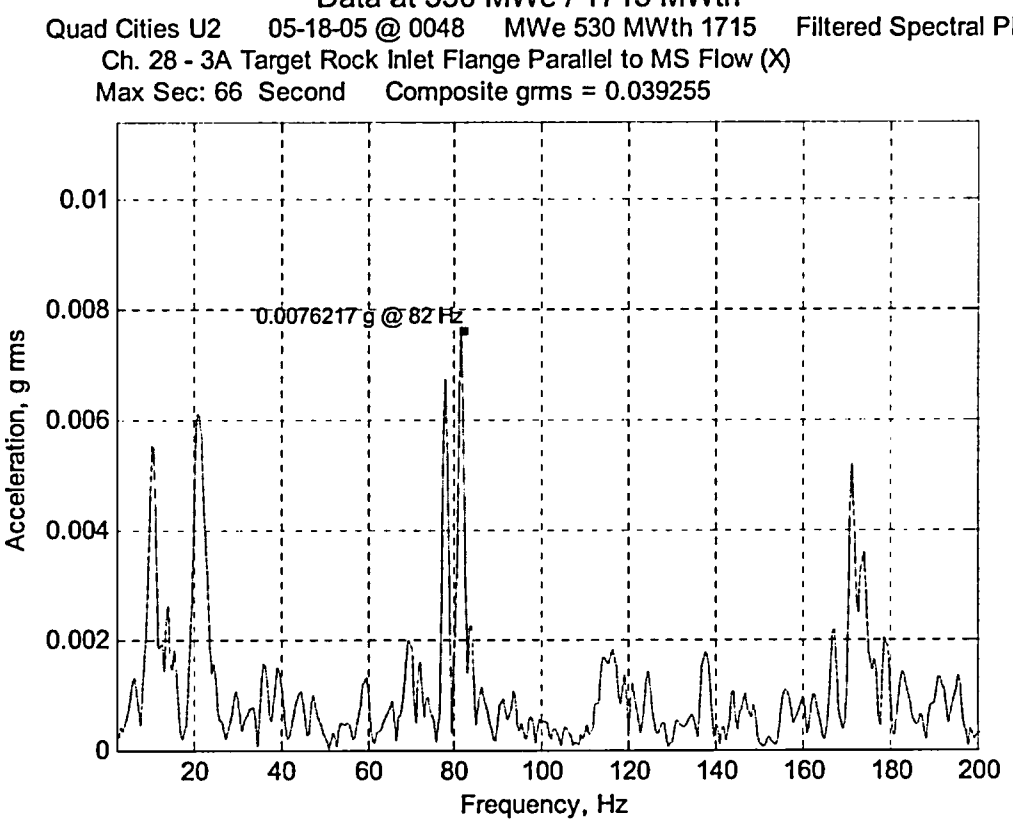
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



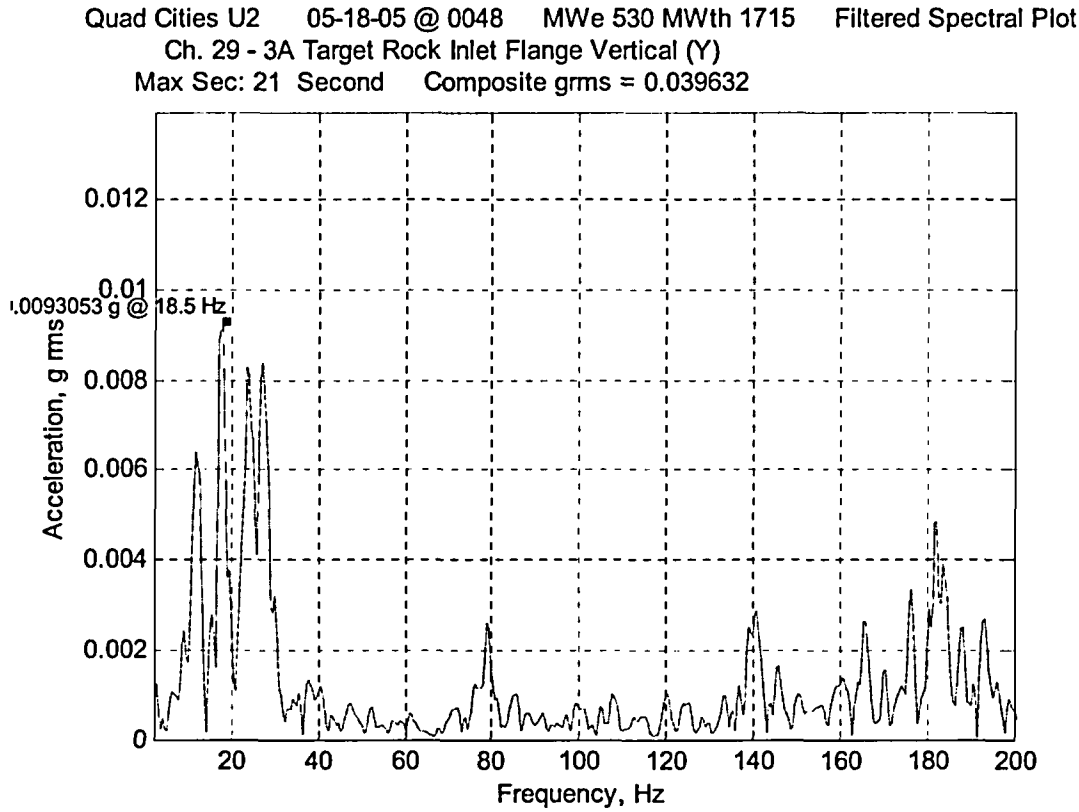
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth

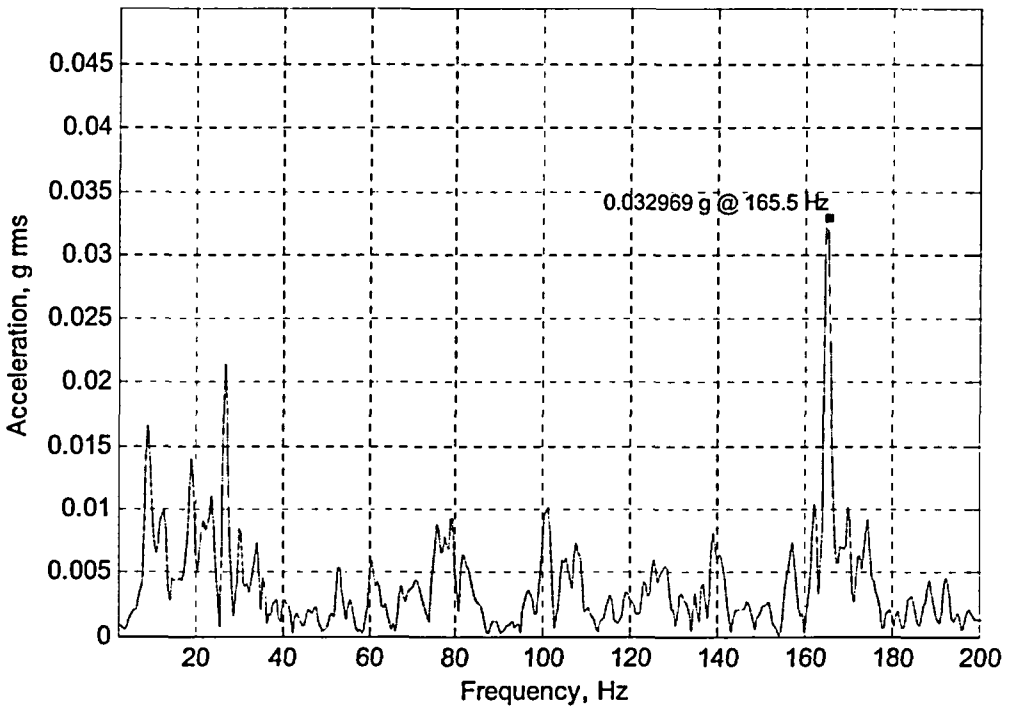


EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



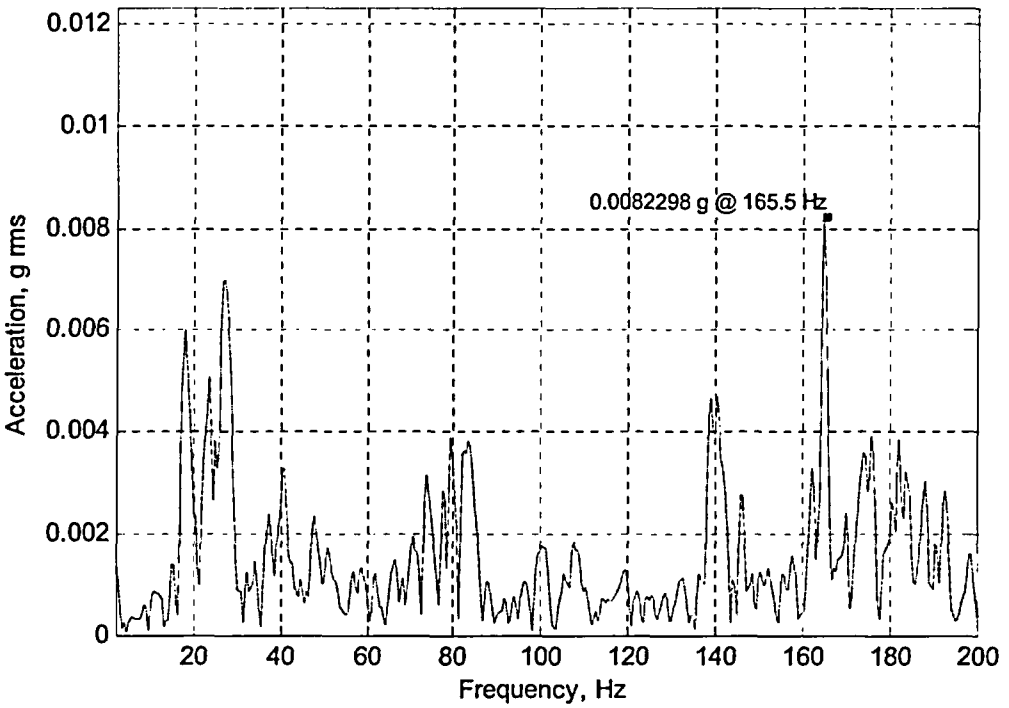
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth

Quad Cities U2 05-18-05 @ 0048 MWe 530 MWth 1715 Filtered Spectral Plot
Ch. 30 - 3A Target Rock Inlet Flange Perpendicular to MS Flow (Z)
Max Sec: 126 Second Composite grms = 0.18948

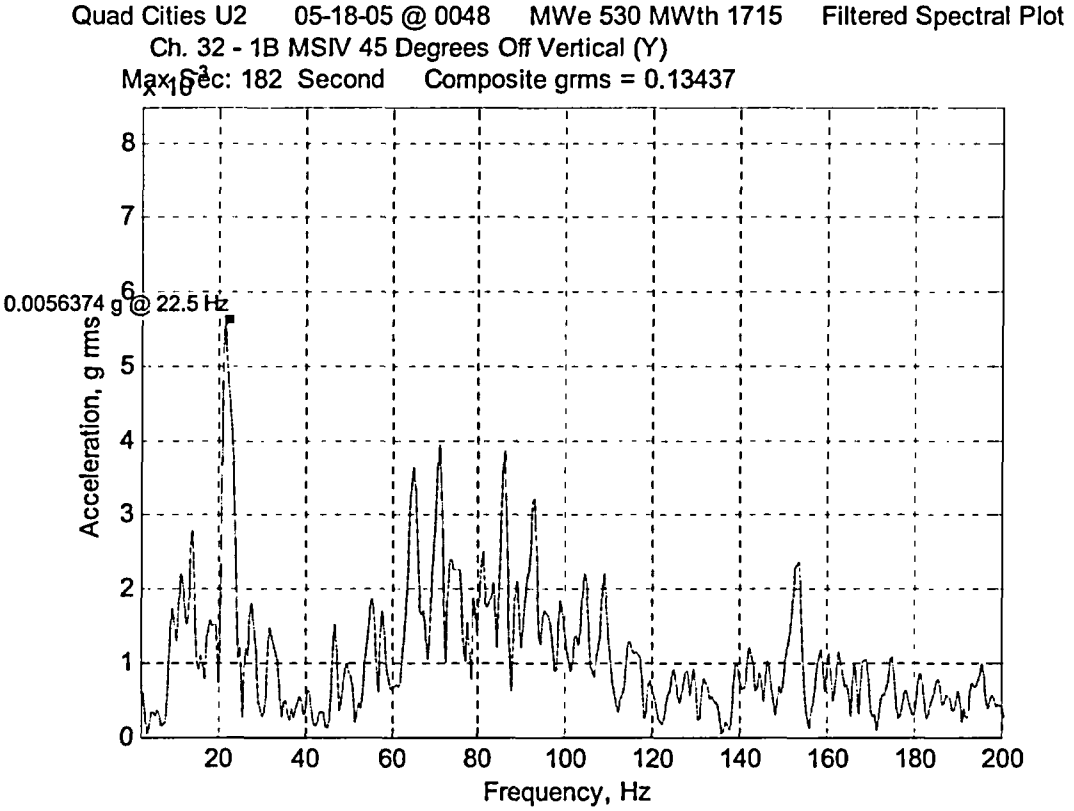


EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth

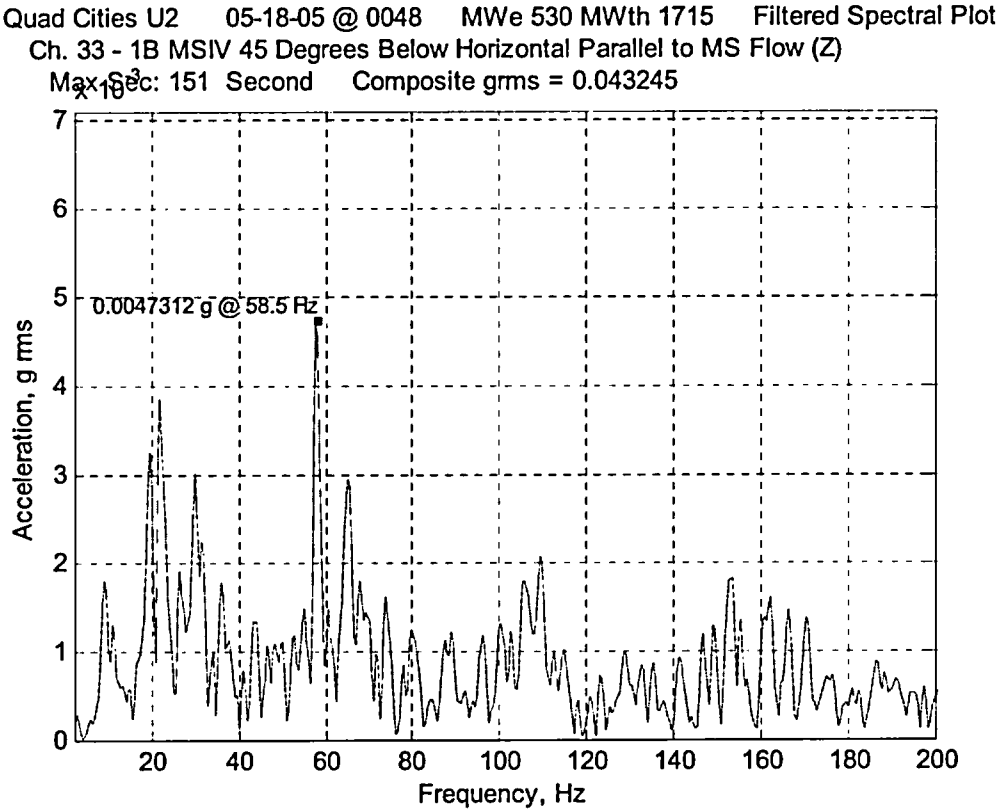
Quad Cities U2 05-18-05 @ 0048 MWe 530 MWth 1715 Filtered Spectral Plot
Ch. 31 - 1B MSIV Horizontal Perpendicular to MS Flow (X)
Max Sec: 144 Second Composite grms = 0.07792



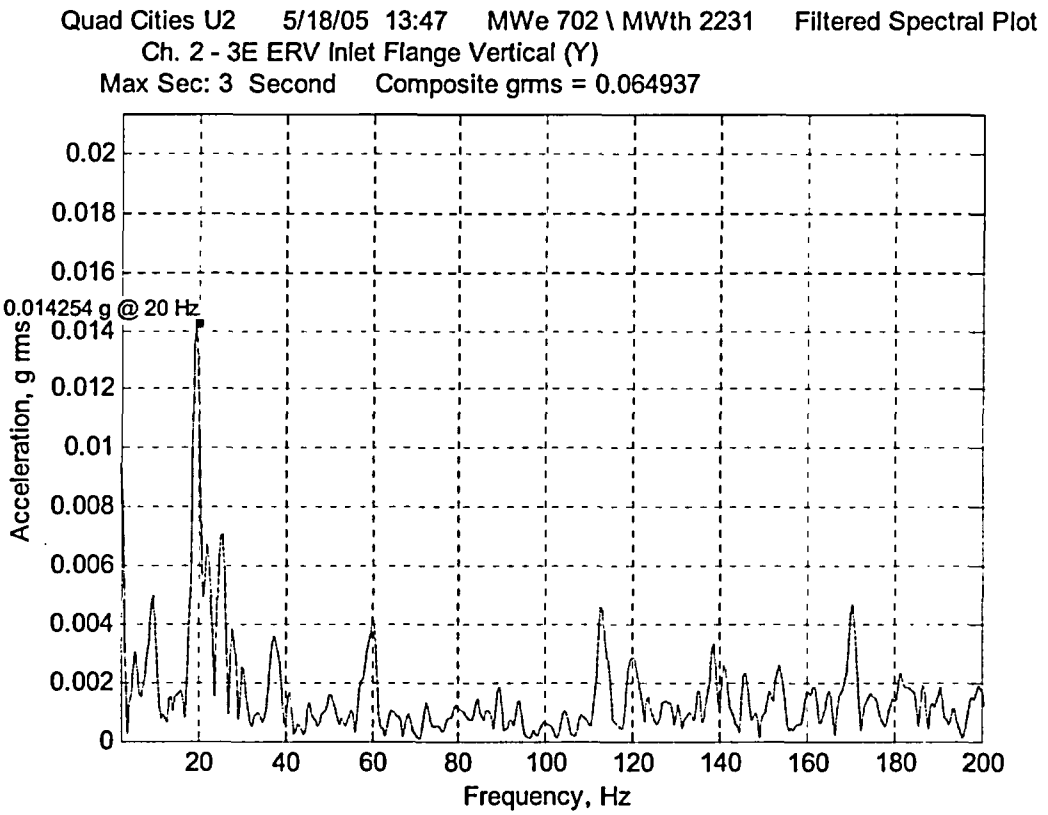
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



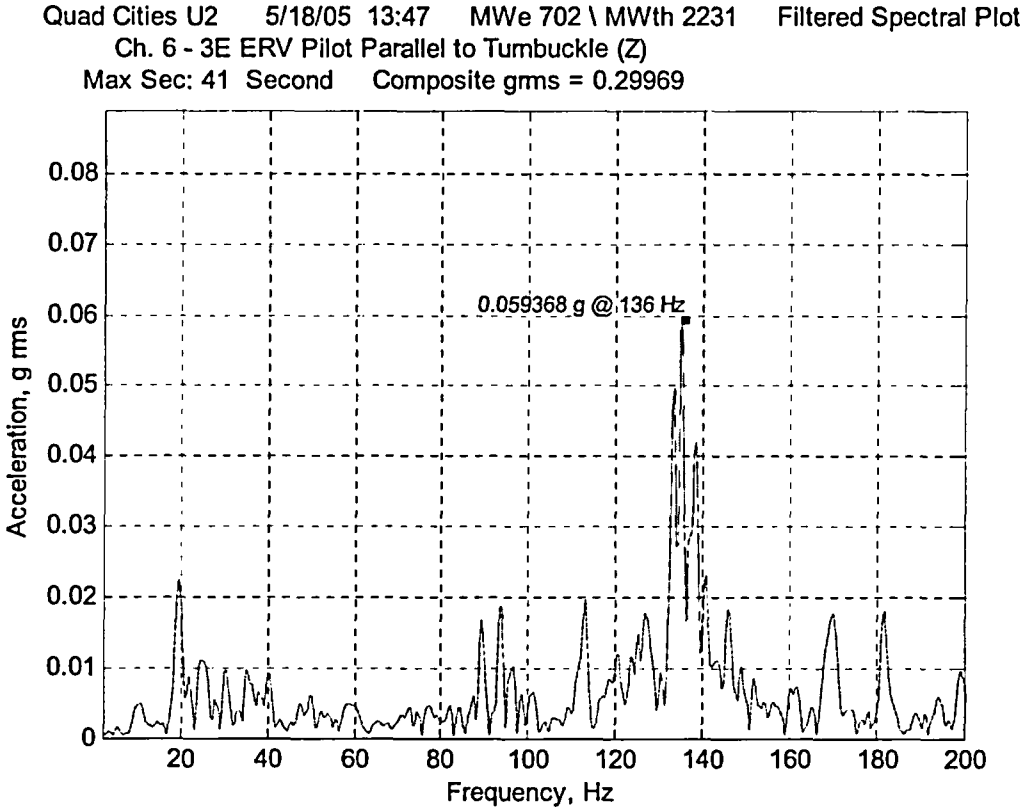
EC 355702
Attachment 2
Data at 530 MWe / 1715 MWth



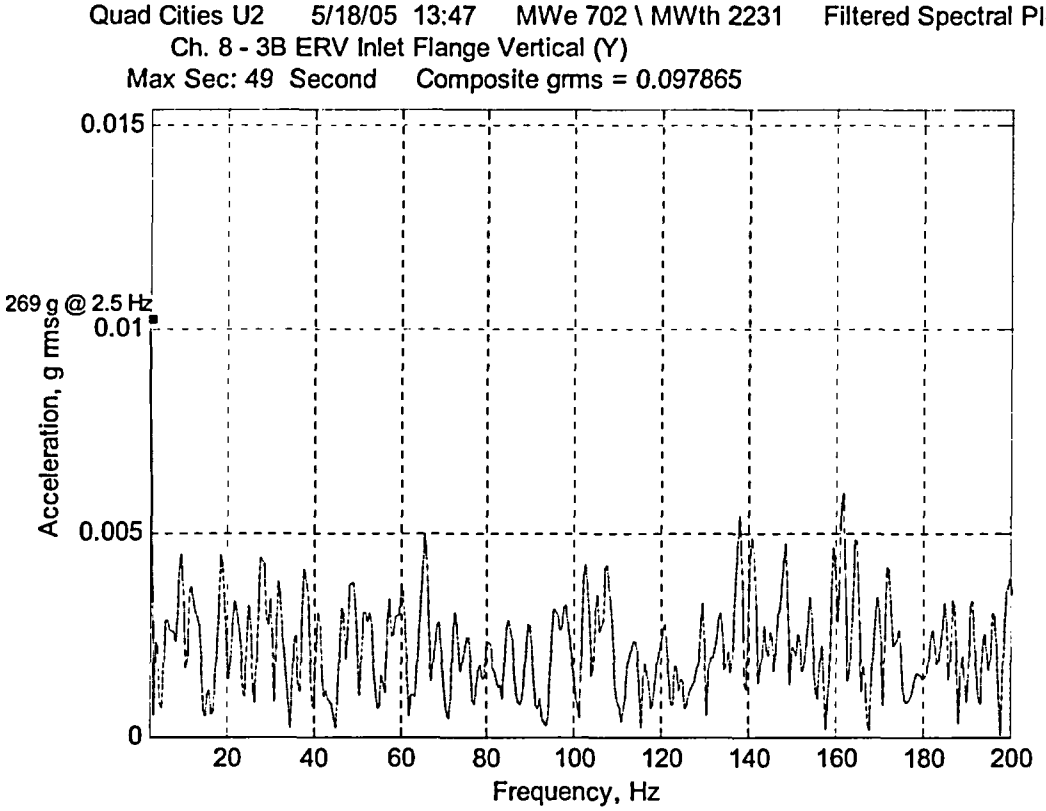
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



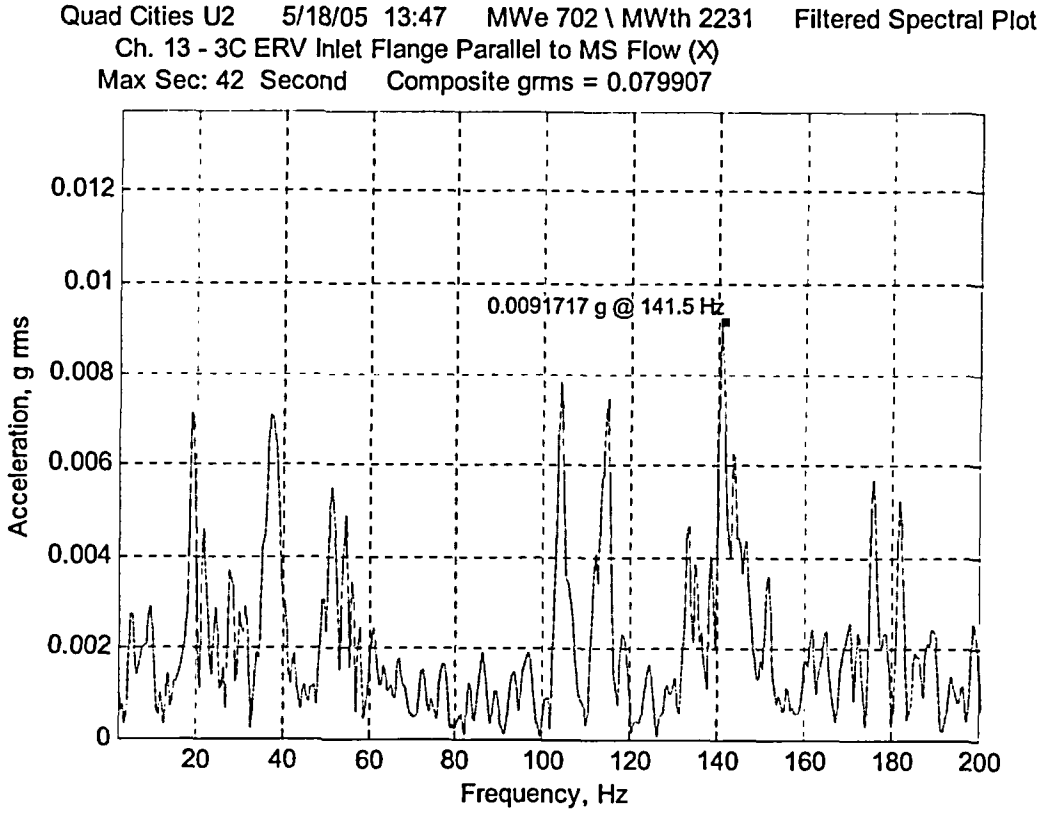
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



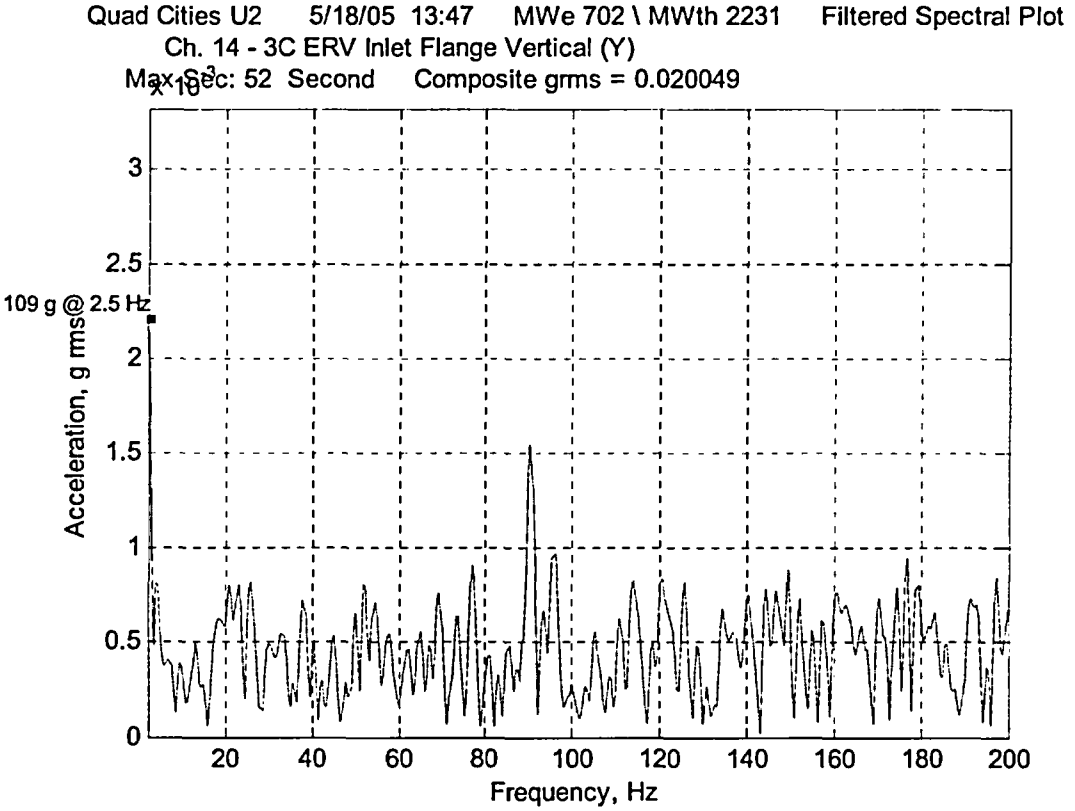
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



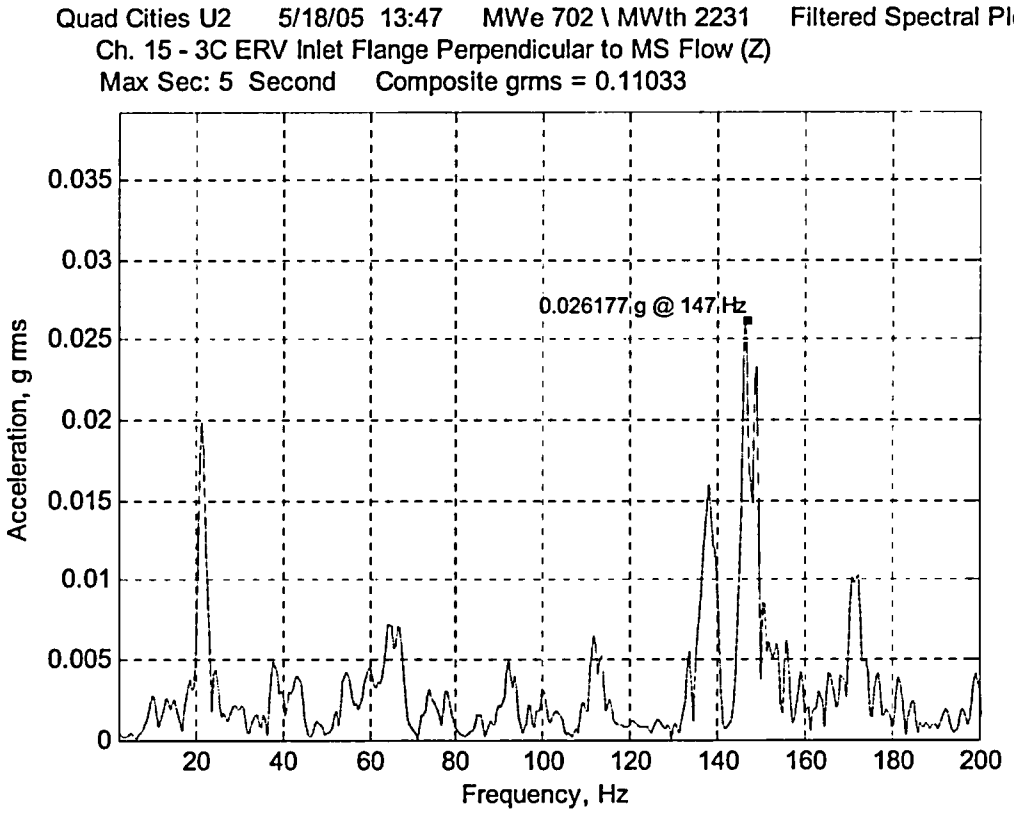
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



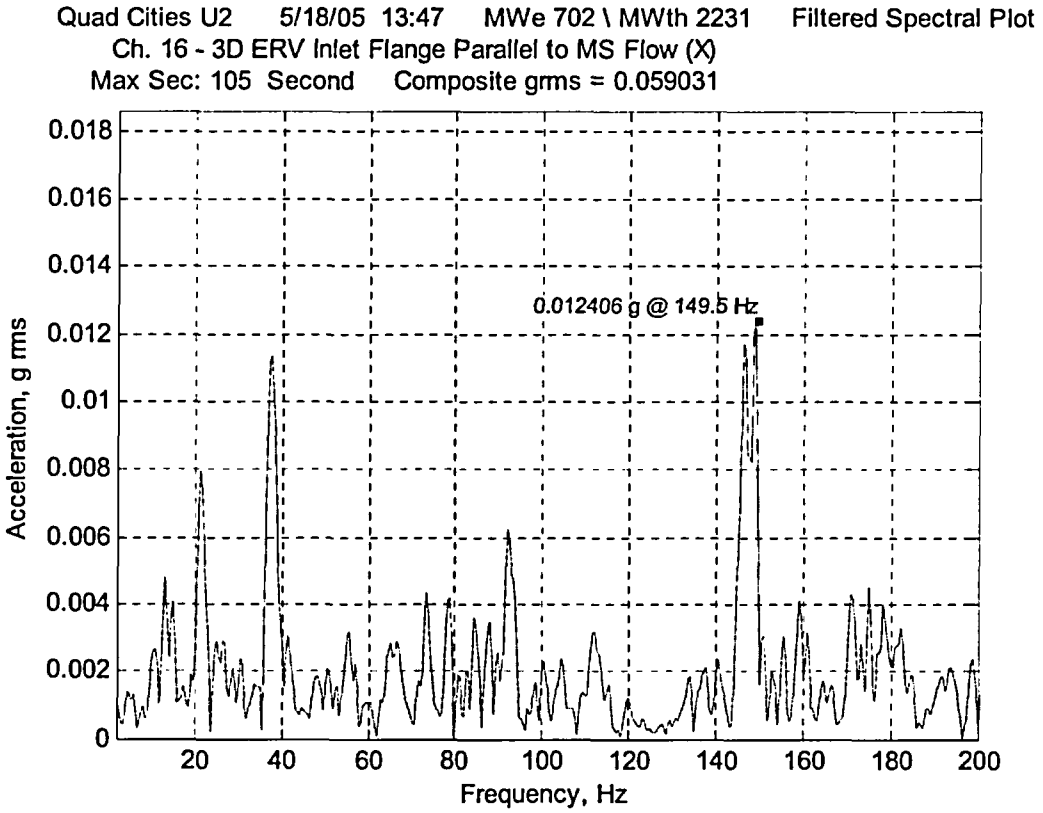
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



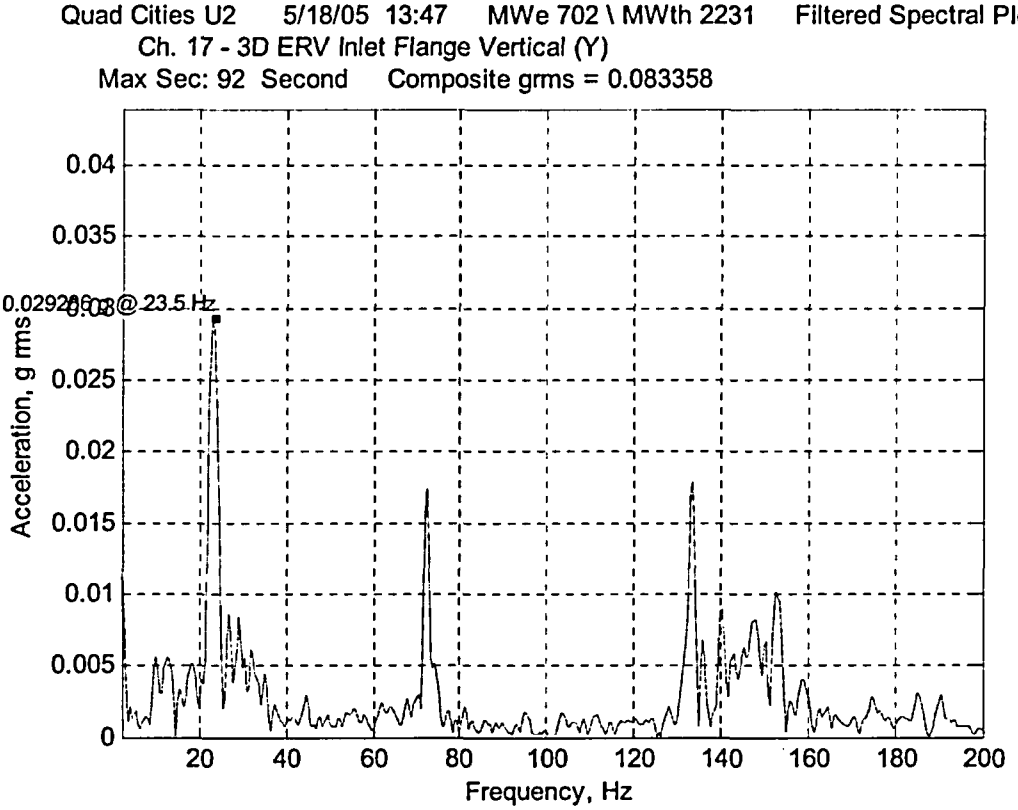
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



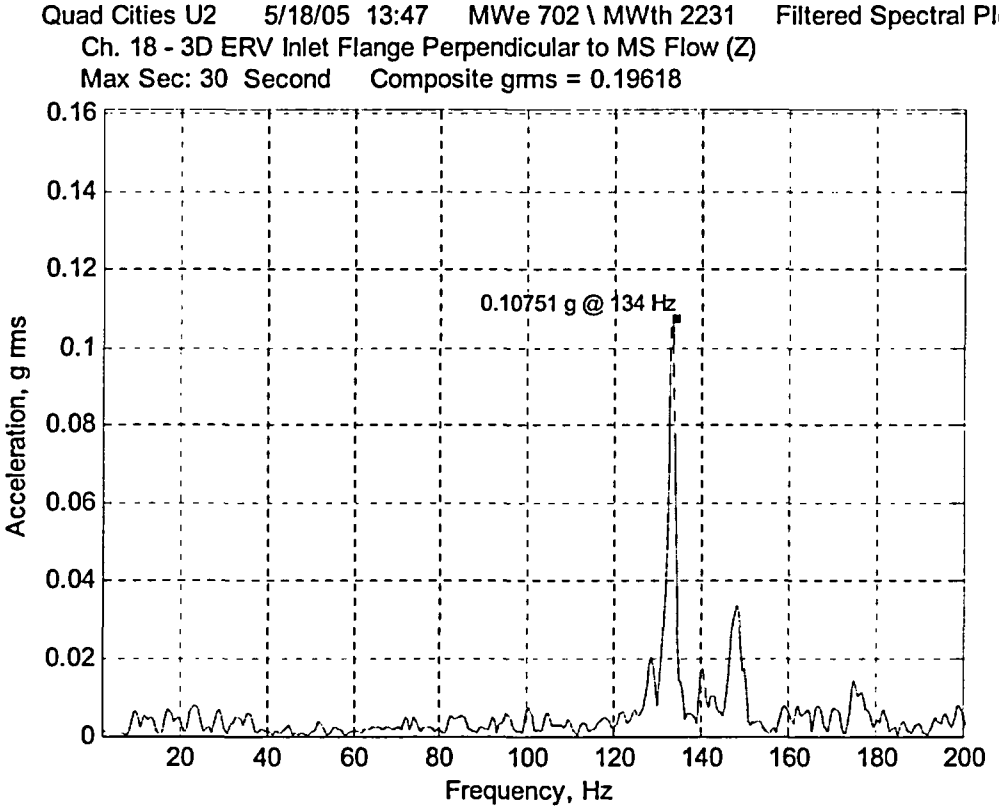
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



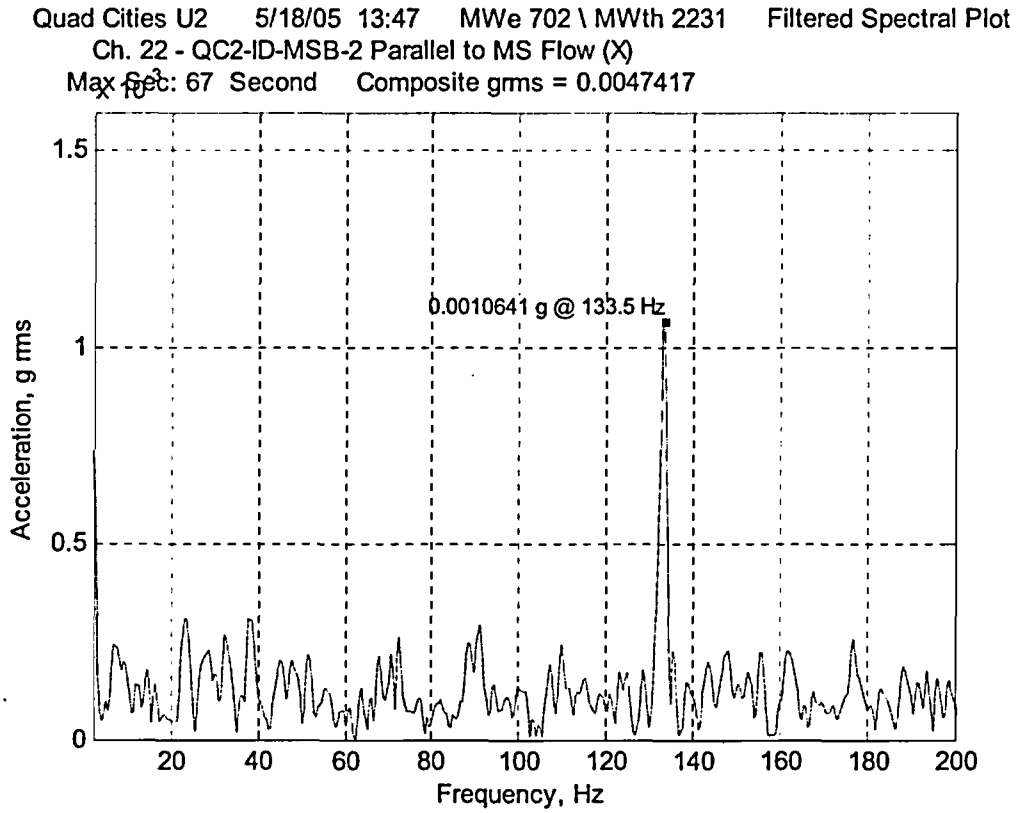
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth

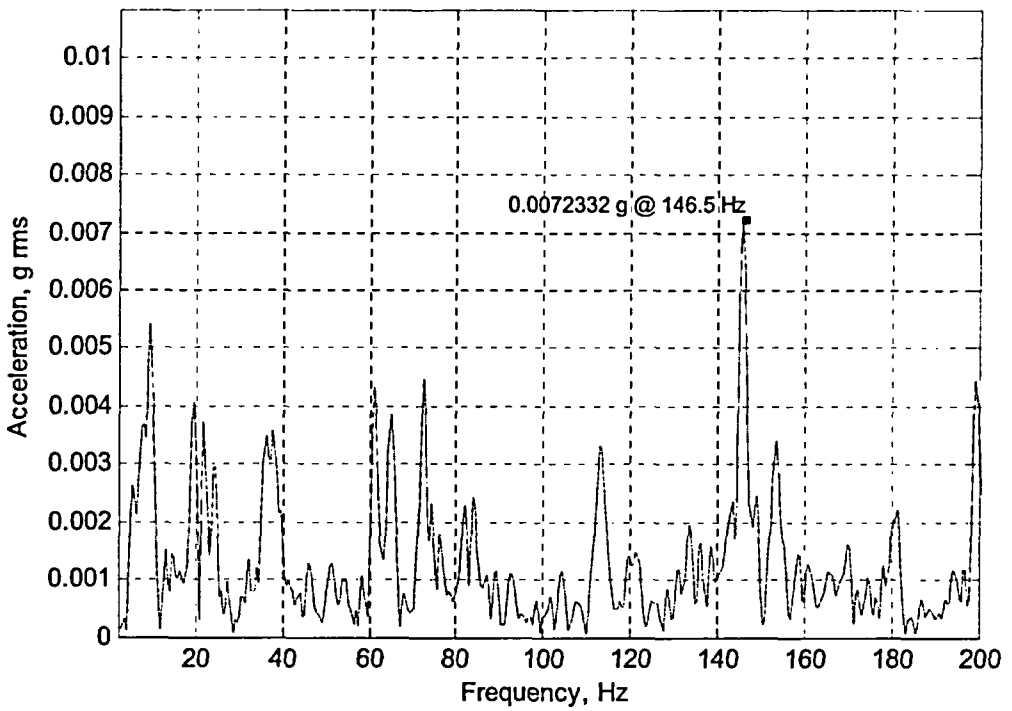


EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth

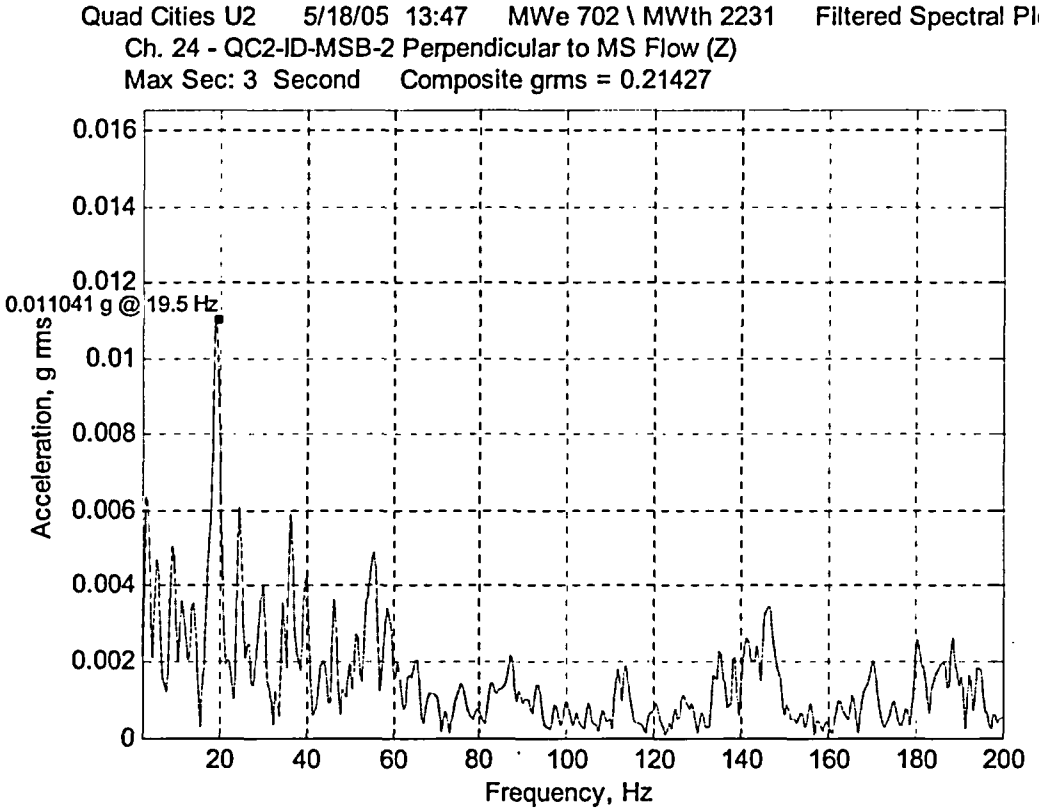


EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth

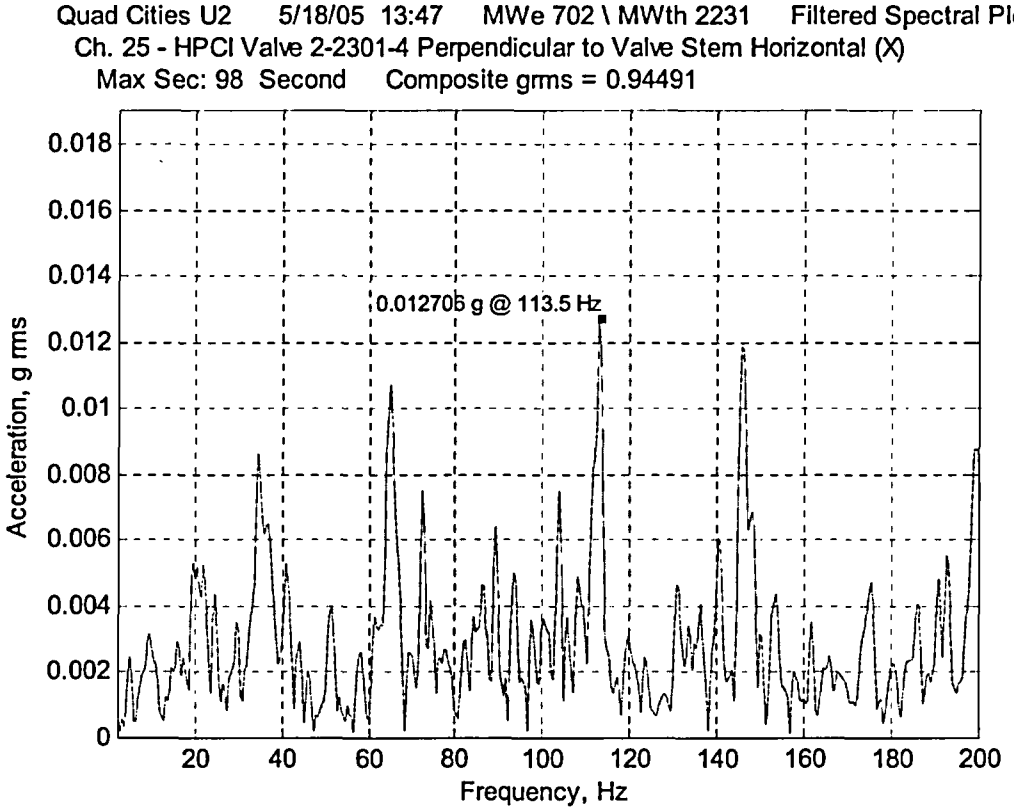
Quad Cities U2 5/18/05 13:47 MWe 702 \ MWth 2231 Filtered Spectral Plot
Ch. 23 - QC2-ID-MSB-2 Vertical (Y)
Max Sec: 5 Second Composite grms = 0.22385



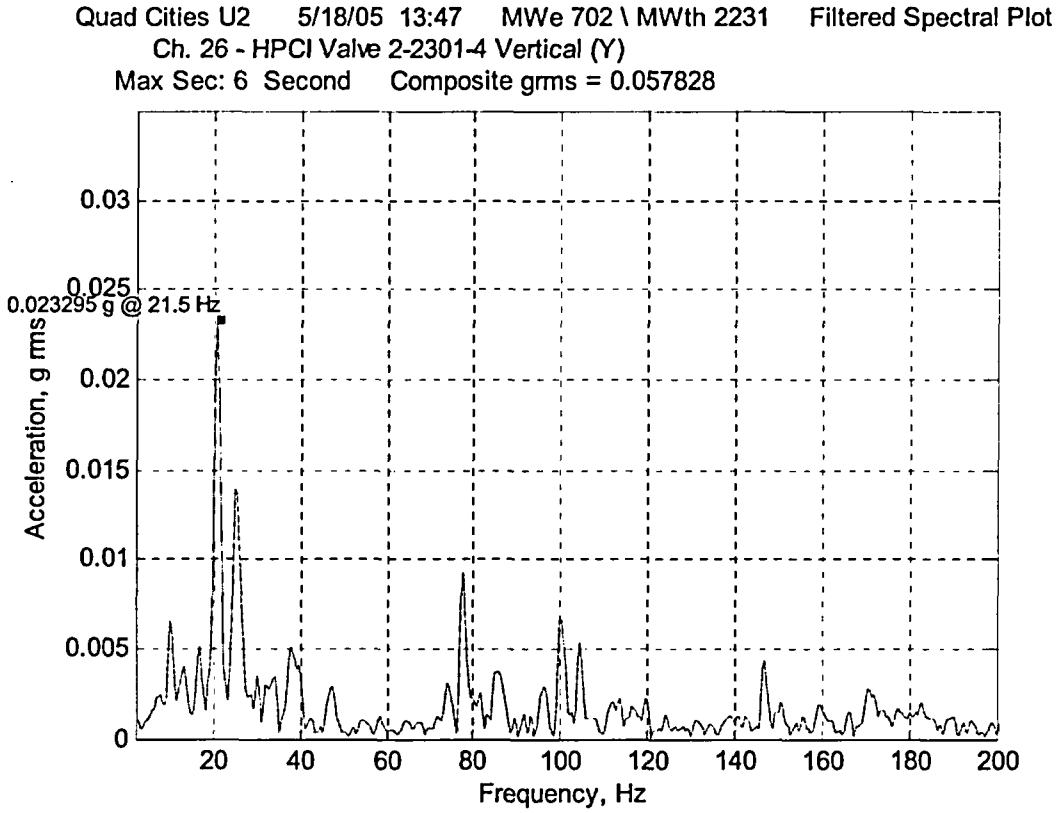
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



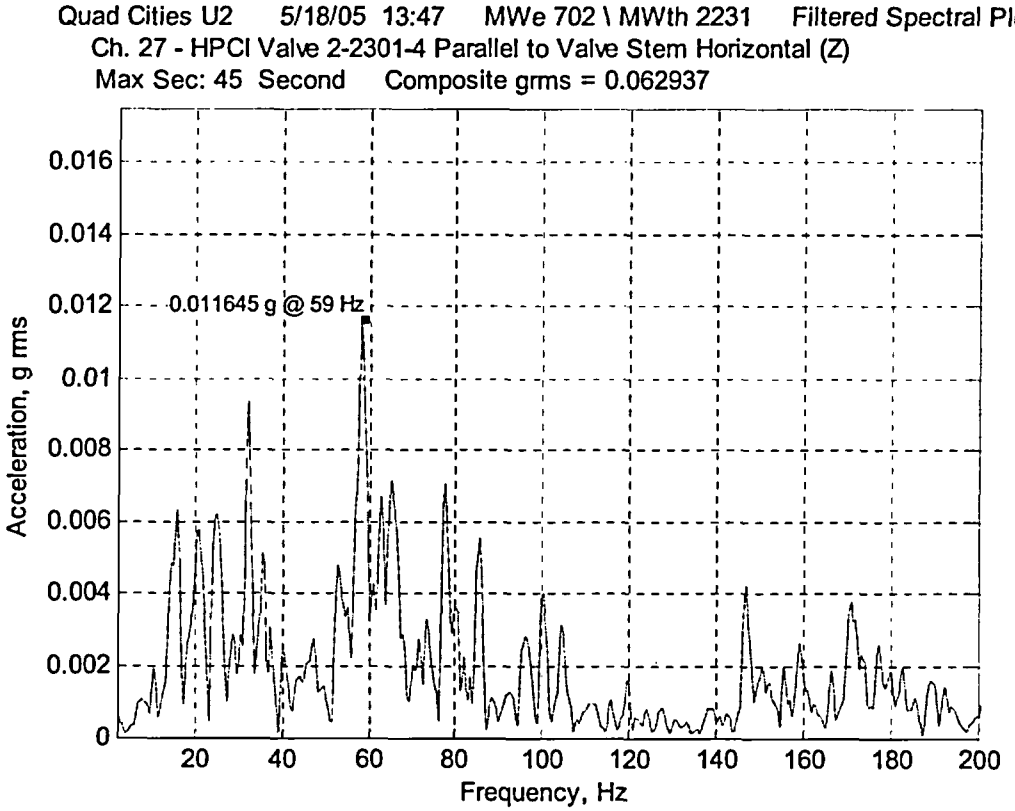
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



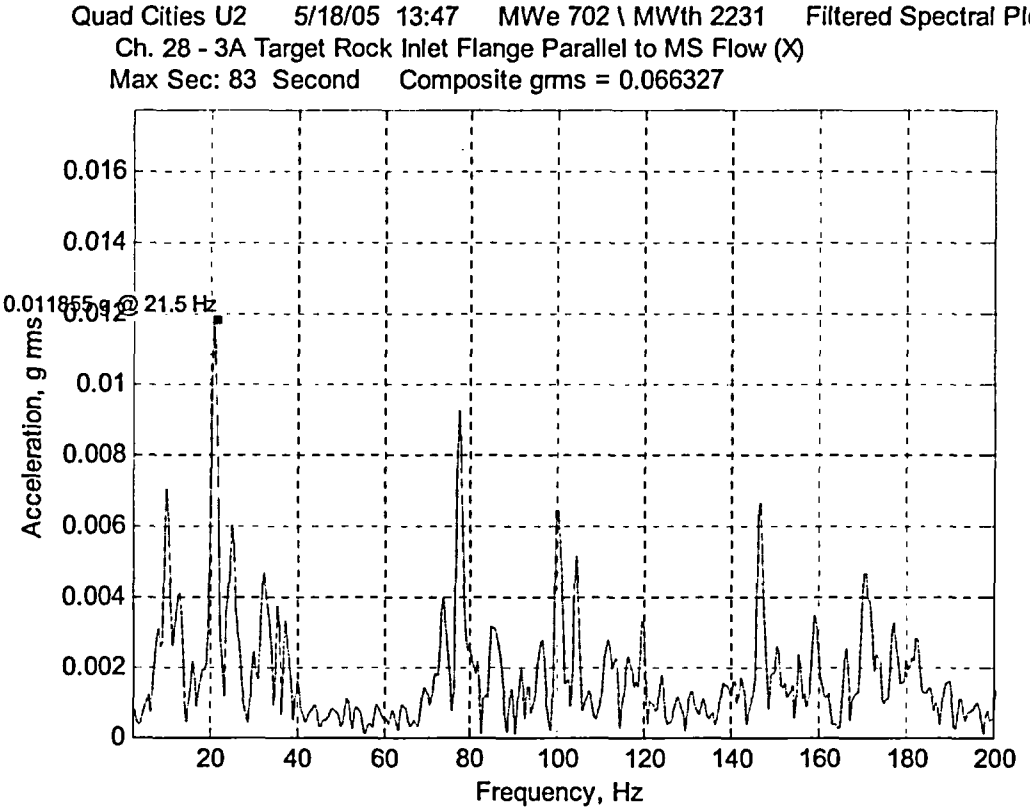
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



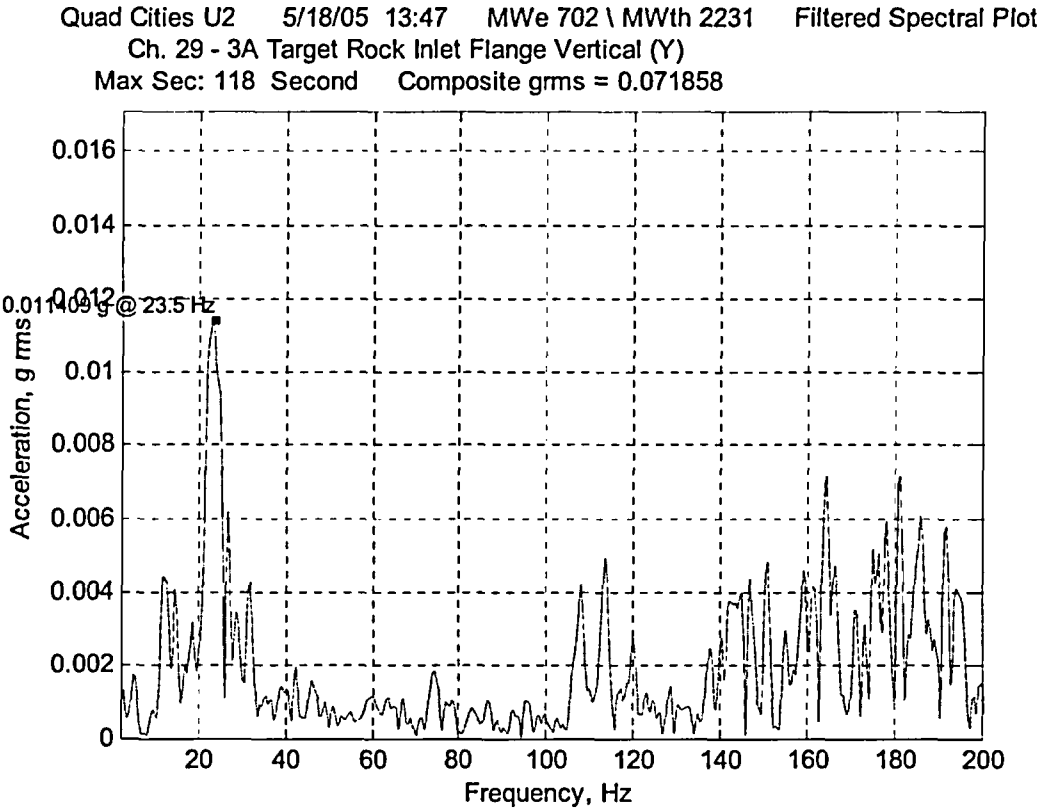
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



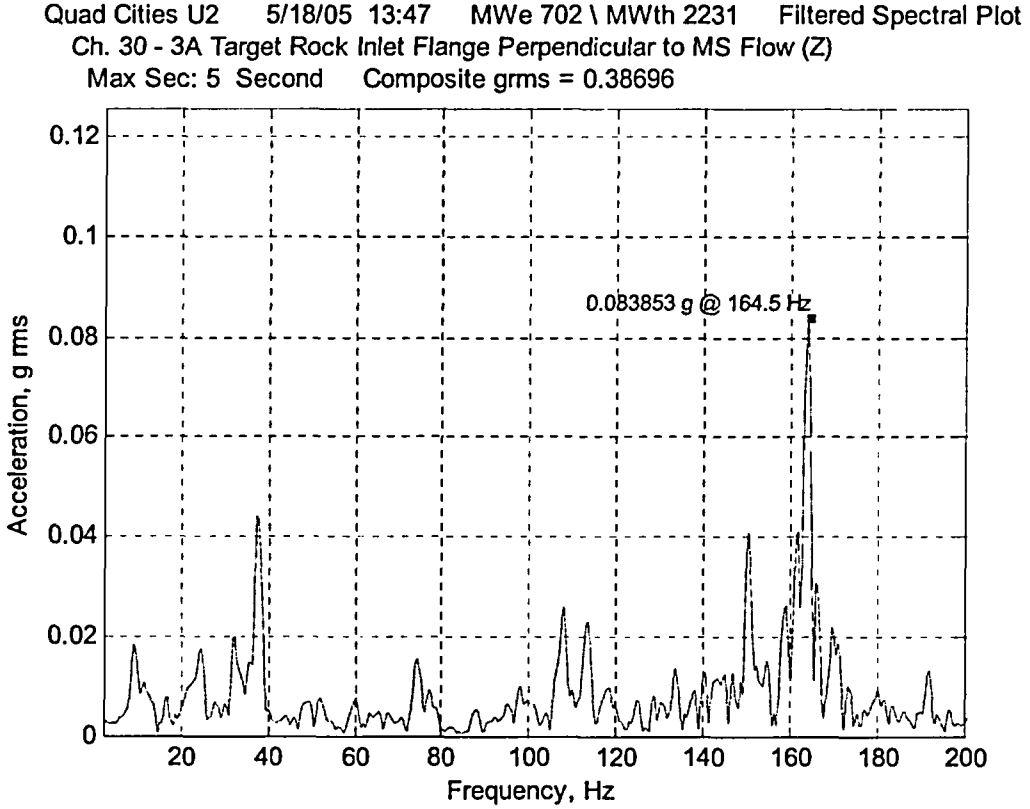
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



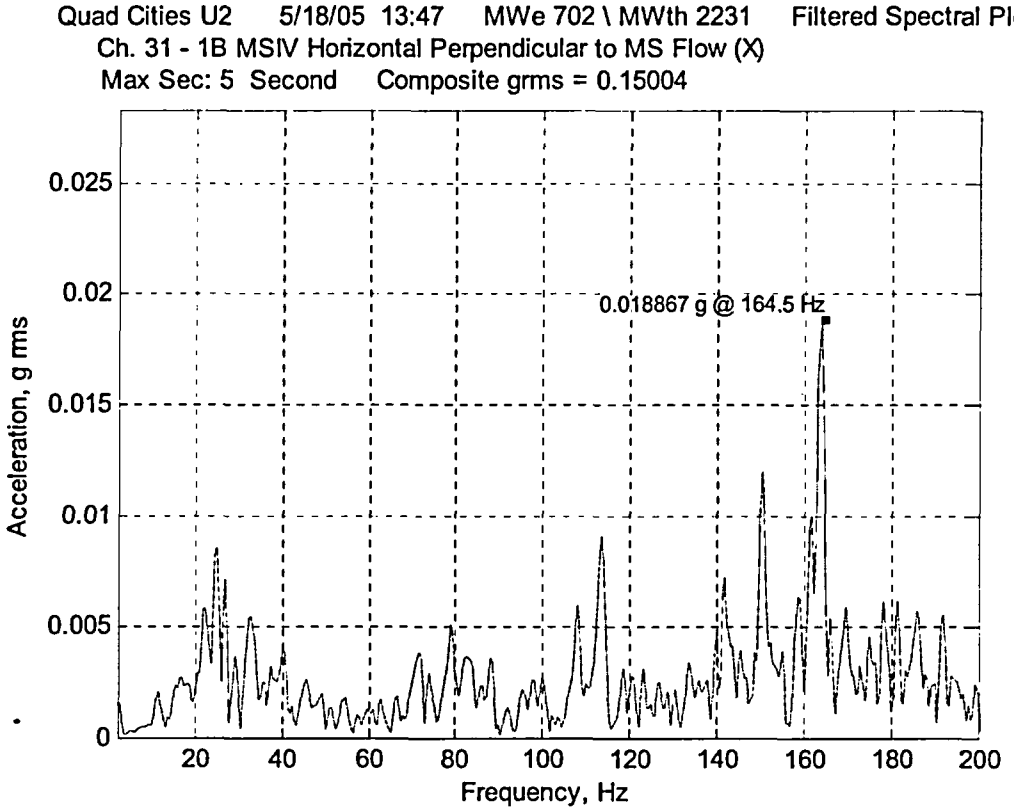
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



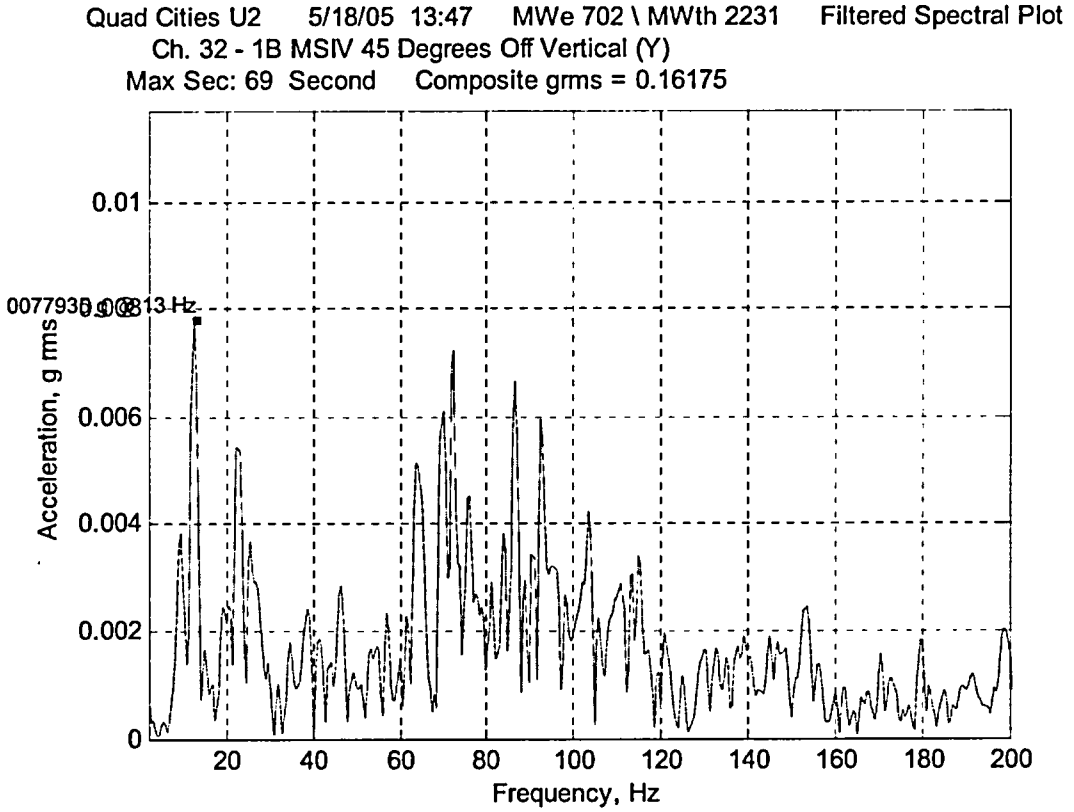
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth



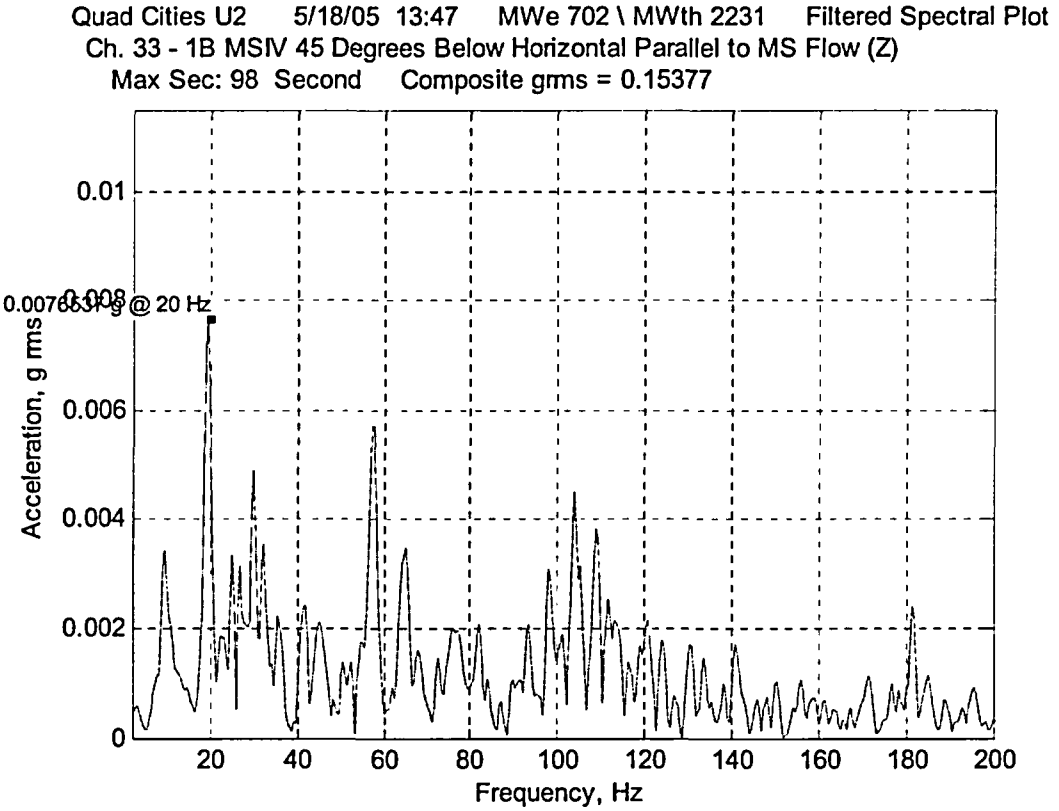
EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth

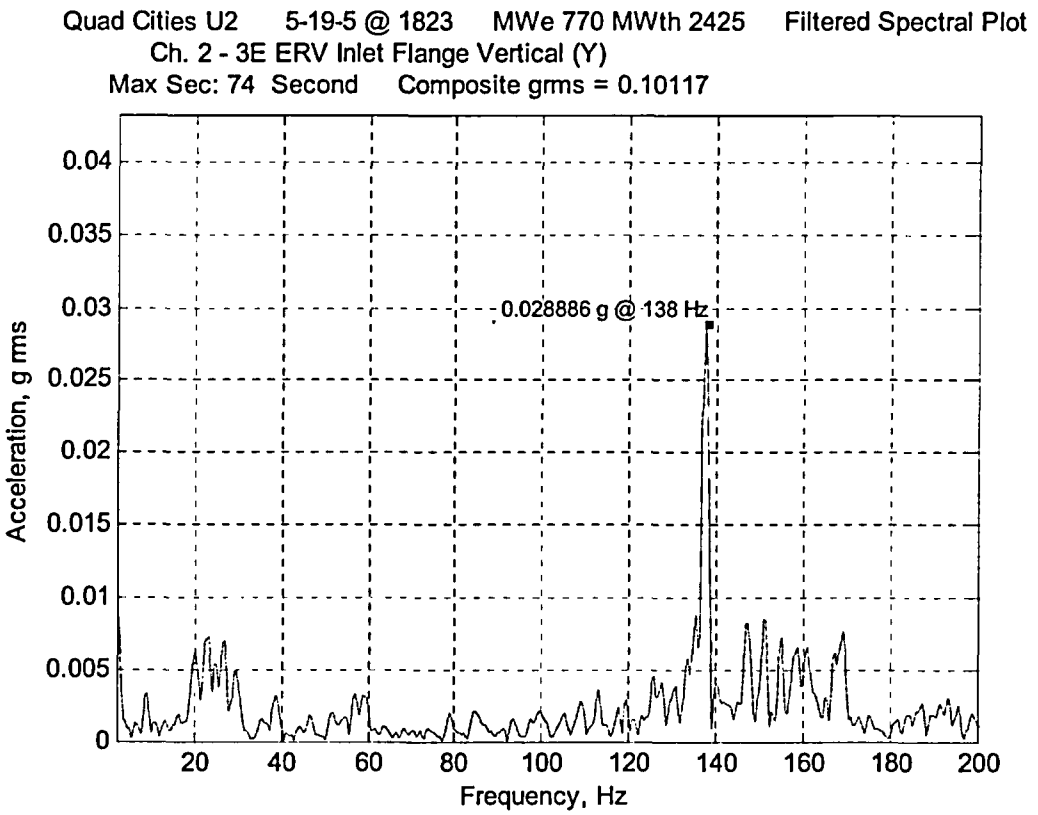


EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth

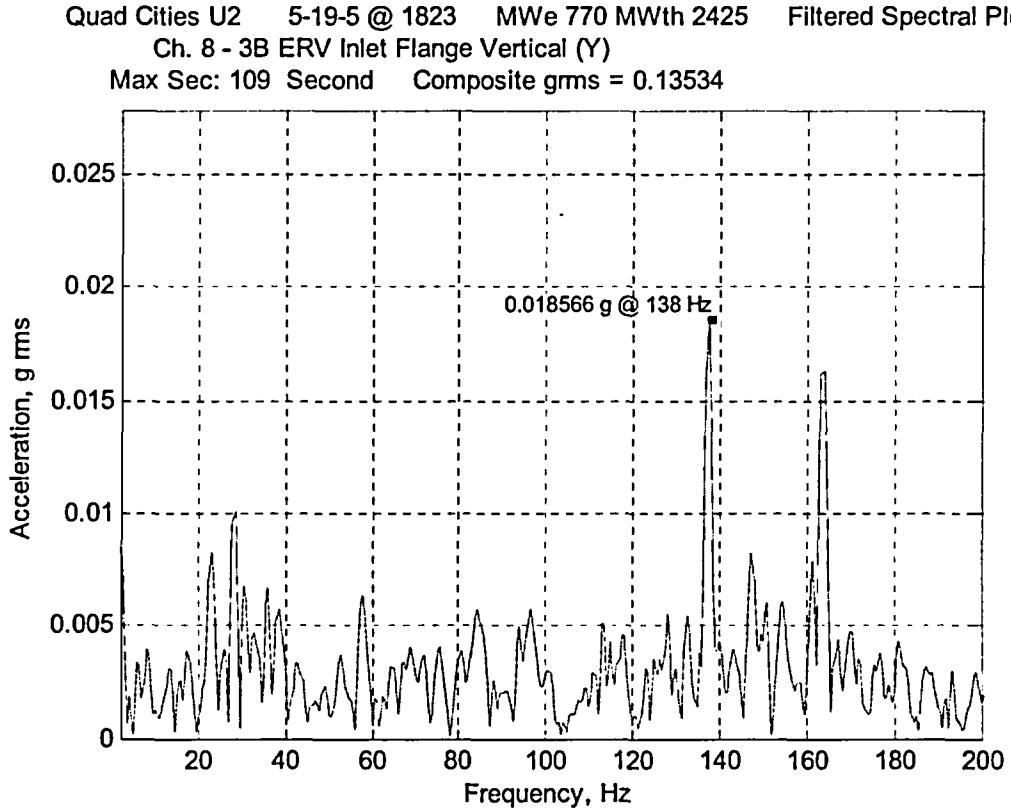


EC 355702
Attachment 2
Data at 702 MWe / 2231 MWth

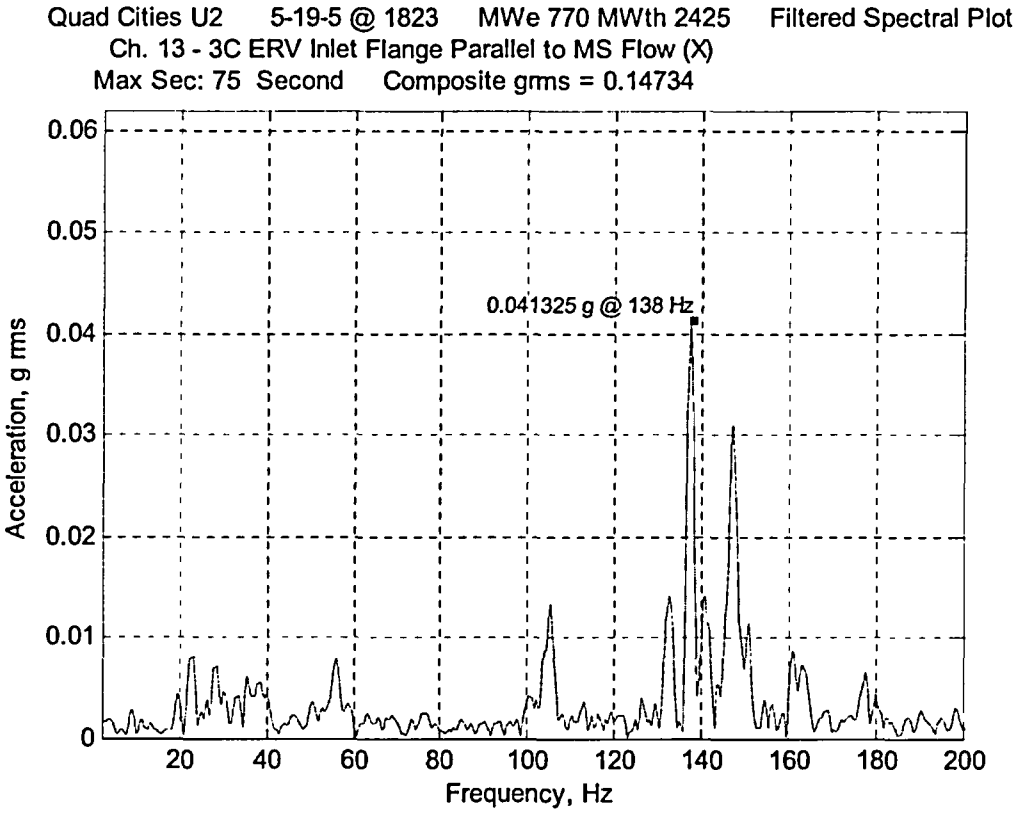



Quad Cities U2 5-19-5 @ 1823 MWe 770 MWth 2425 Filtered Spectral Plot
Ch. 2 - 3E ERV Inlet Flange Vertical (Y)
Max Sec: 74 Second Composite grms = 0.10117
0.028886 g @ 138 Hz
Acceleration, g rms
Frequency, Hz
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
20
40
60
80
100
120
140
160
180
200

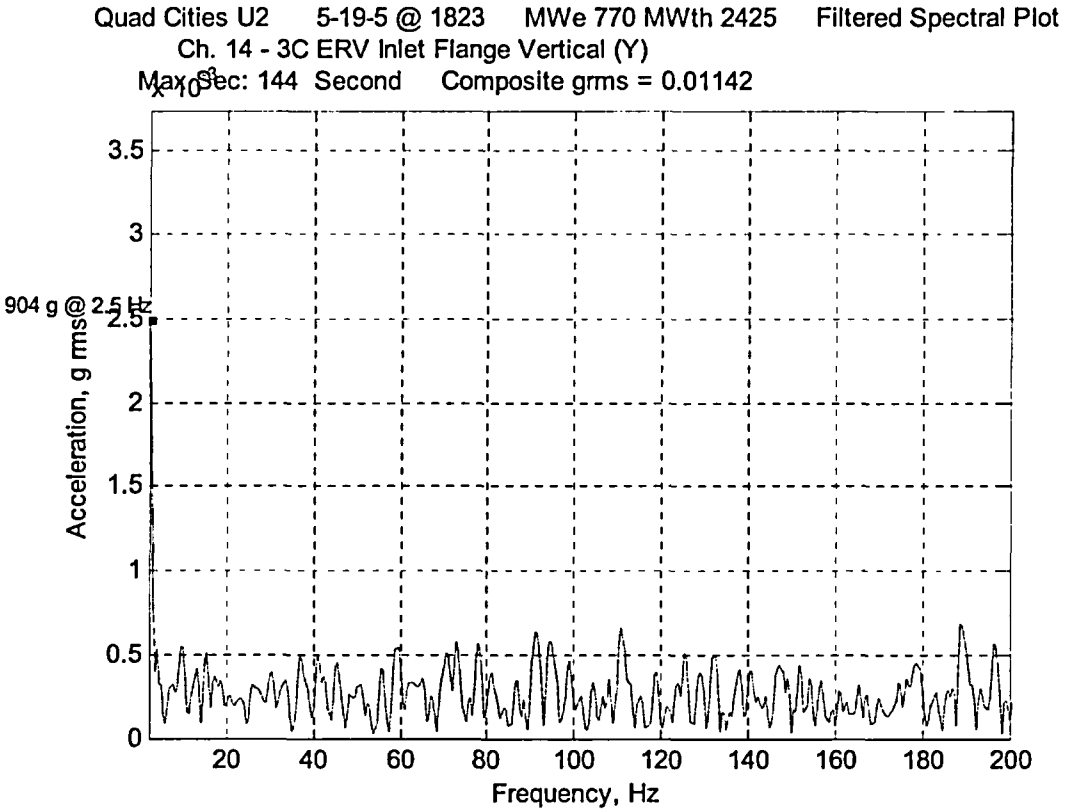
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



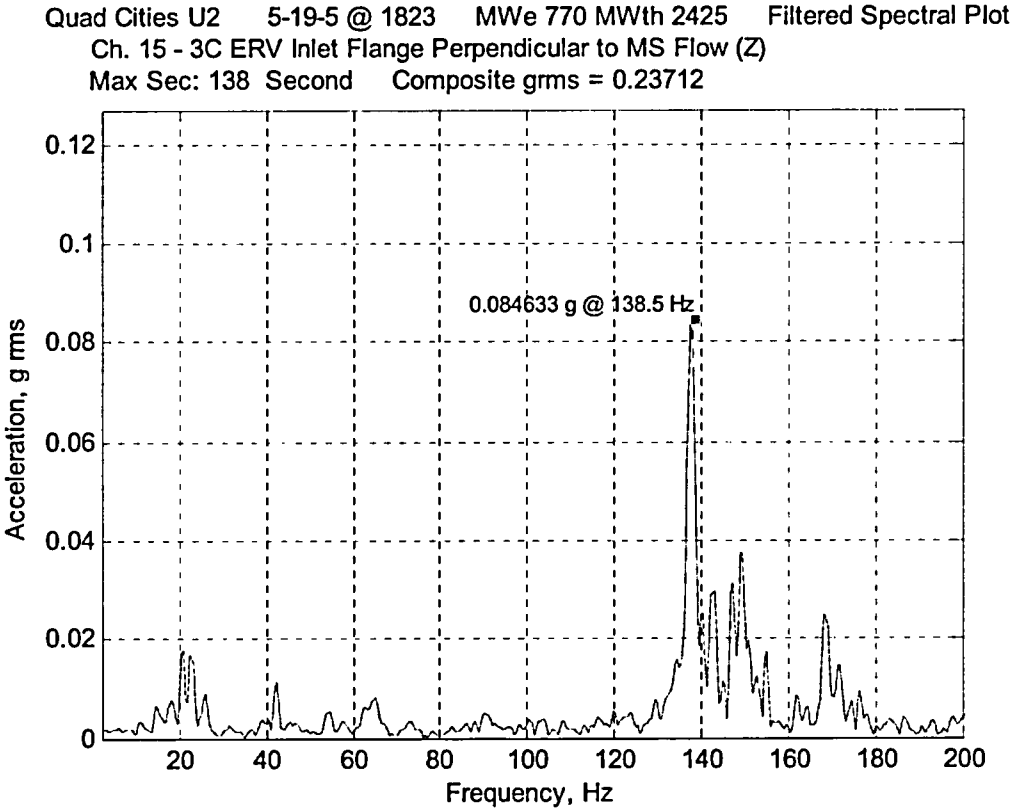
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



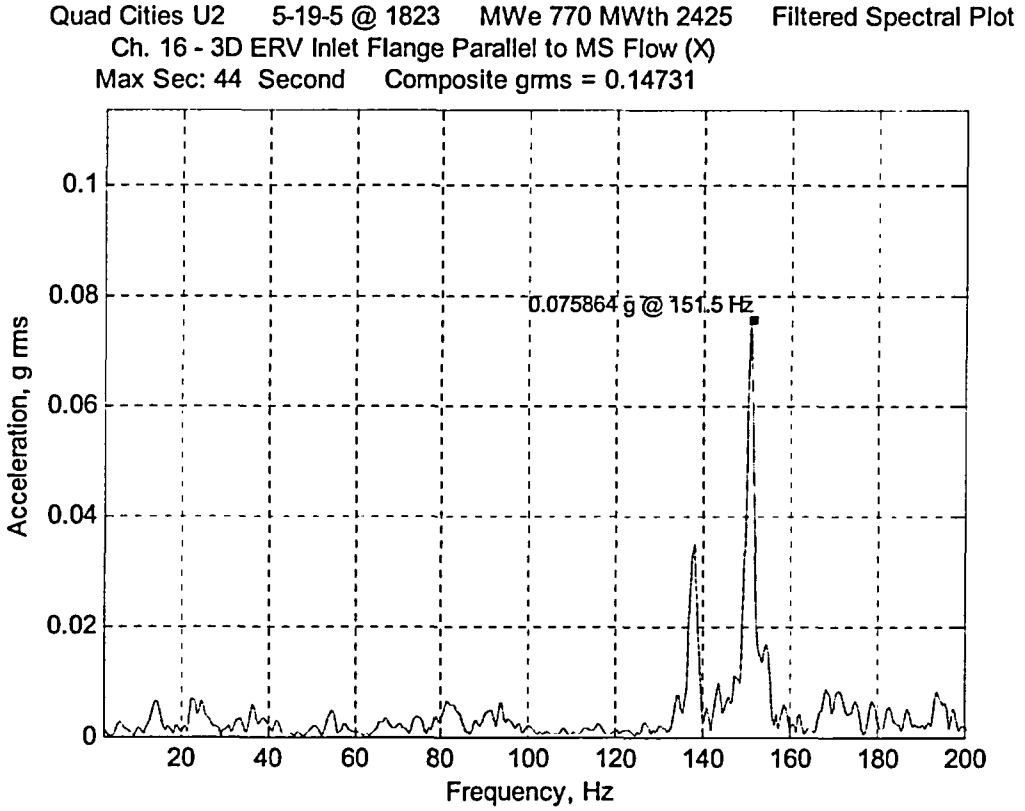
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



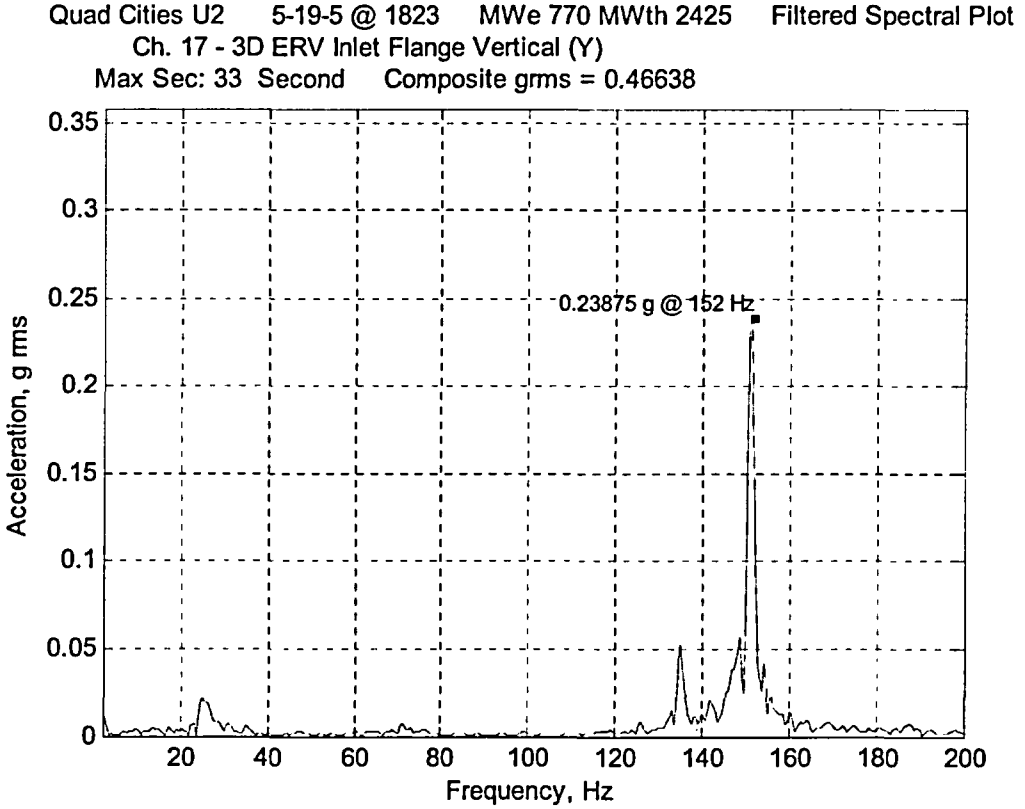
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



EC355702
Attachment 2
Data at 770 MWe / 2425 MWth

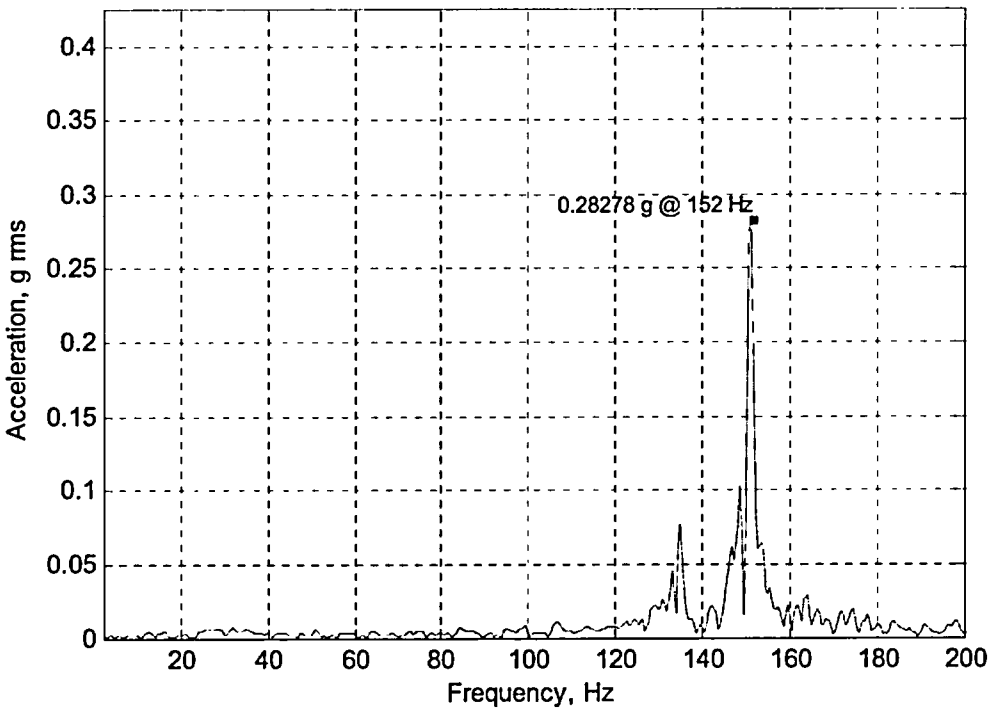


EC355702
Attachment 2
Data at 770 MWe / 2425 MWth

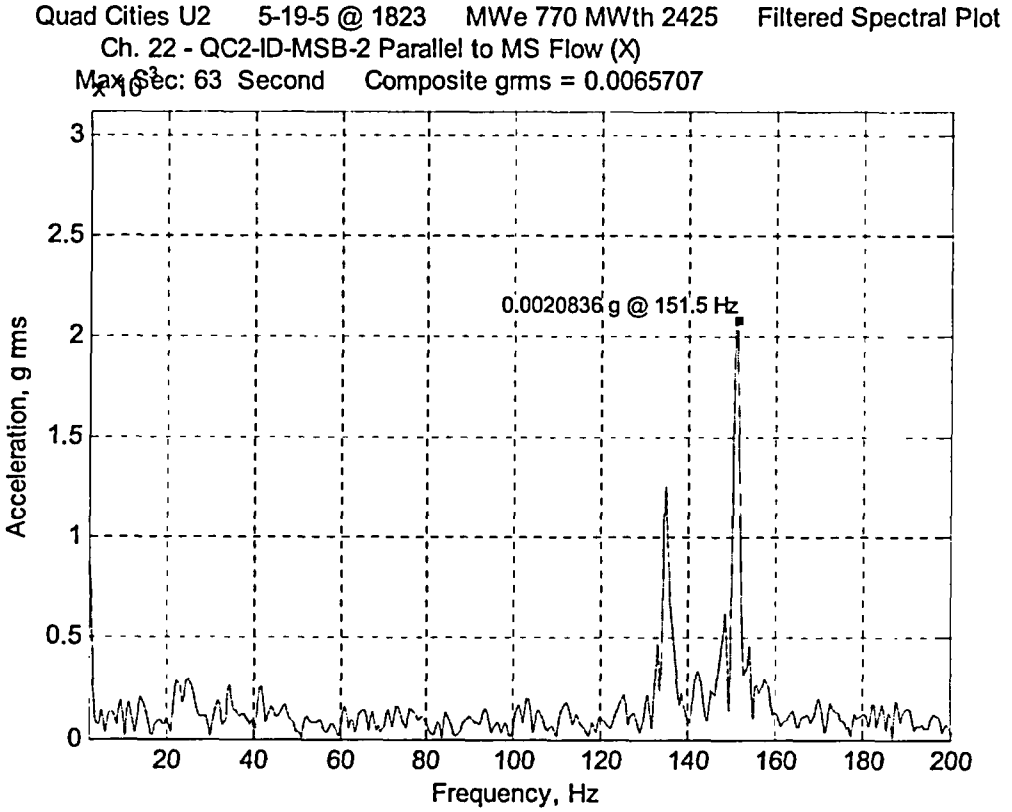


EC355702
Attachment 2
Data at 770 MWe / 2425 MWth

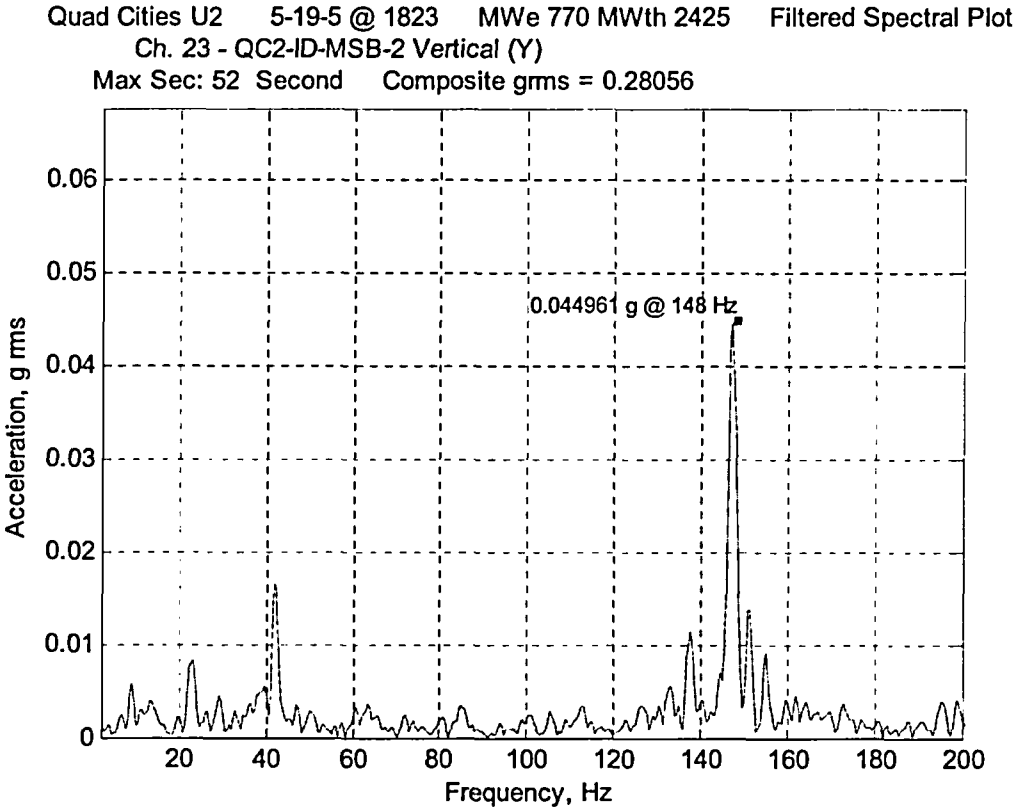
Quad Cities U2 5-19-5 @ 1823 MWe 770 MWth 2425 Filtered Spectral Plot
Ch. 18 - 3D ERV Inlet Flange Perpendicular to MS Flow (Z)
Max Sec: 21 Second Composite grms = 0.54929



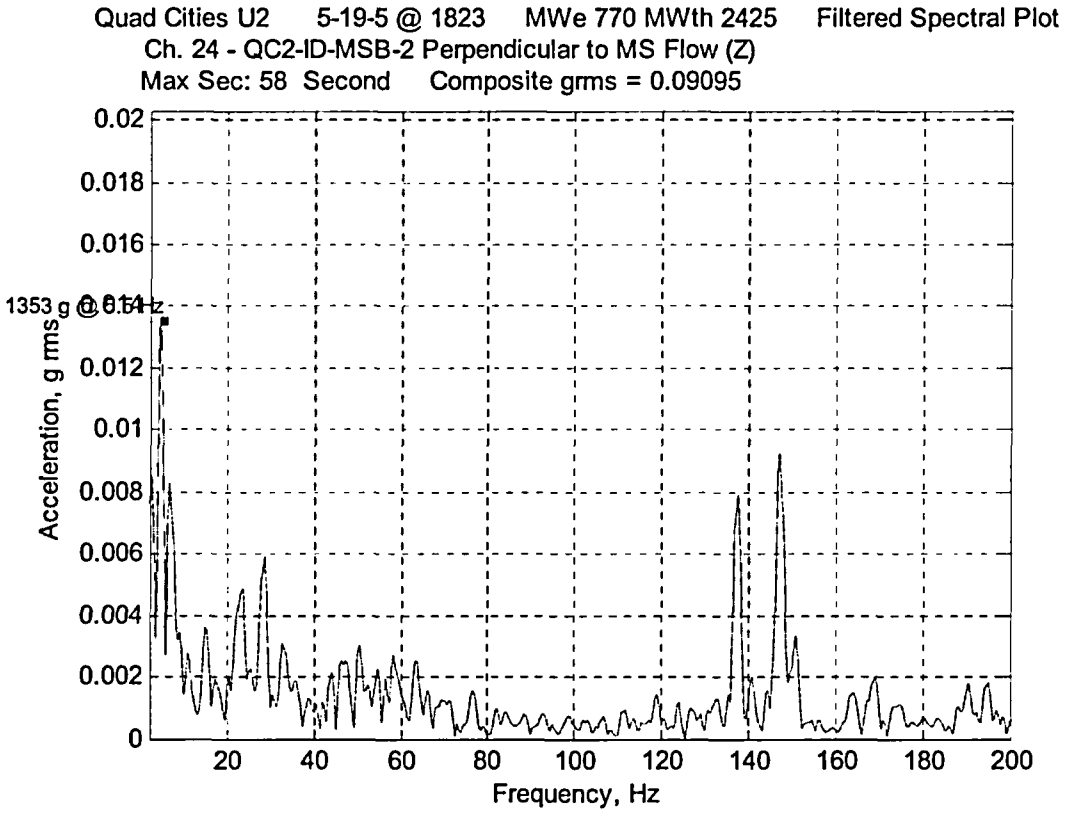
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



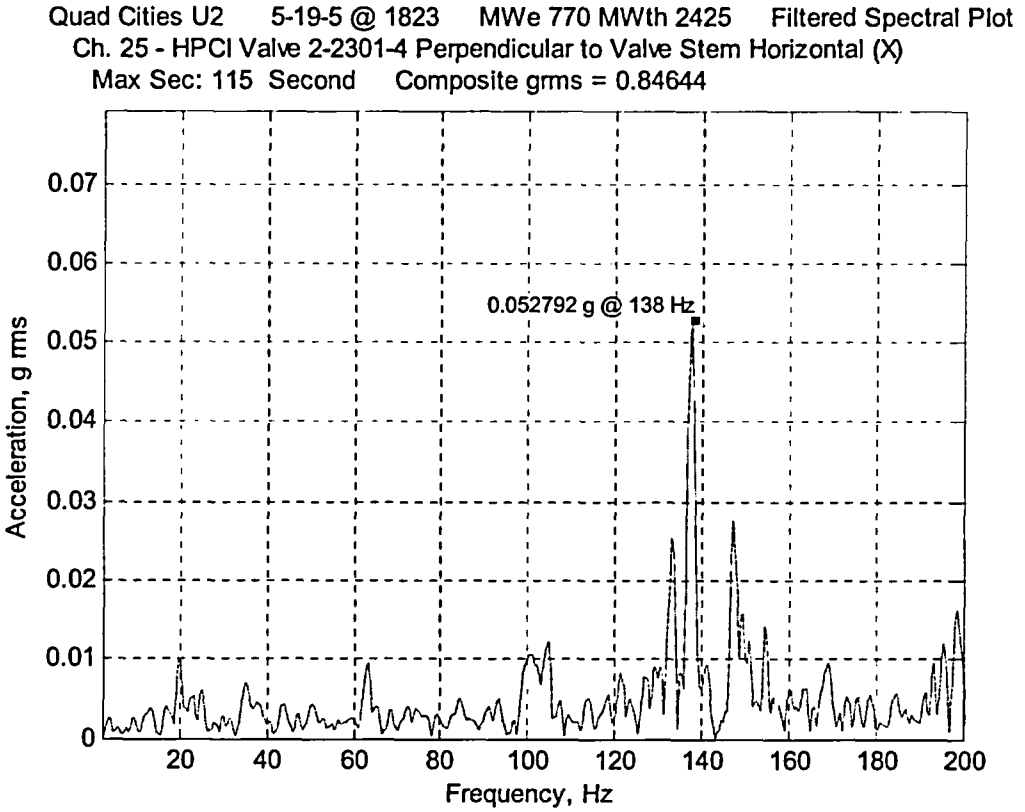
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



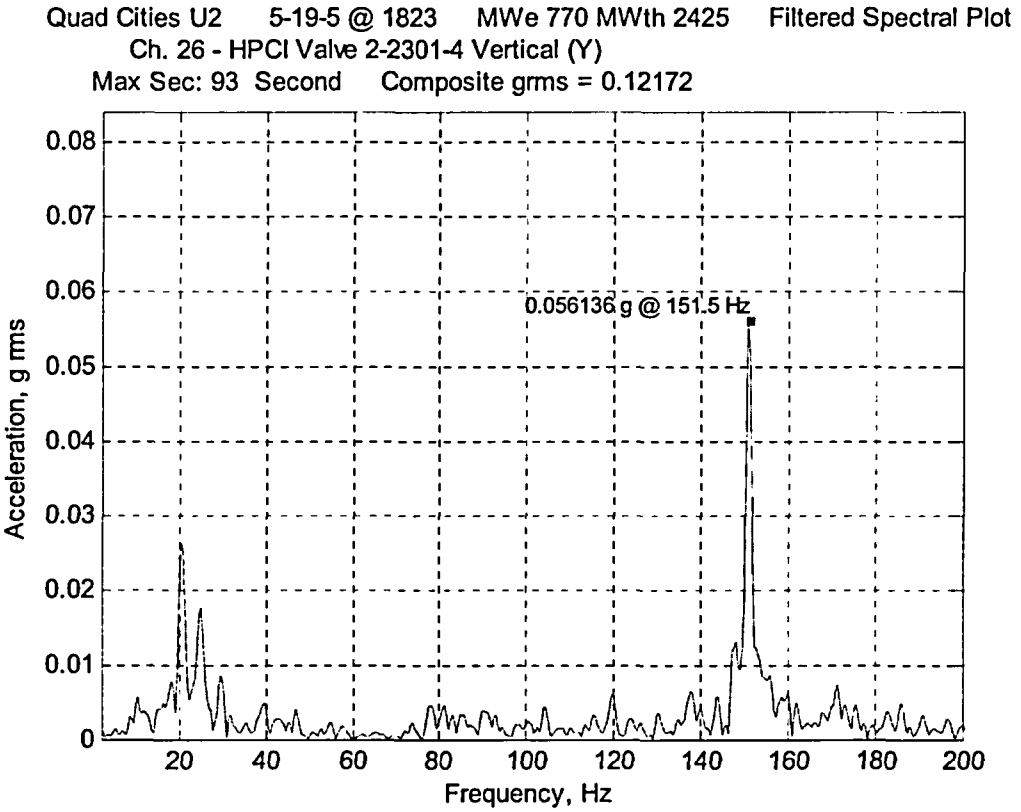
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



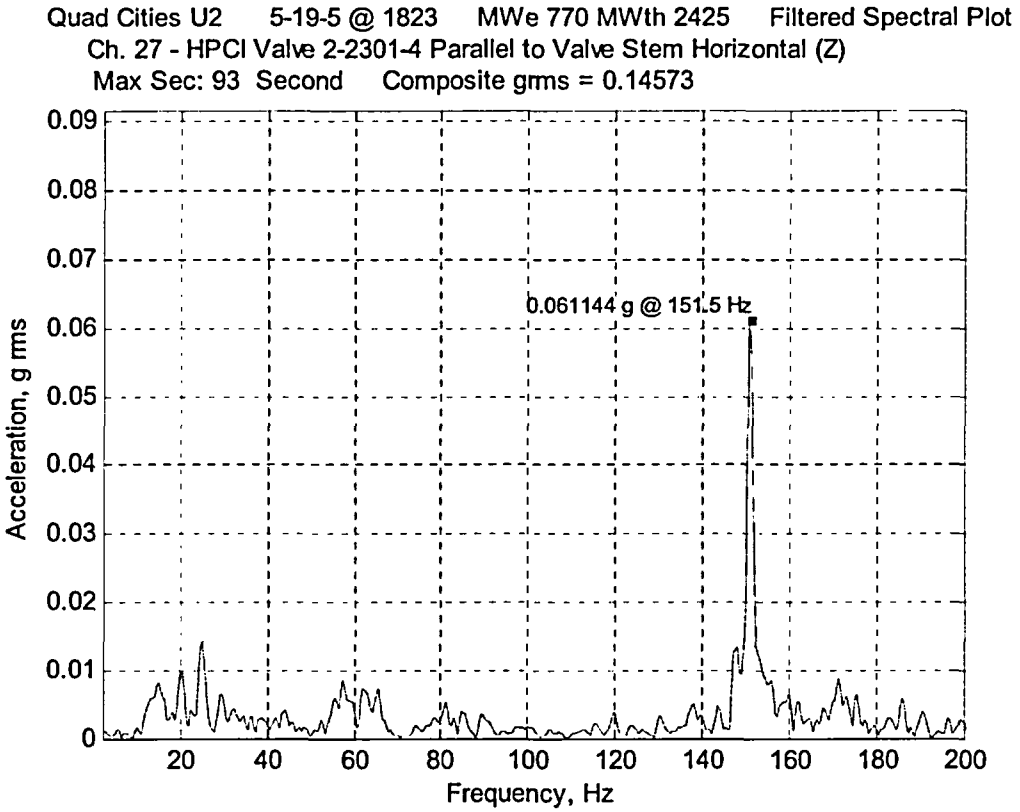
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



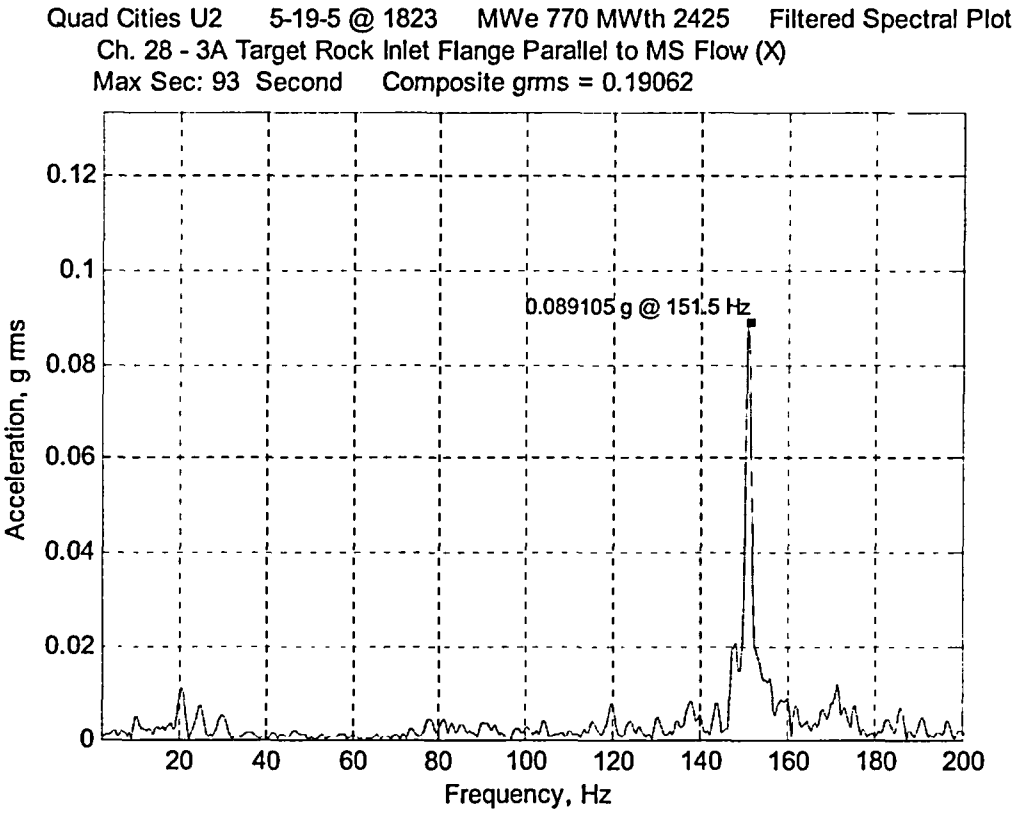
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



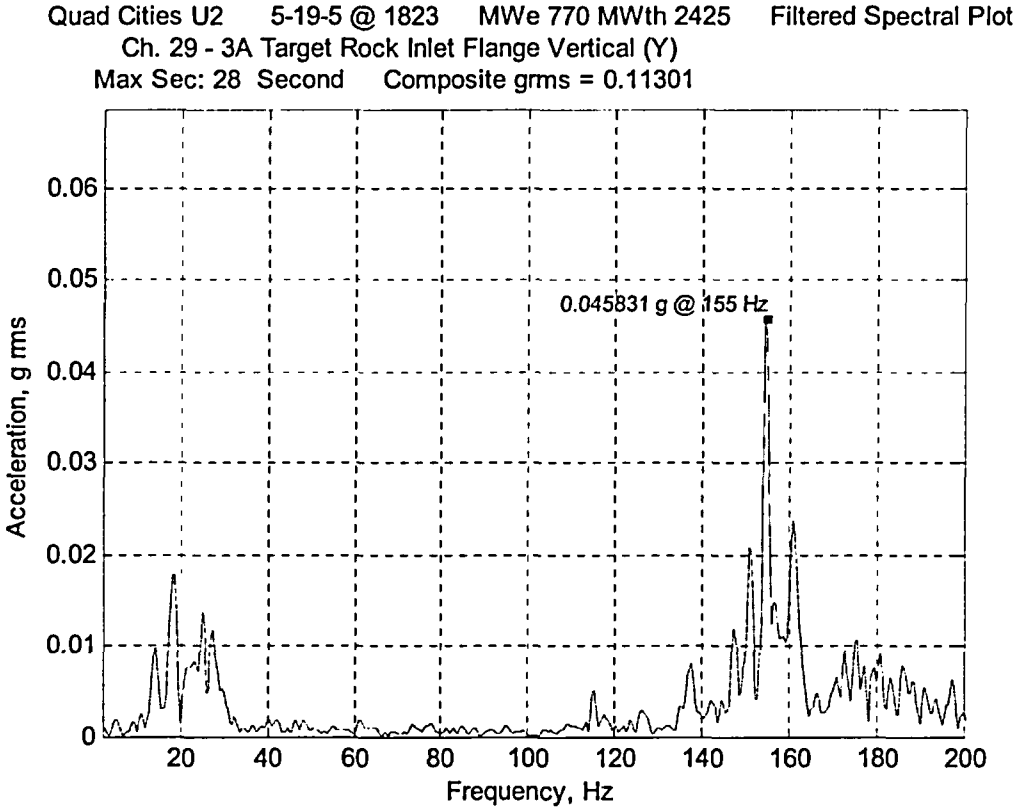
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



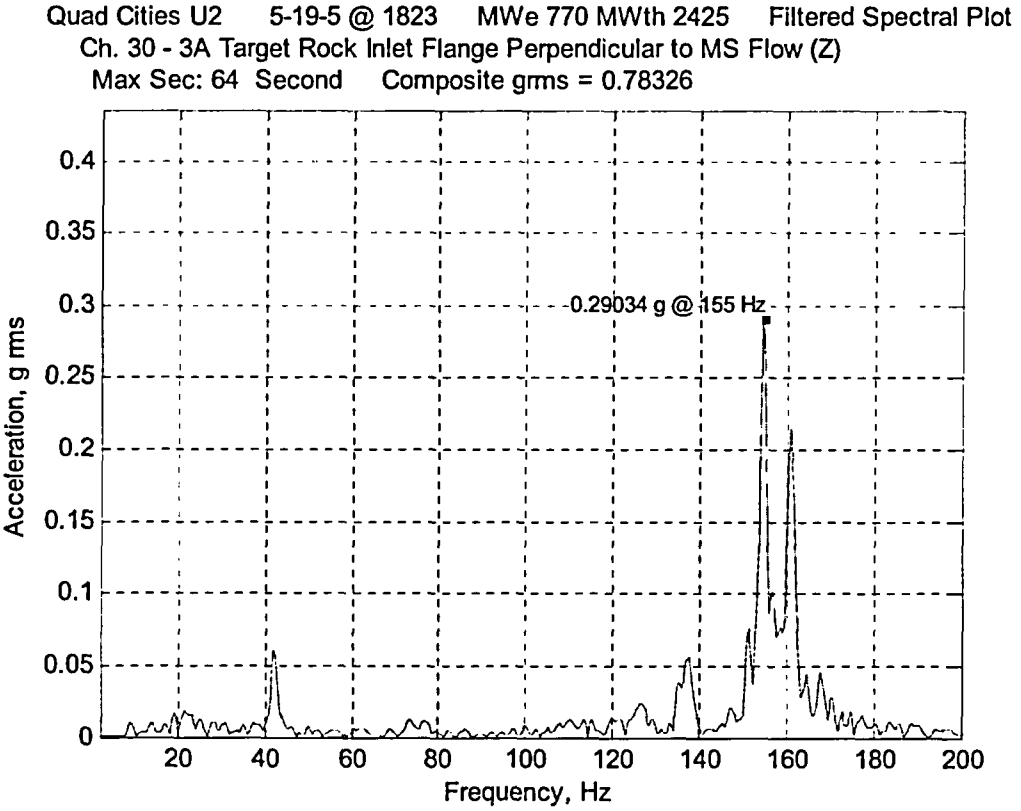
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



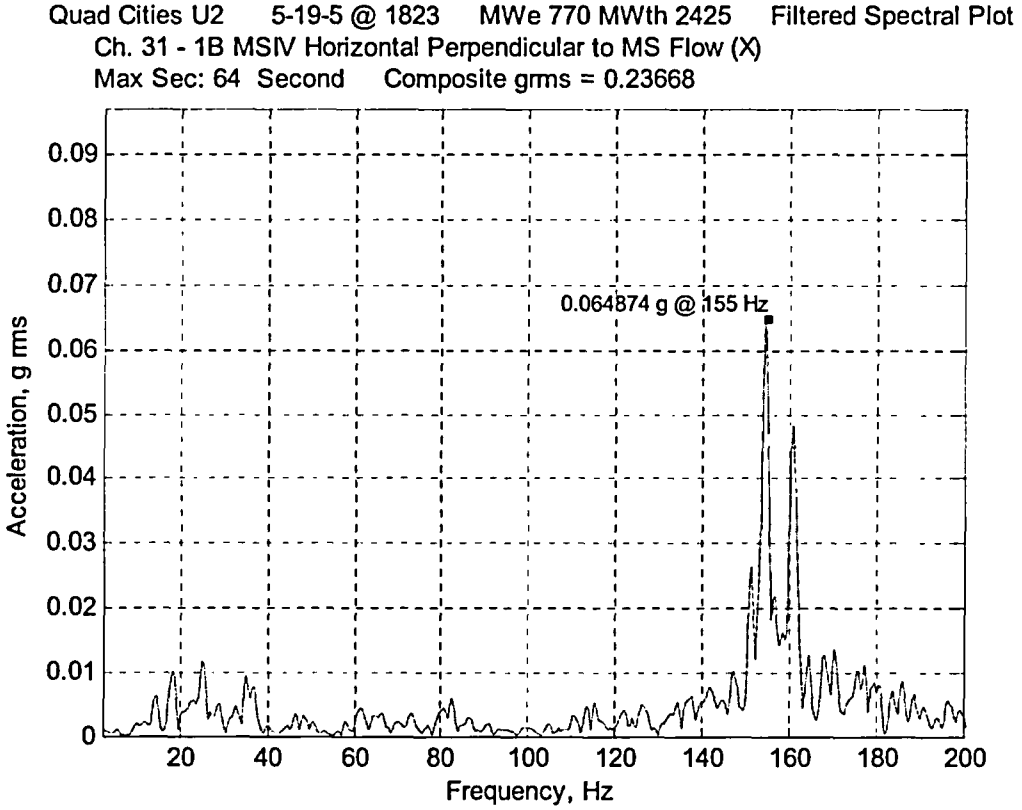
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



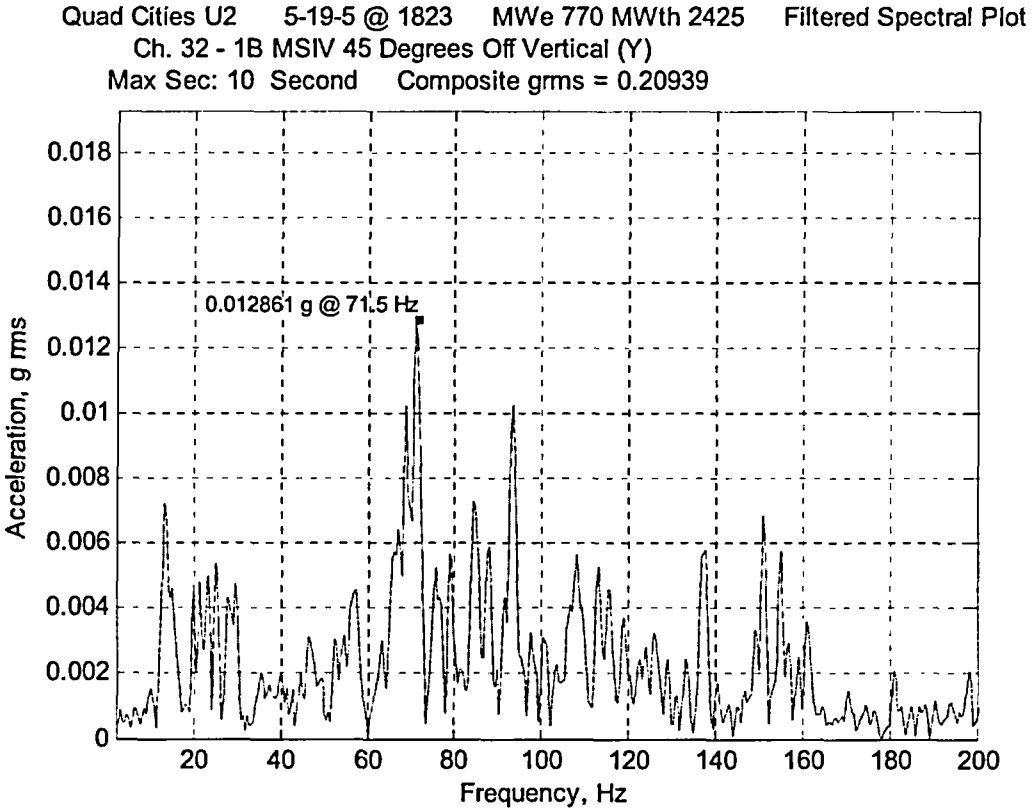
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



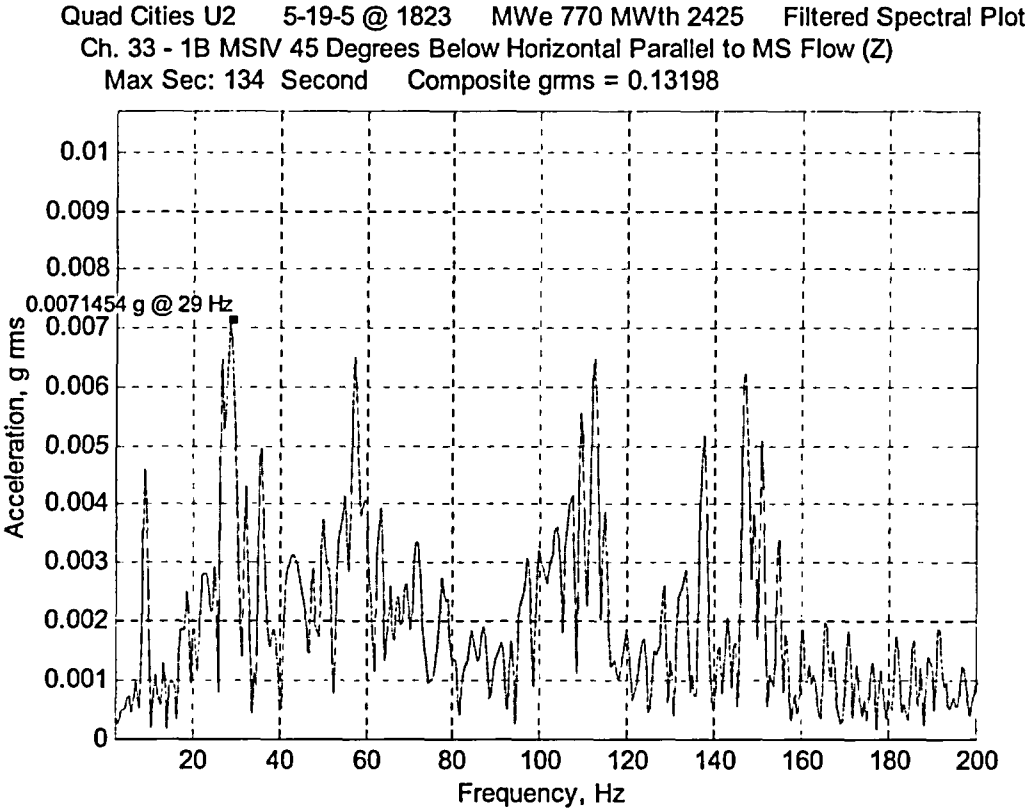
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



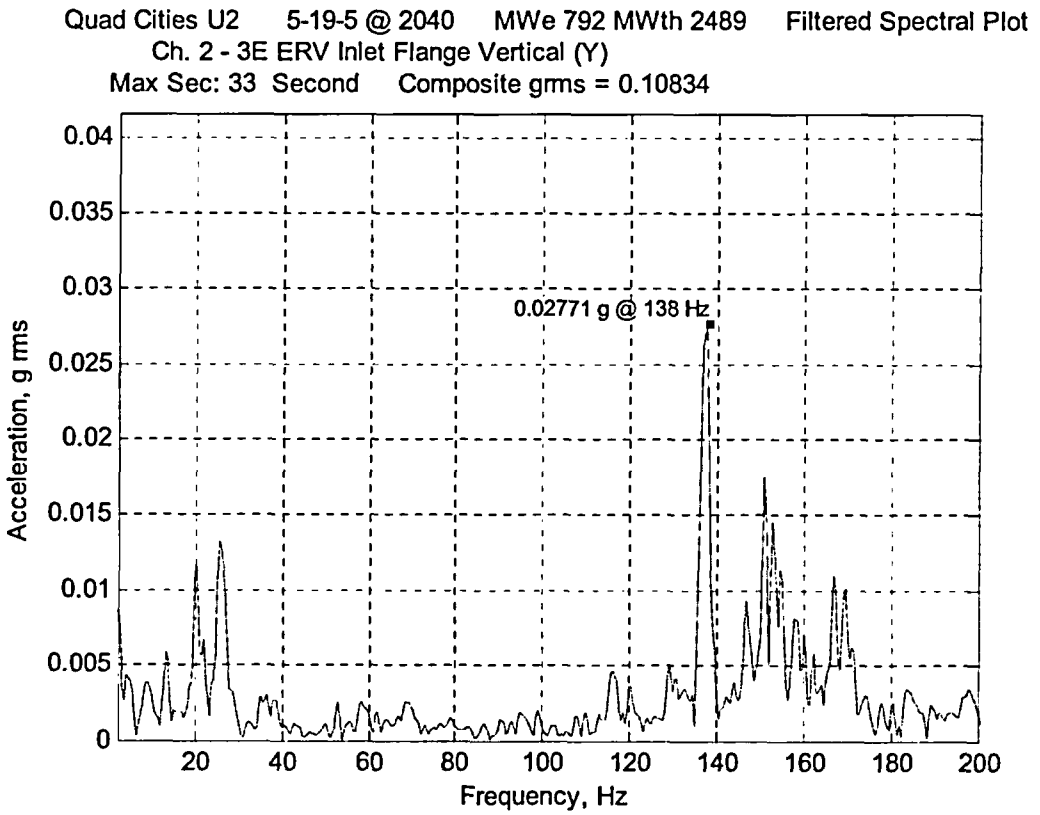
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



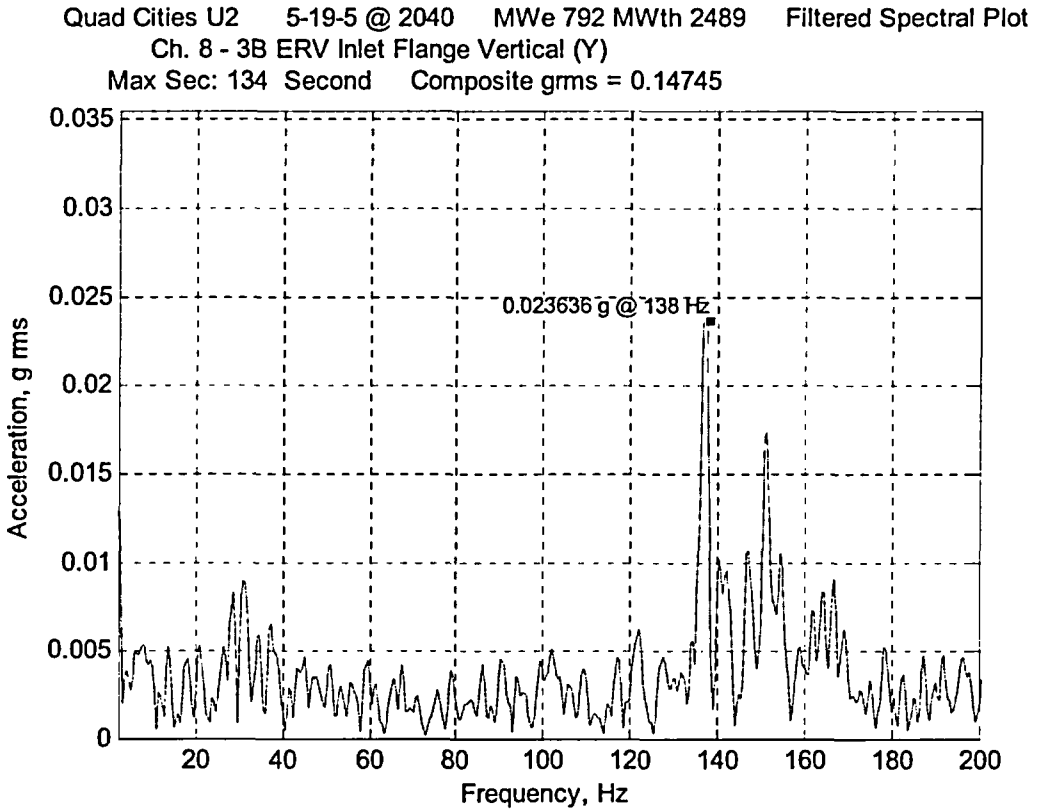
EC355702
Attachment 2
Data at 770 MWe / 2425 MWth



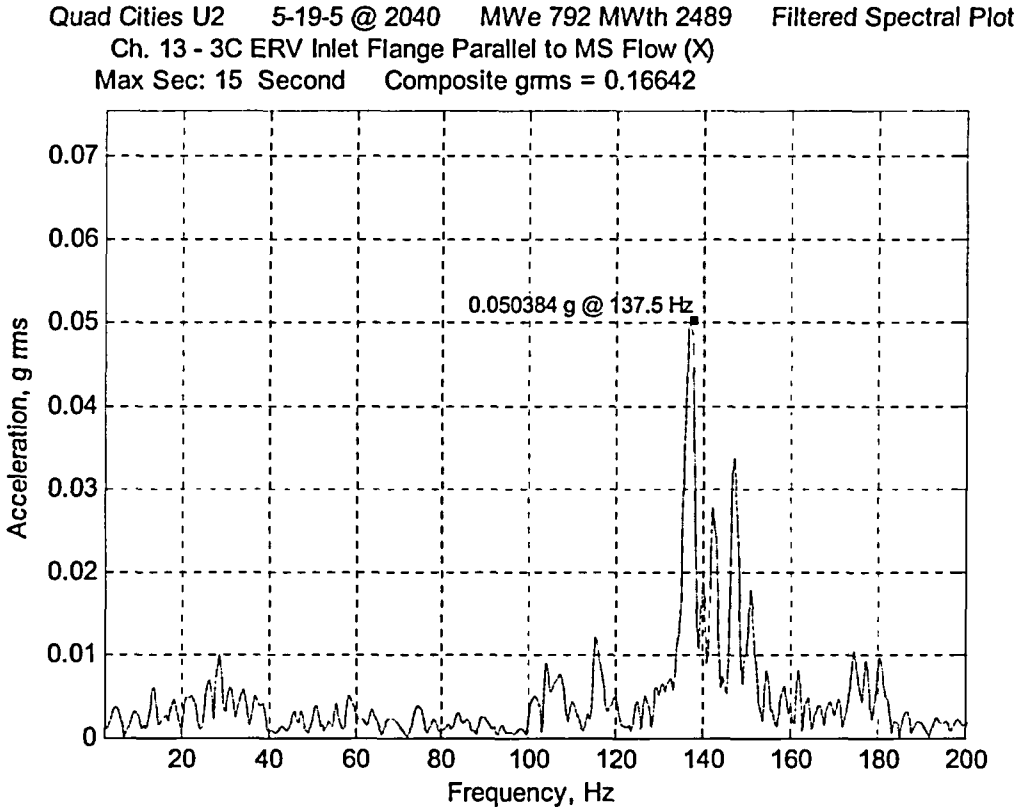
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



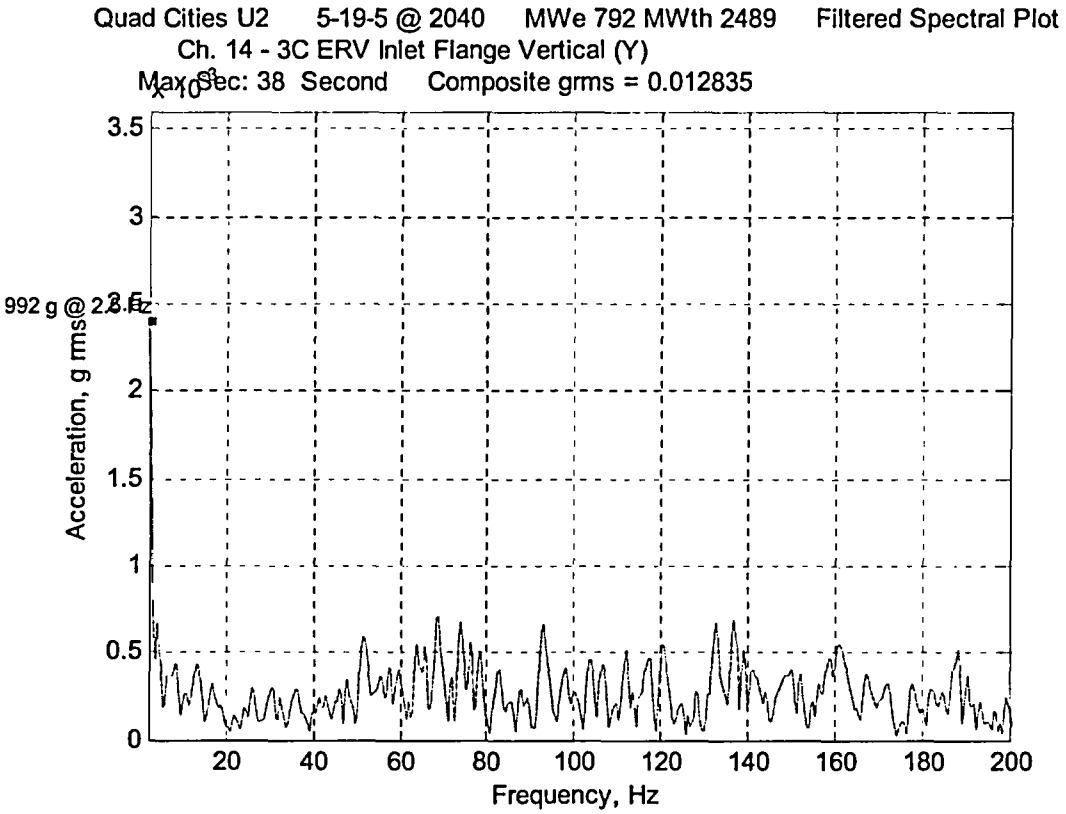
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



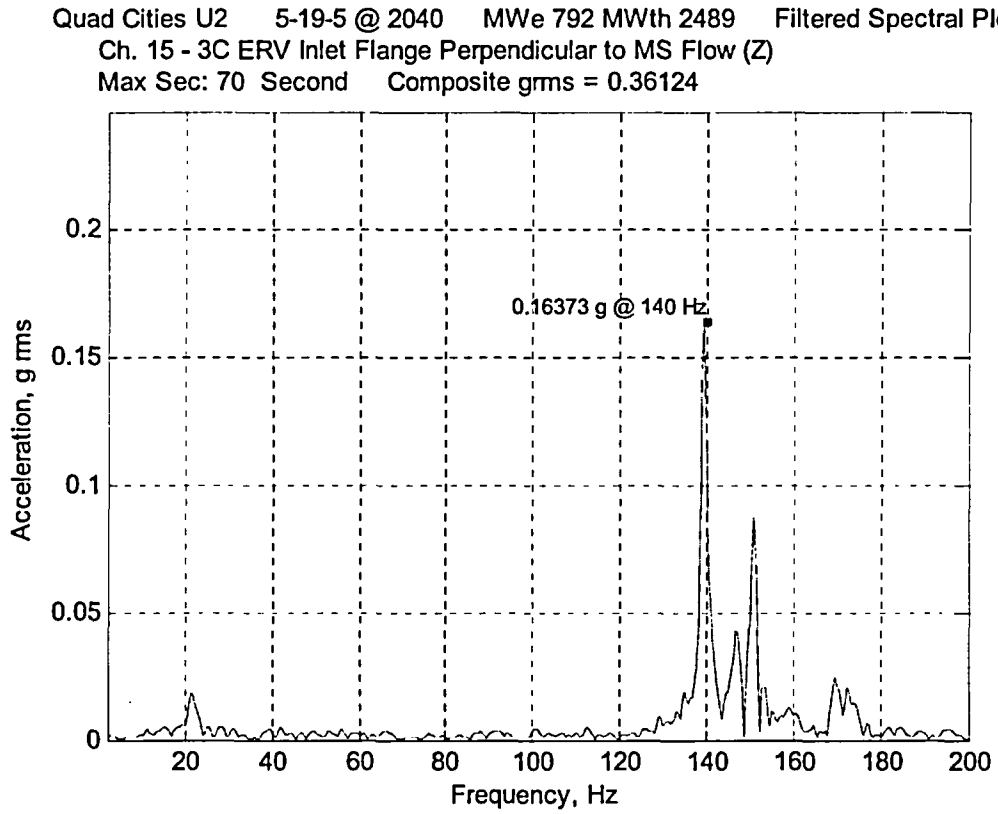
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



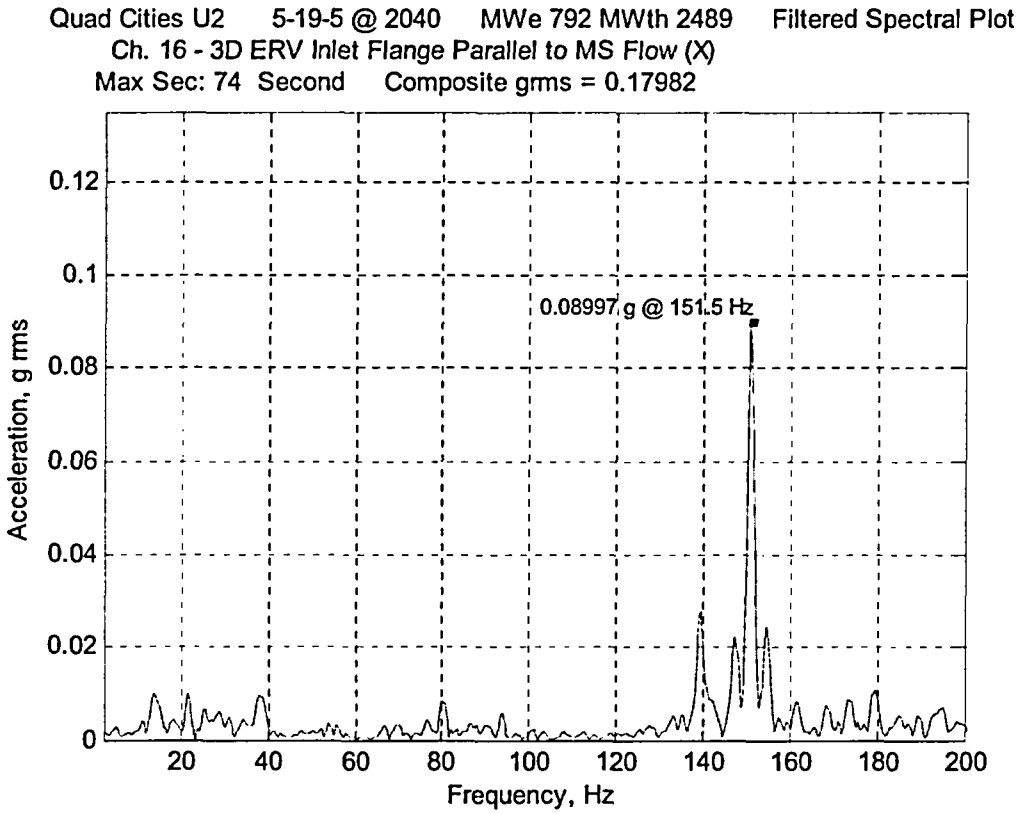
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



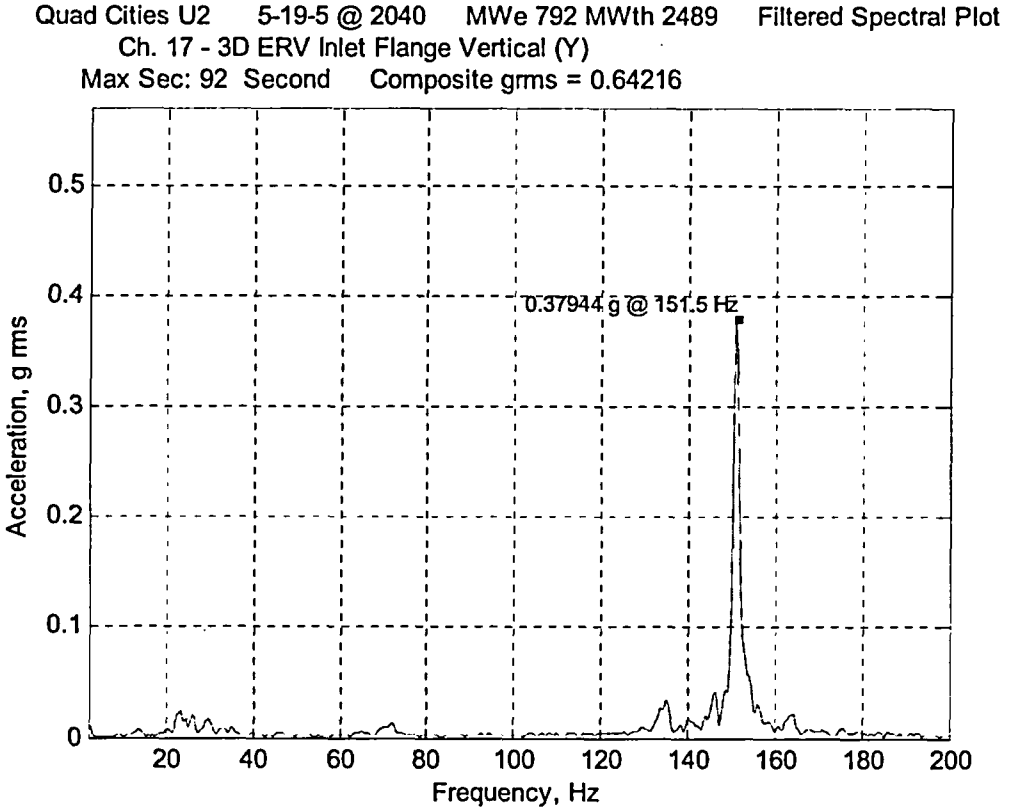
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



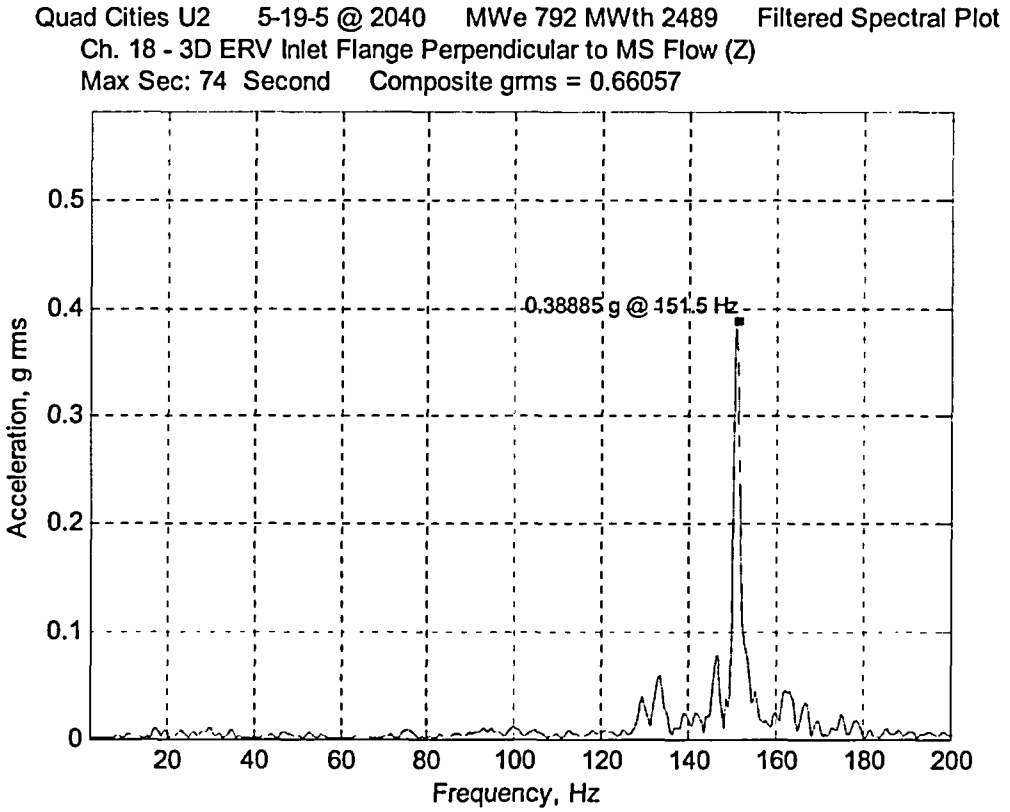
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



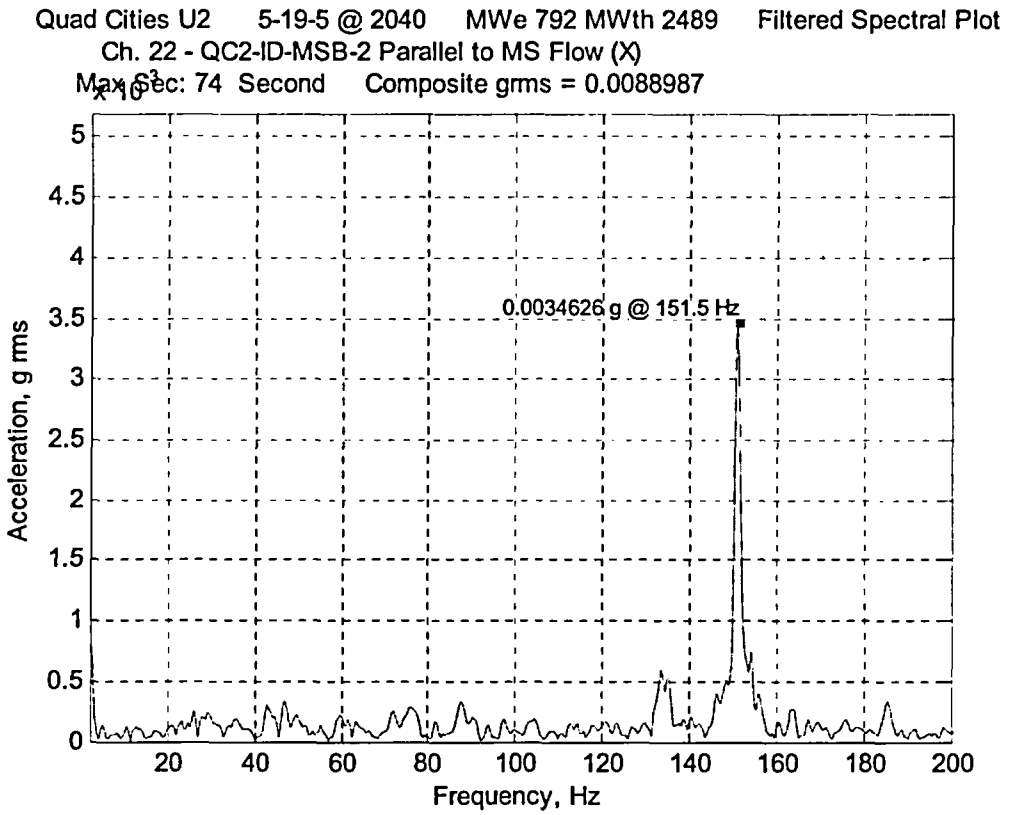
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



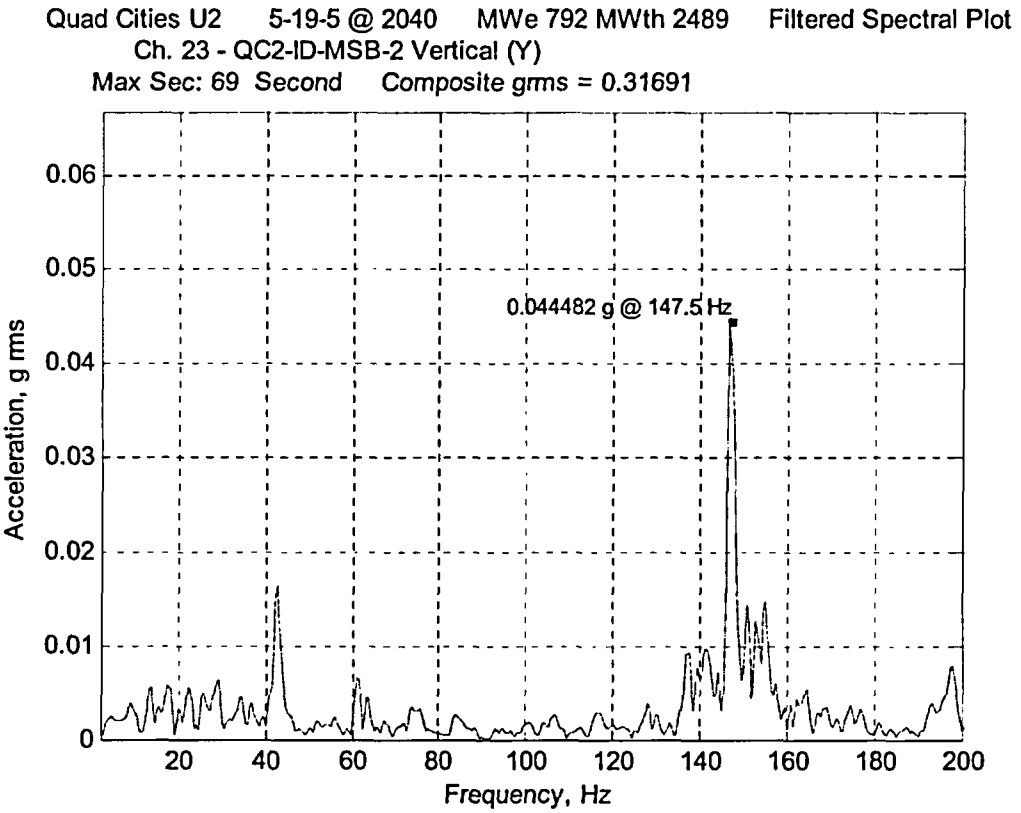
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



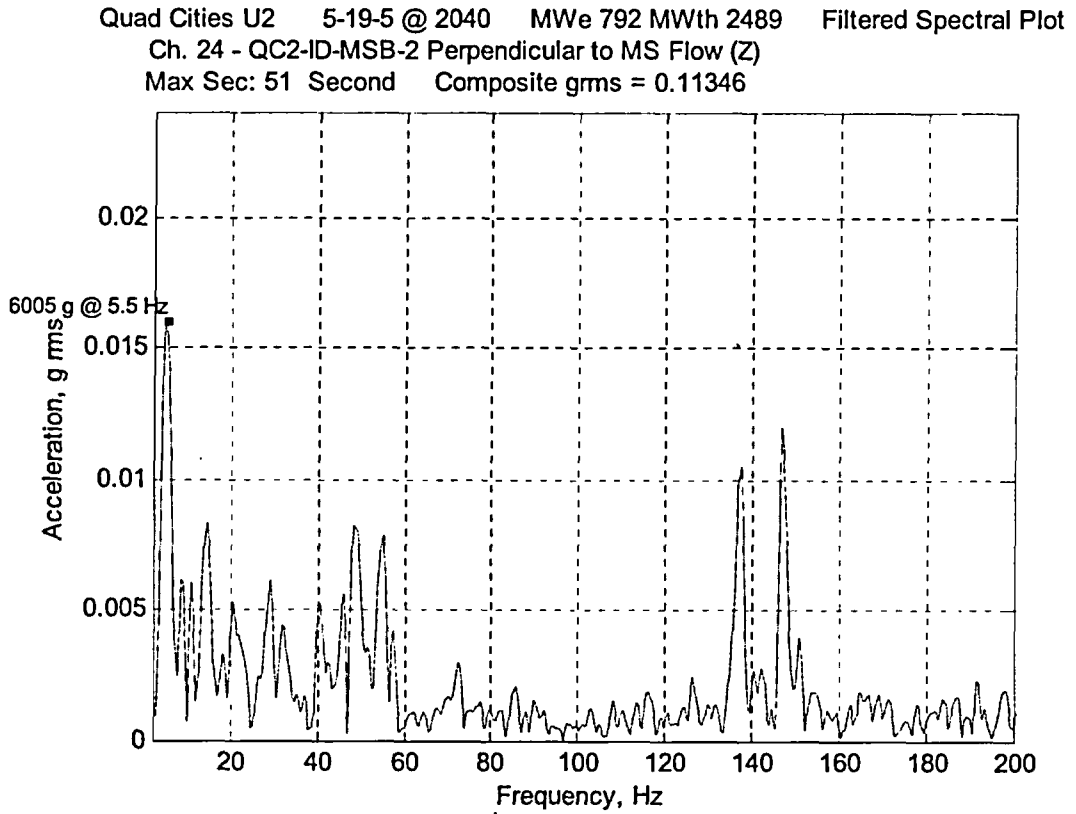
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



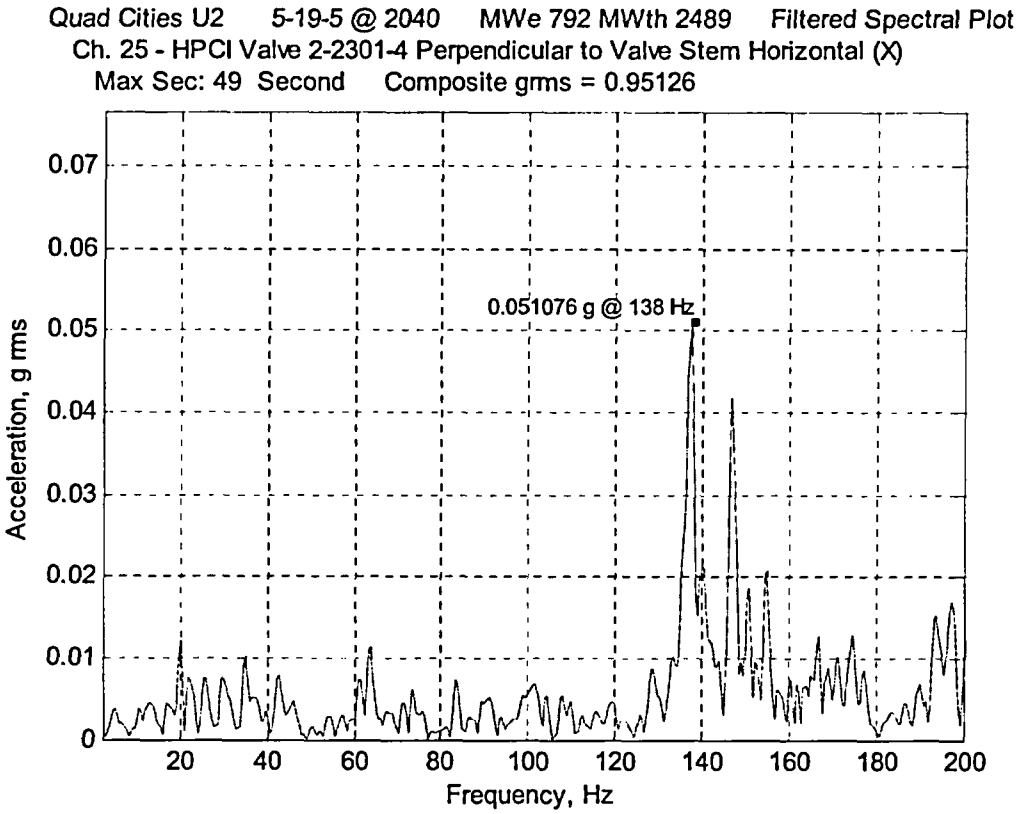
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



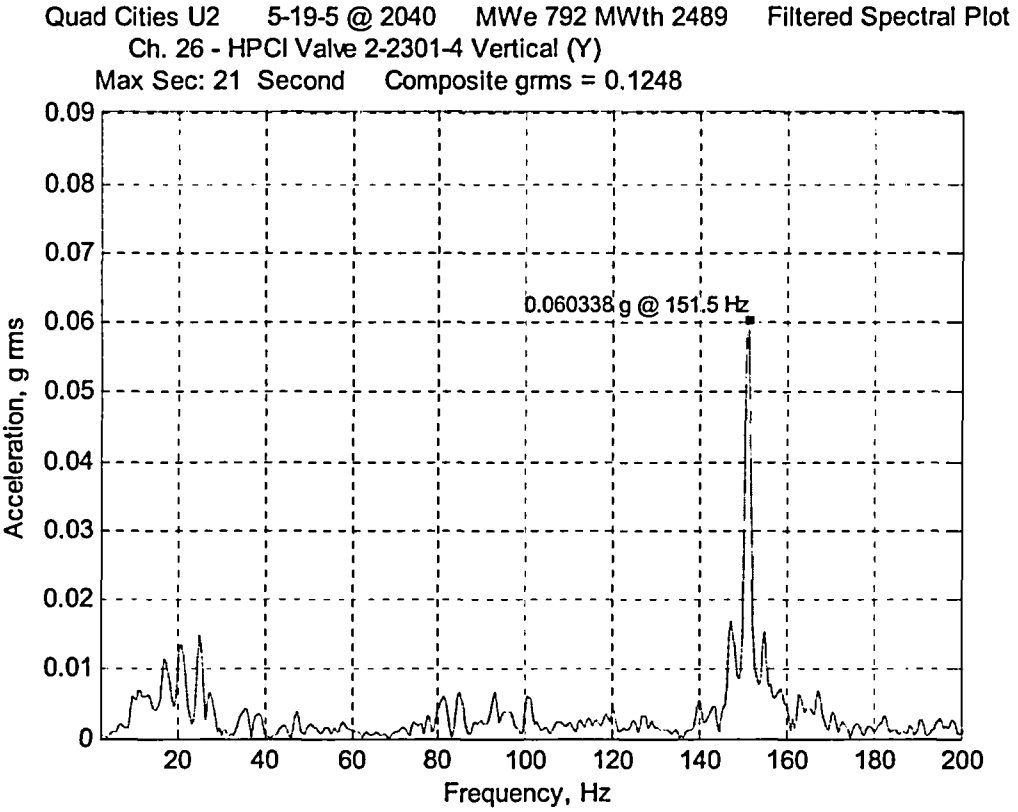
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



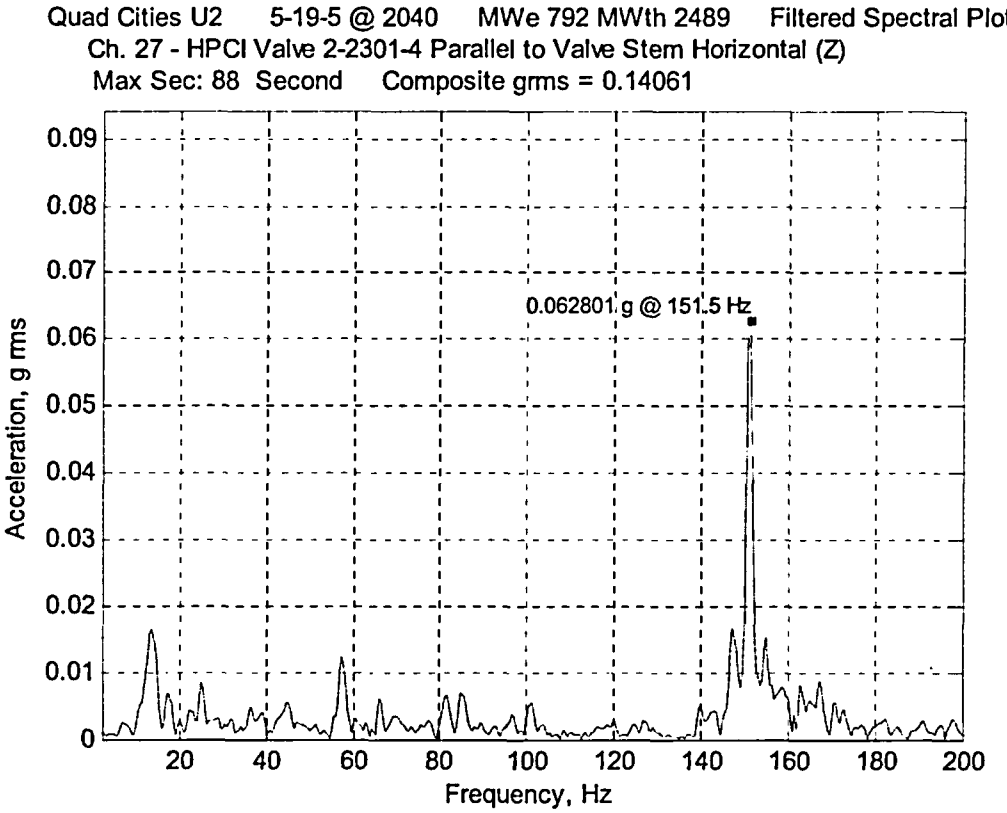
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



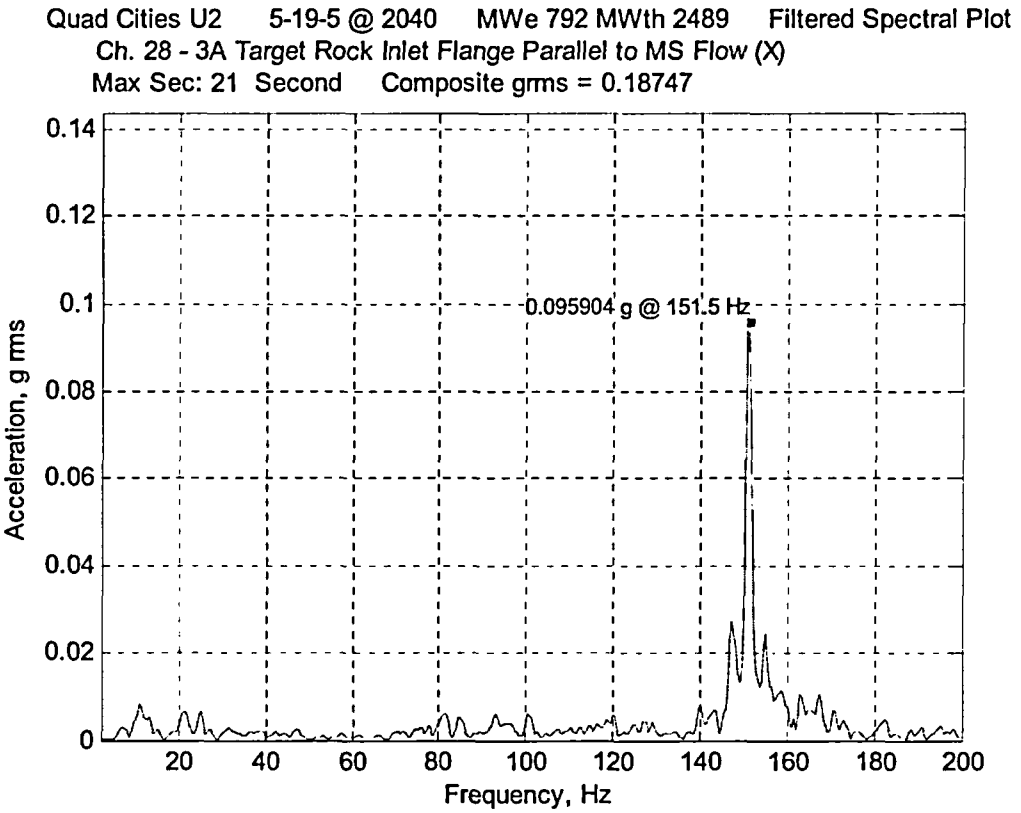
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



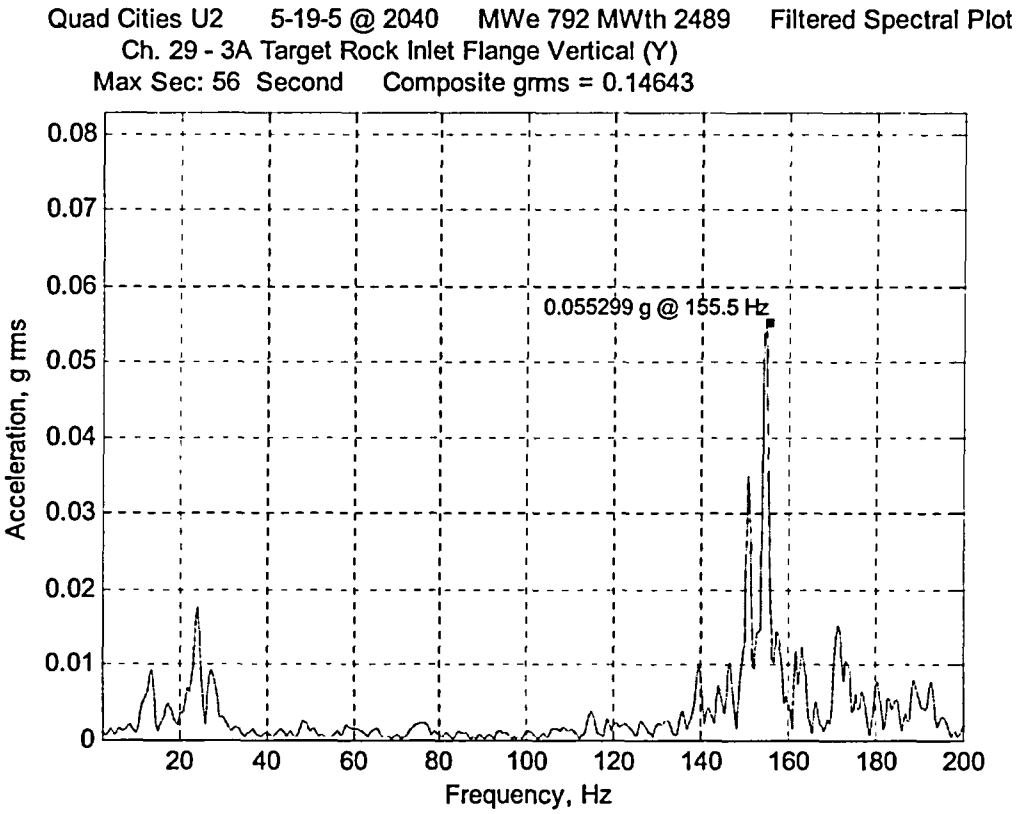
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



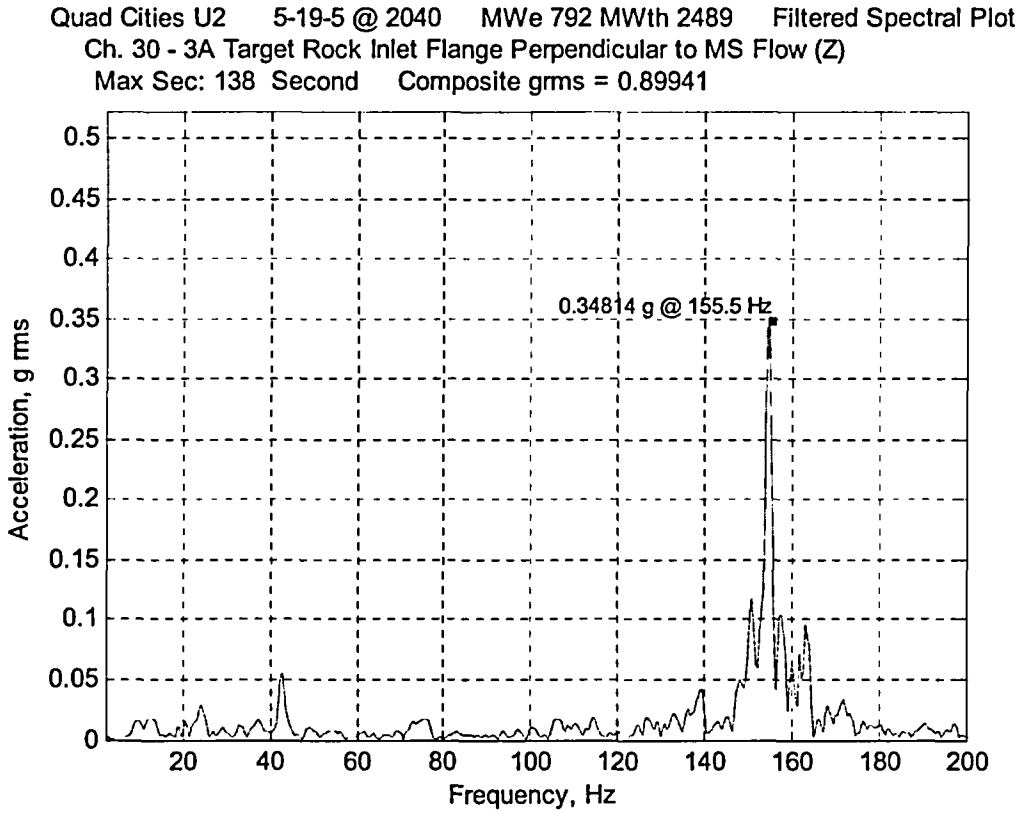
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



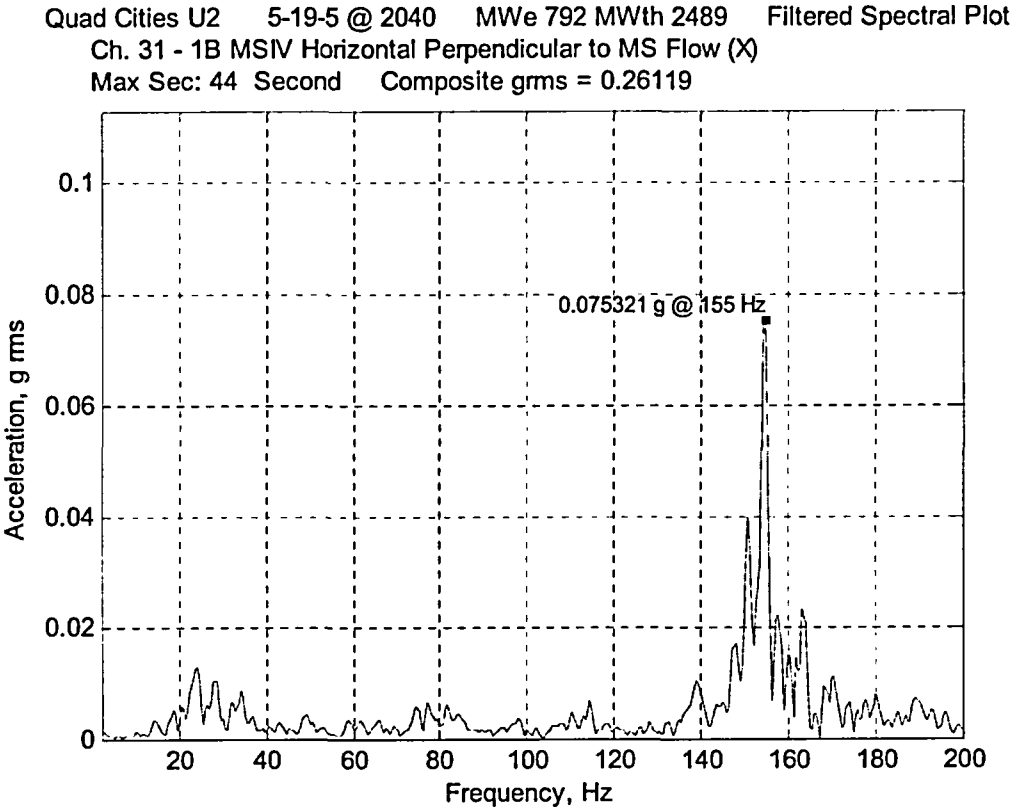
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



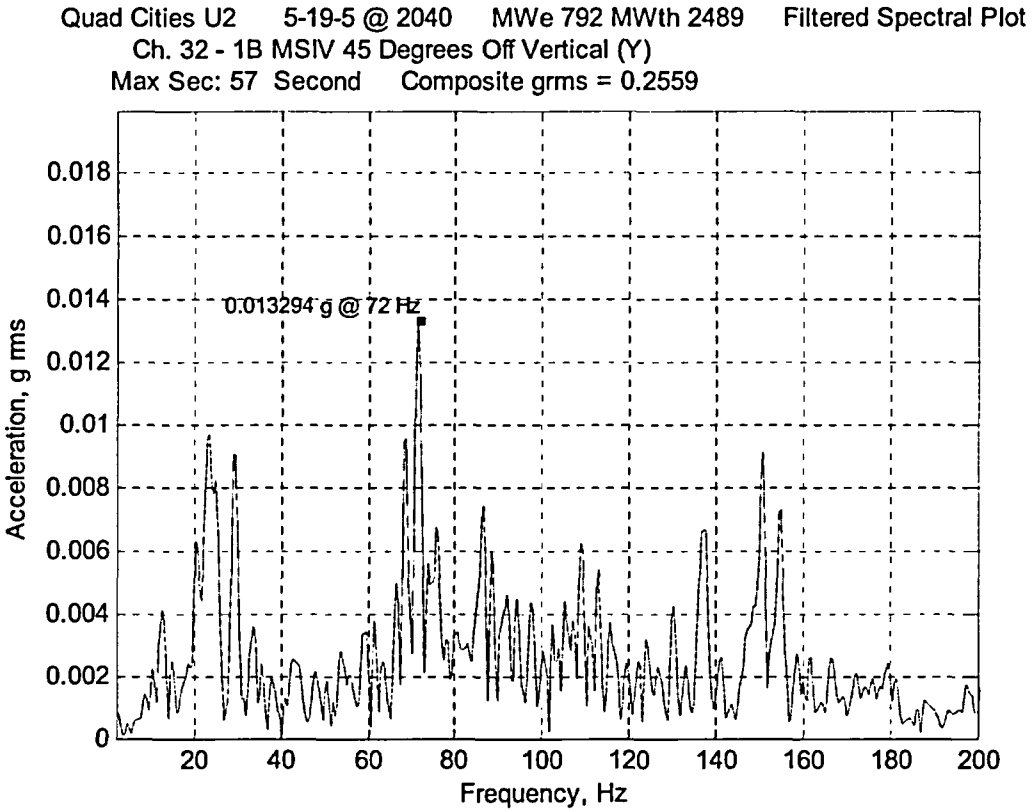
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



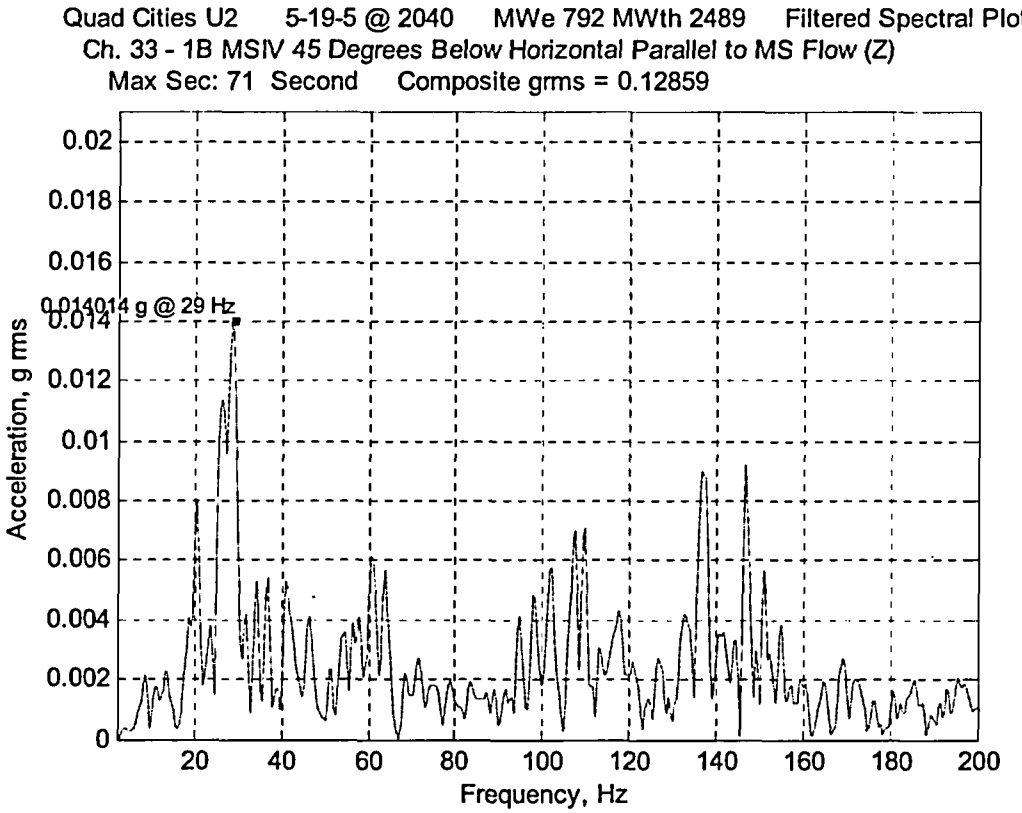
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



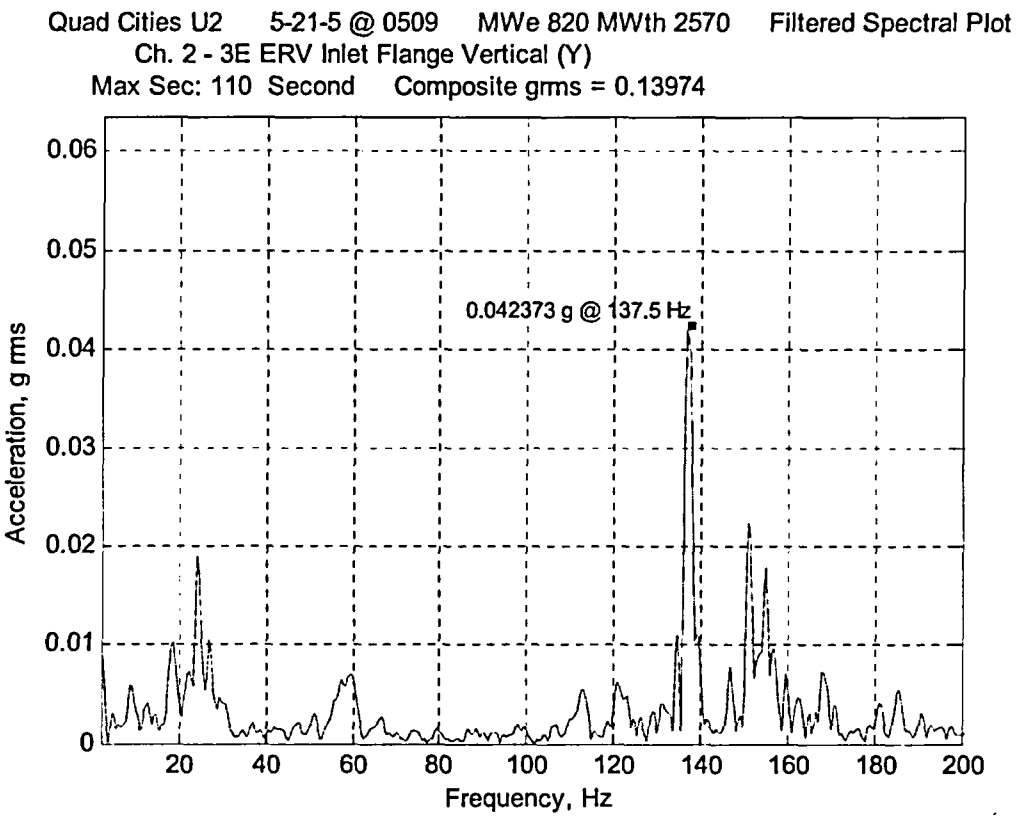
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



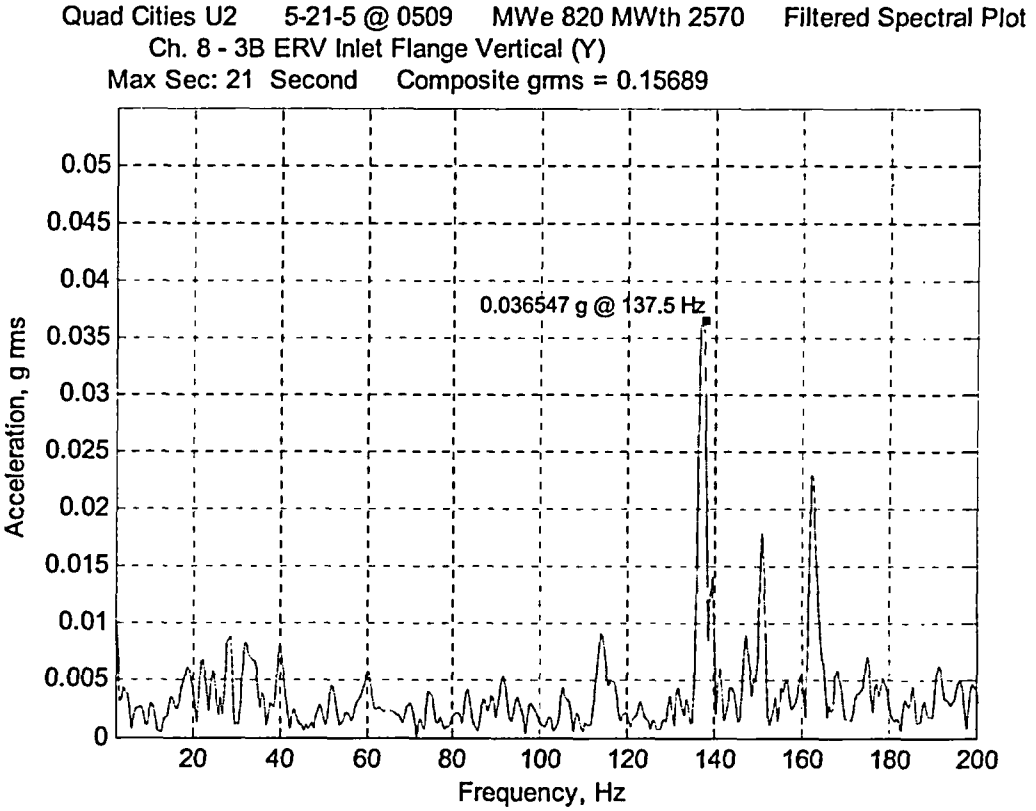
EC 355702
Attachment 2
Data at 792 MWe / 2489 MWth



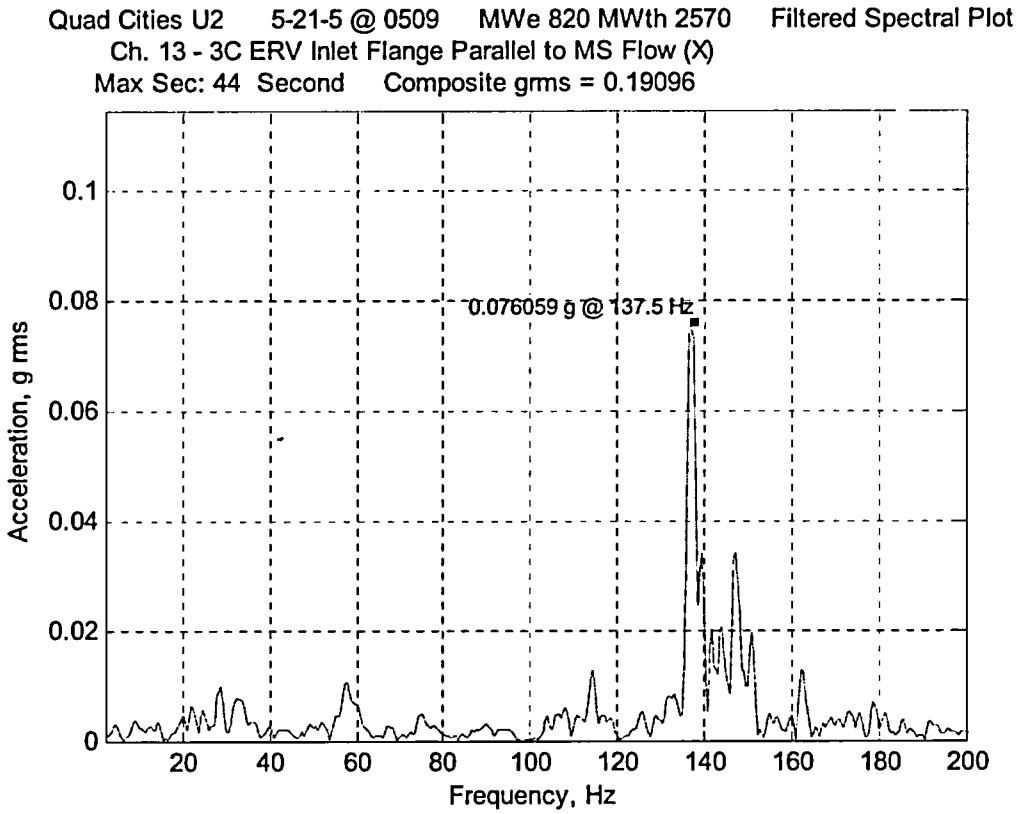
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



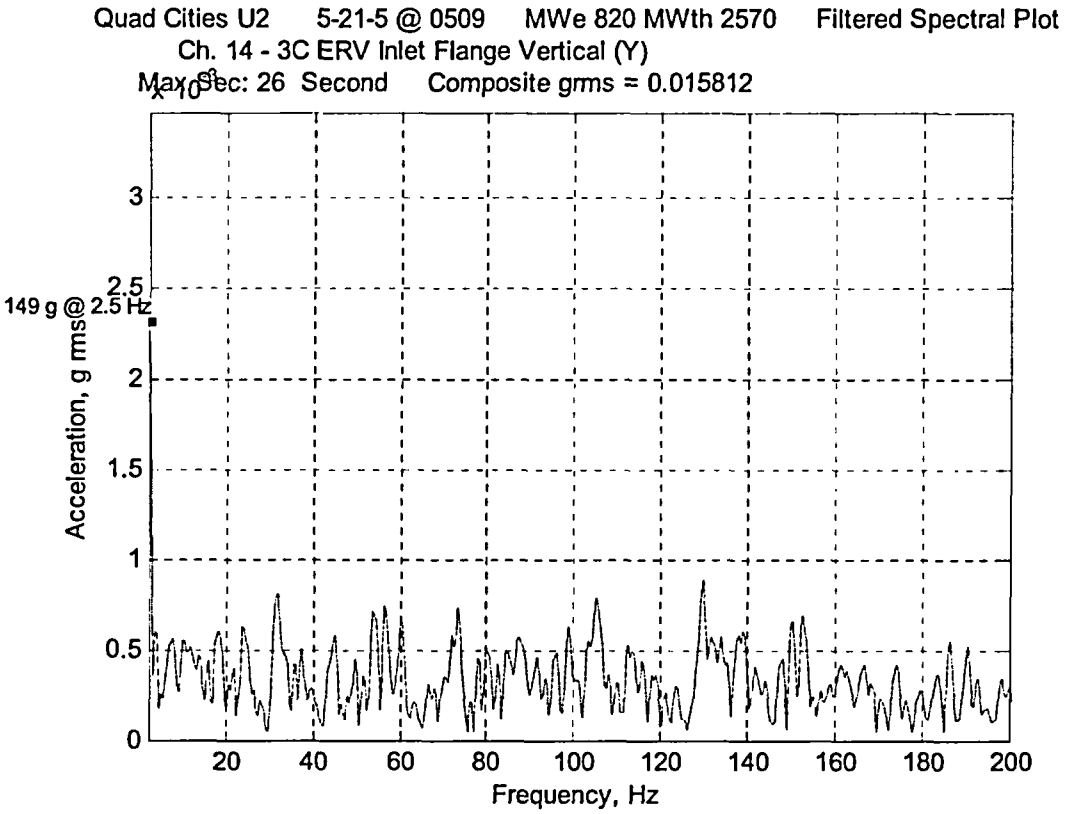
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth

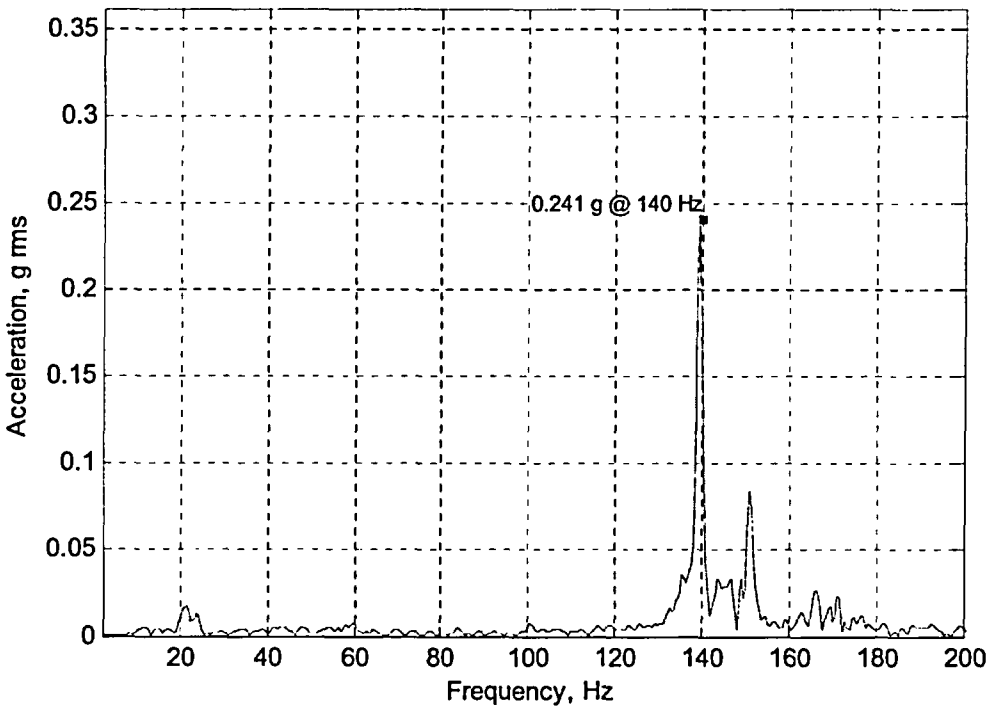


EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth

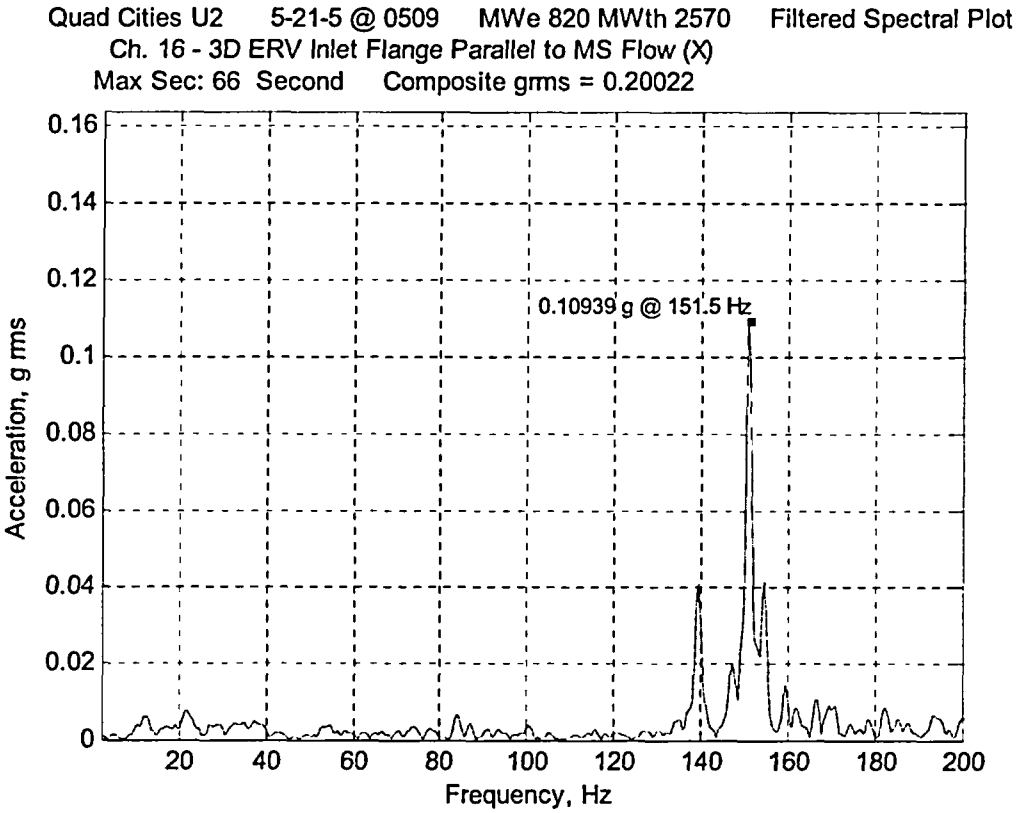


EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth

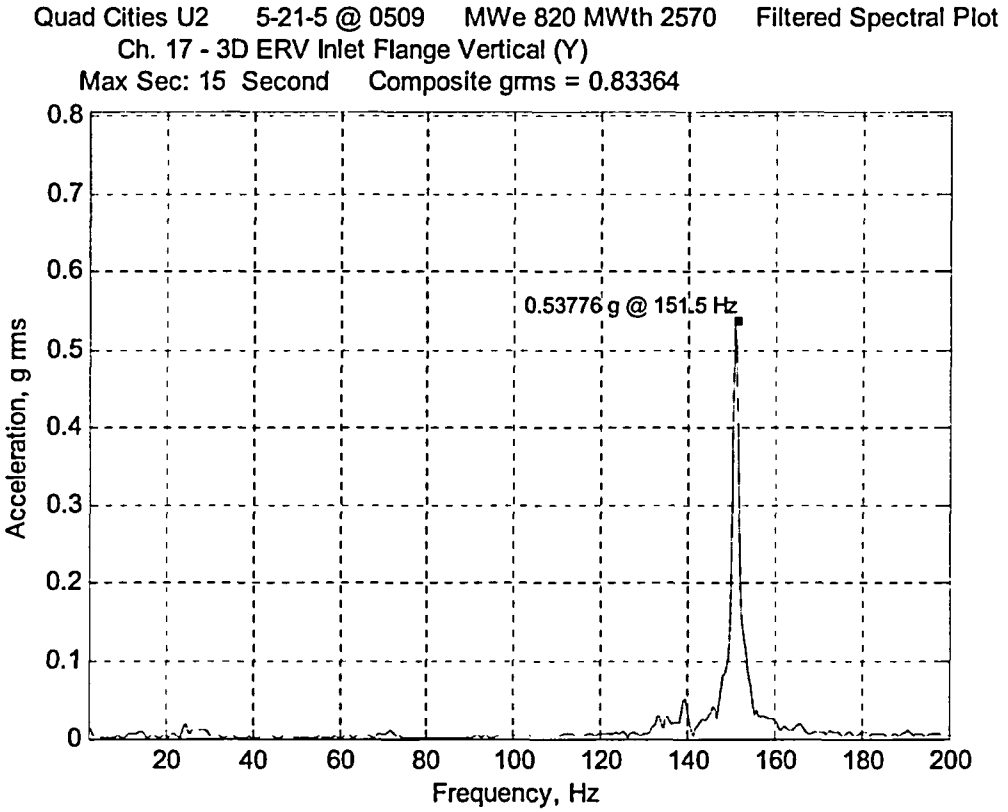
Quad Cities U2 5-21-5 @ 0509 MWe 820 MWth 2570 Filtered Spectral Plot
Ch. 15 - 3C ERV Inlet Flange Perpendicular to MS Flow (Z)
Max Sec: 6 Second Composite grms = 0.398



EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth

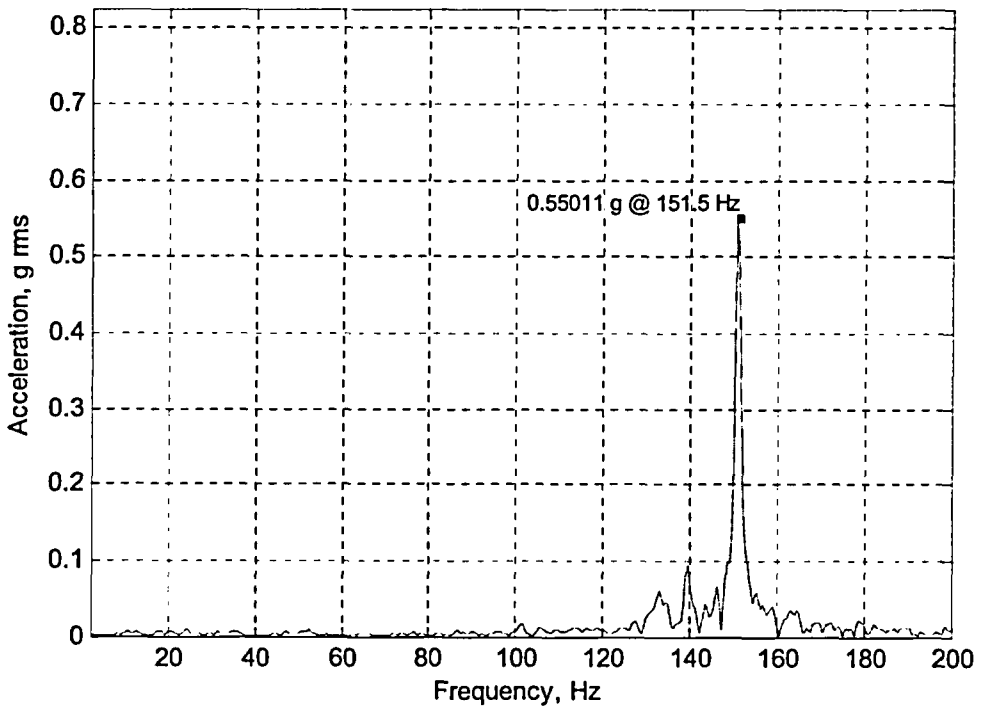


EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth

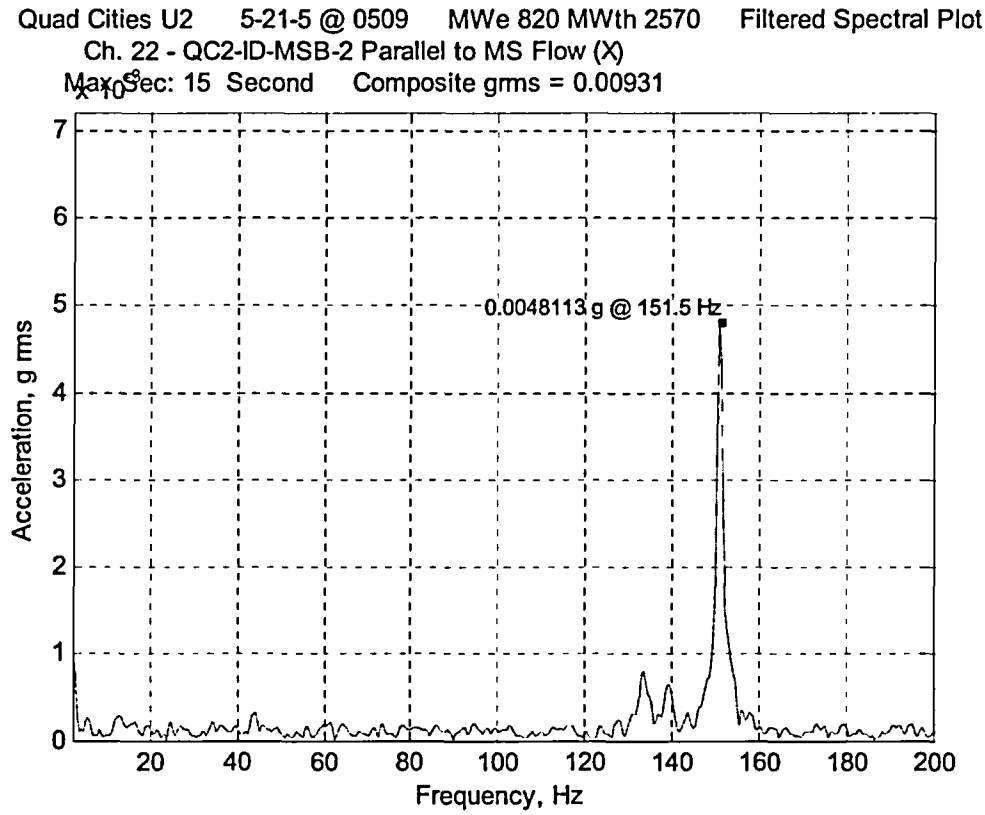


EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth

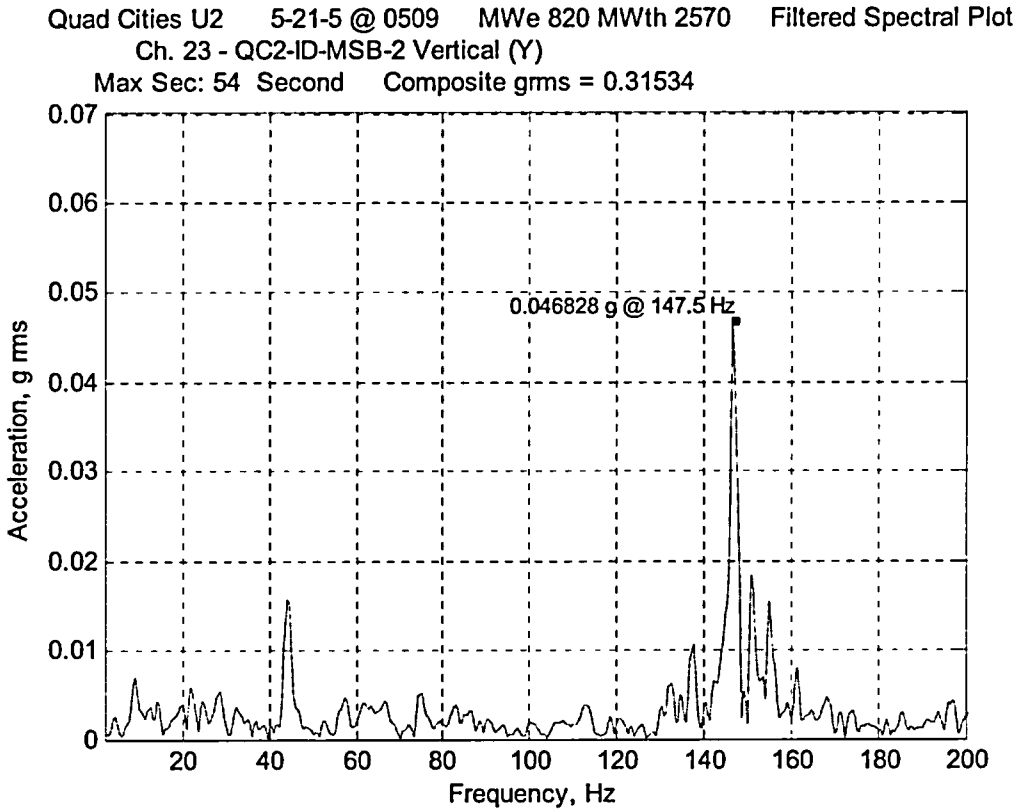
Quad Cities U2 5-21-5 @ 0509 MWe 820 MWth 2570 Filtered Spectral Plot
Ch. 18 - 3D ERV Inlet Flange Perpendicular to MS Flow (Z)
Max Sec: 15 Second Composite grms = 0.82986



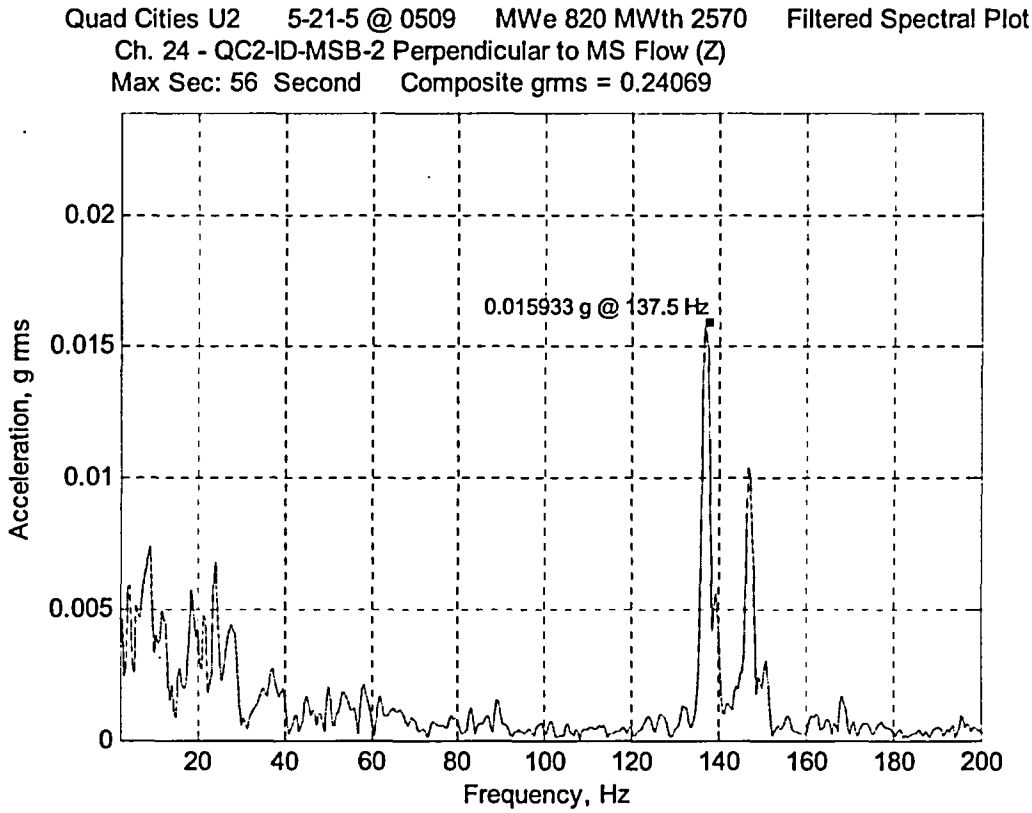
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



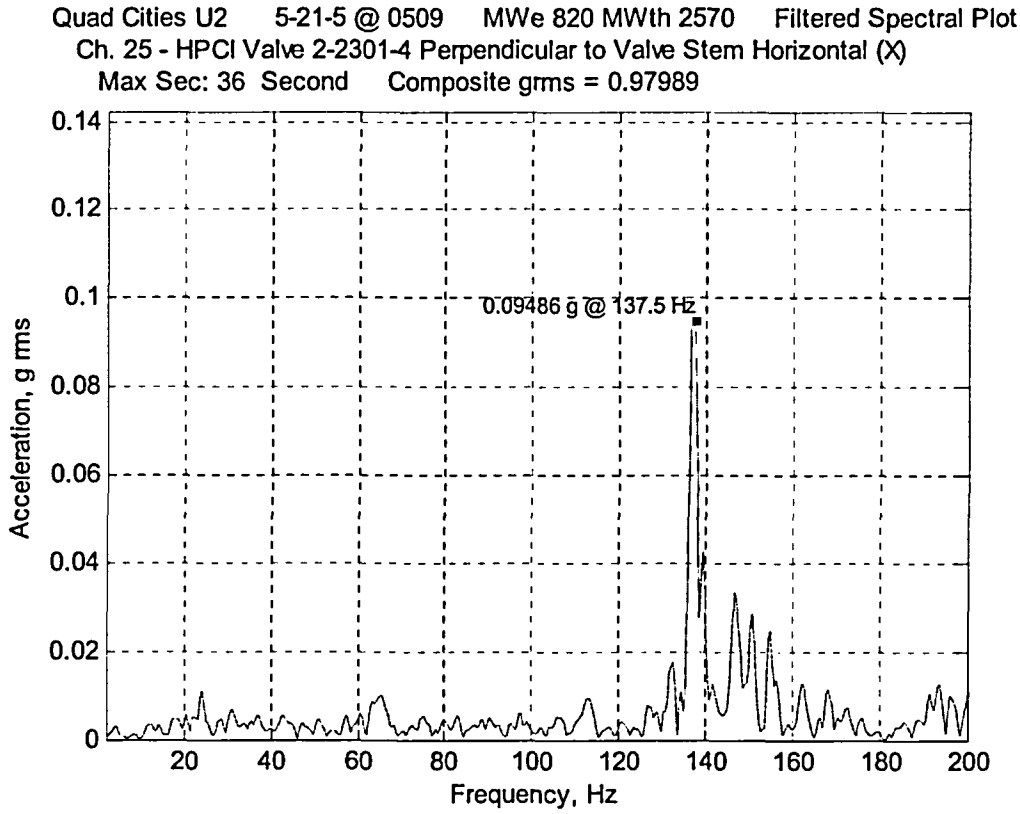
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



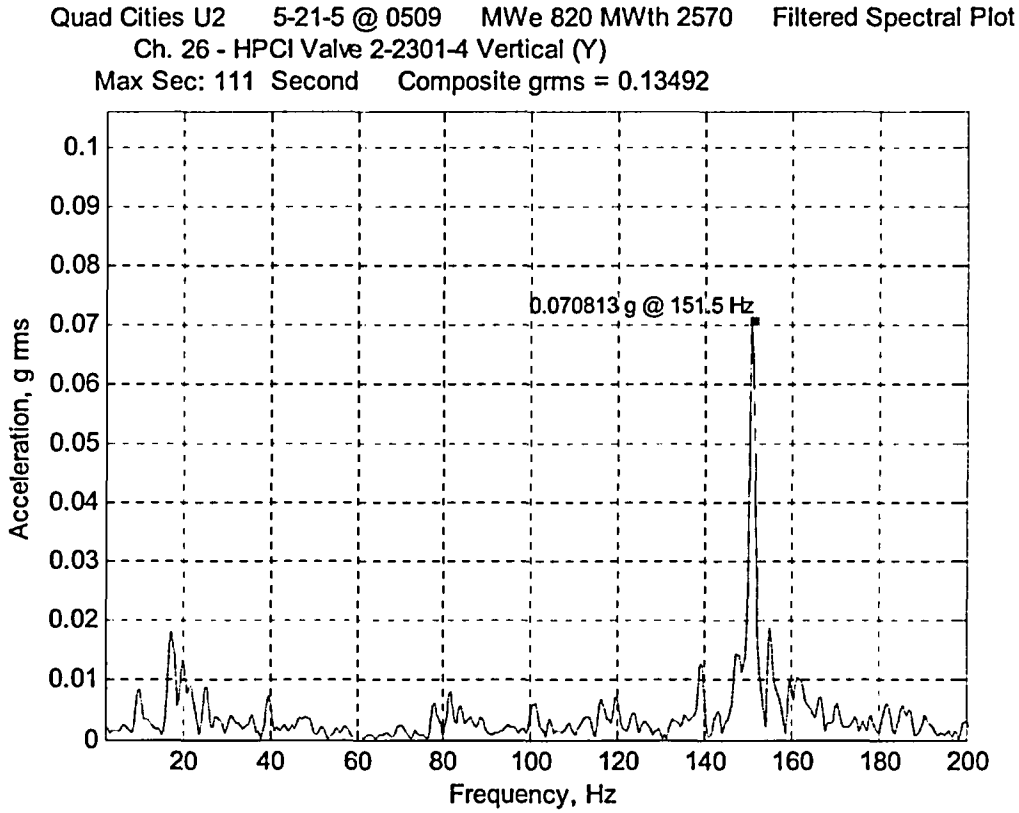
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



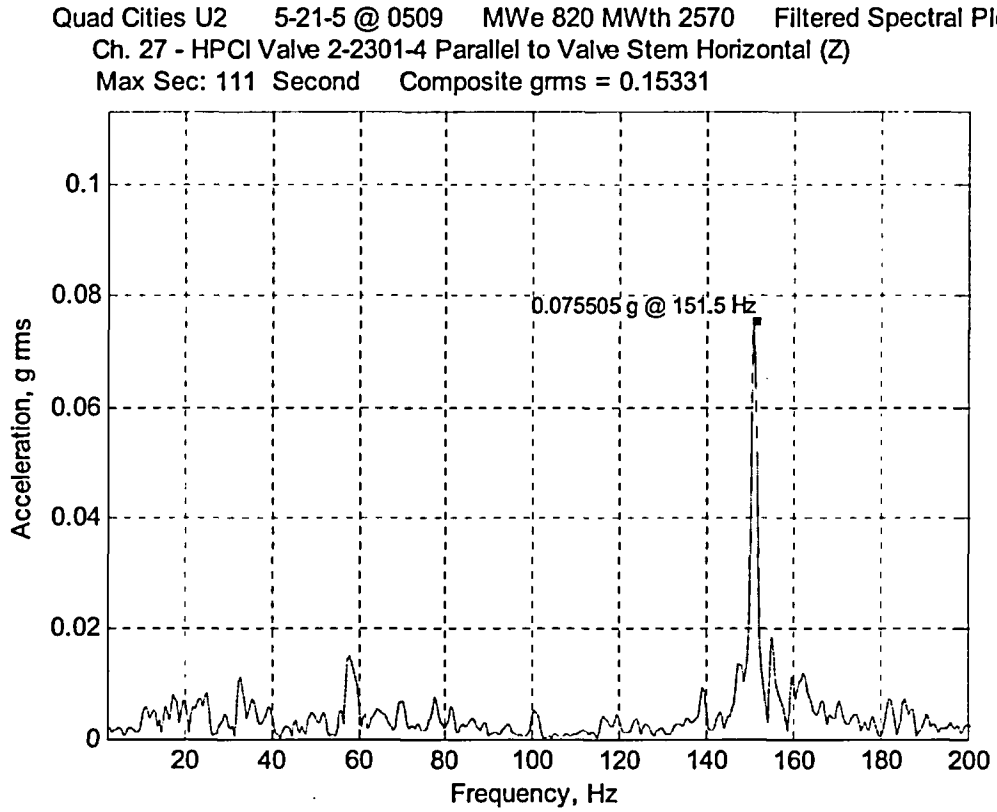
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



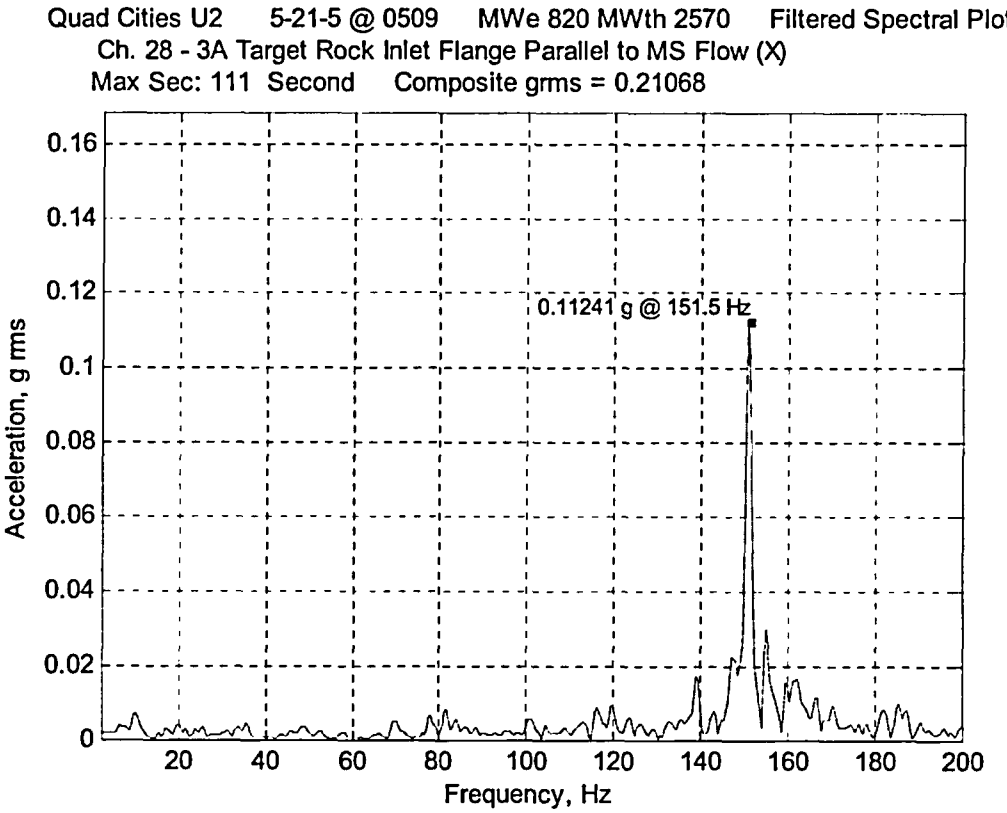
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



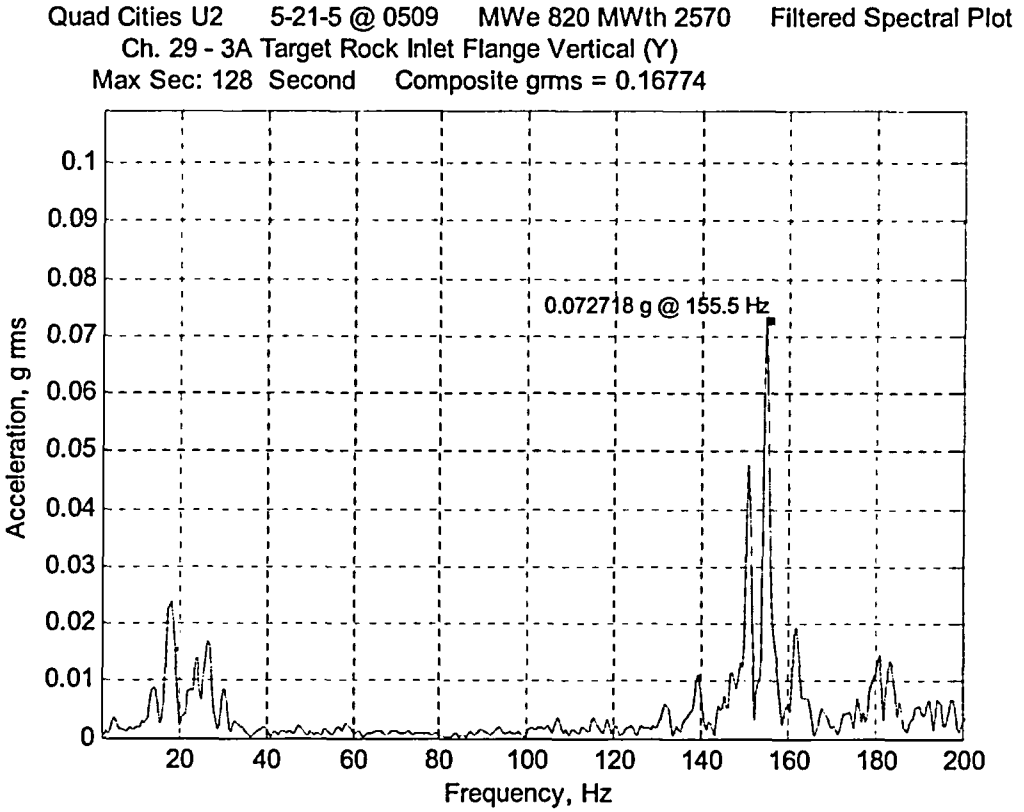
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



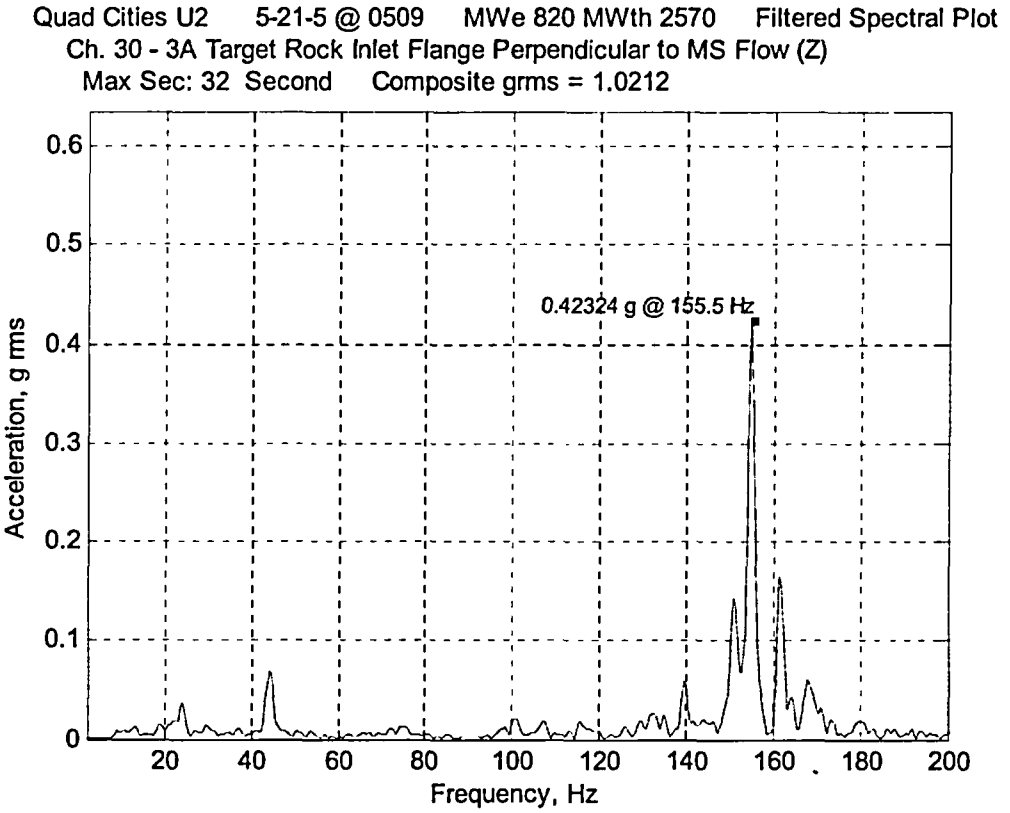
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



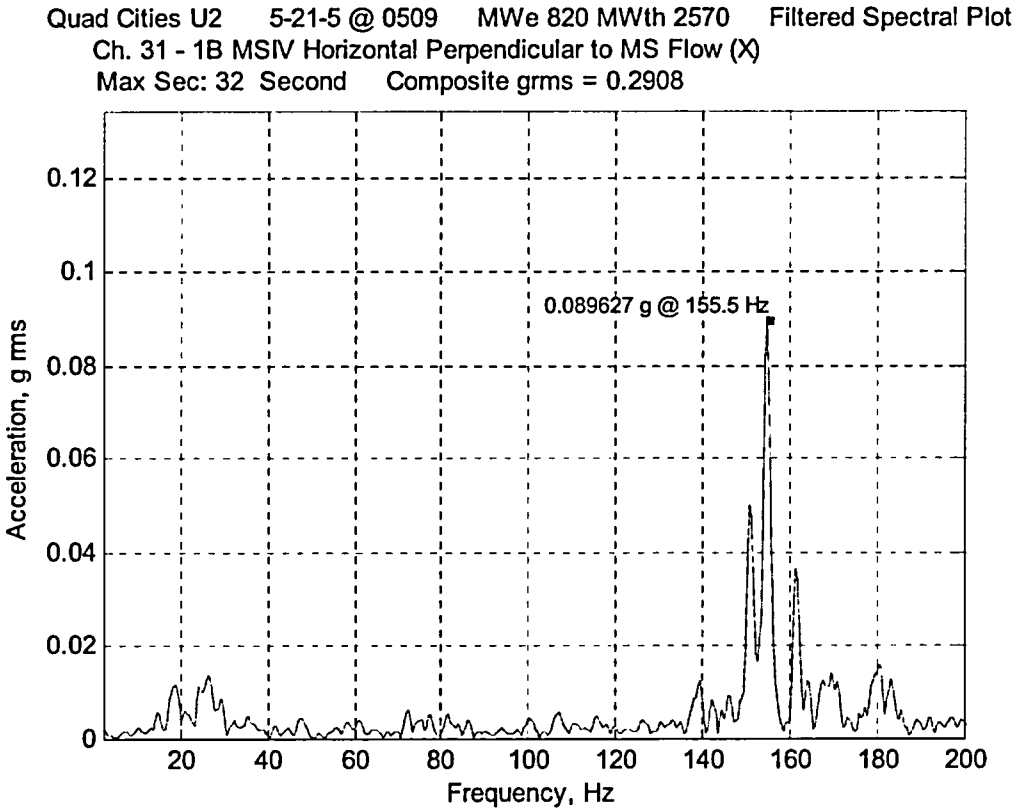
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



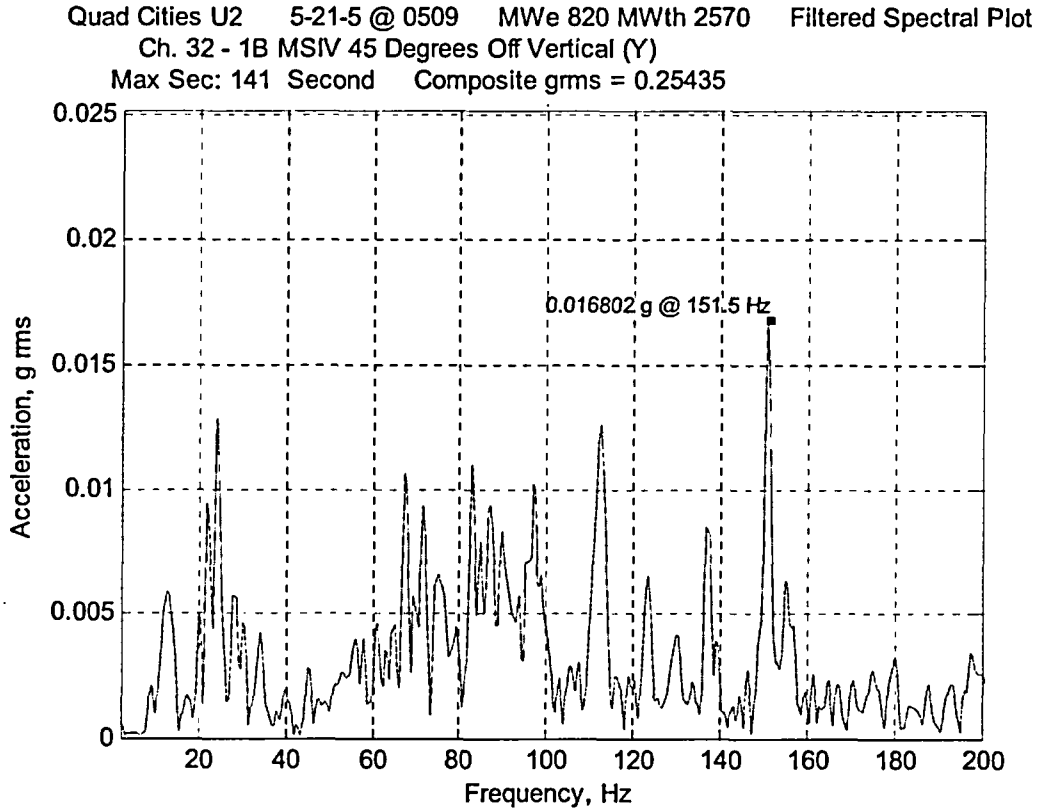
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



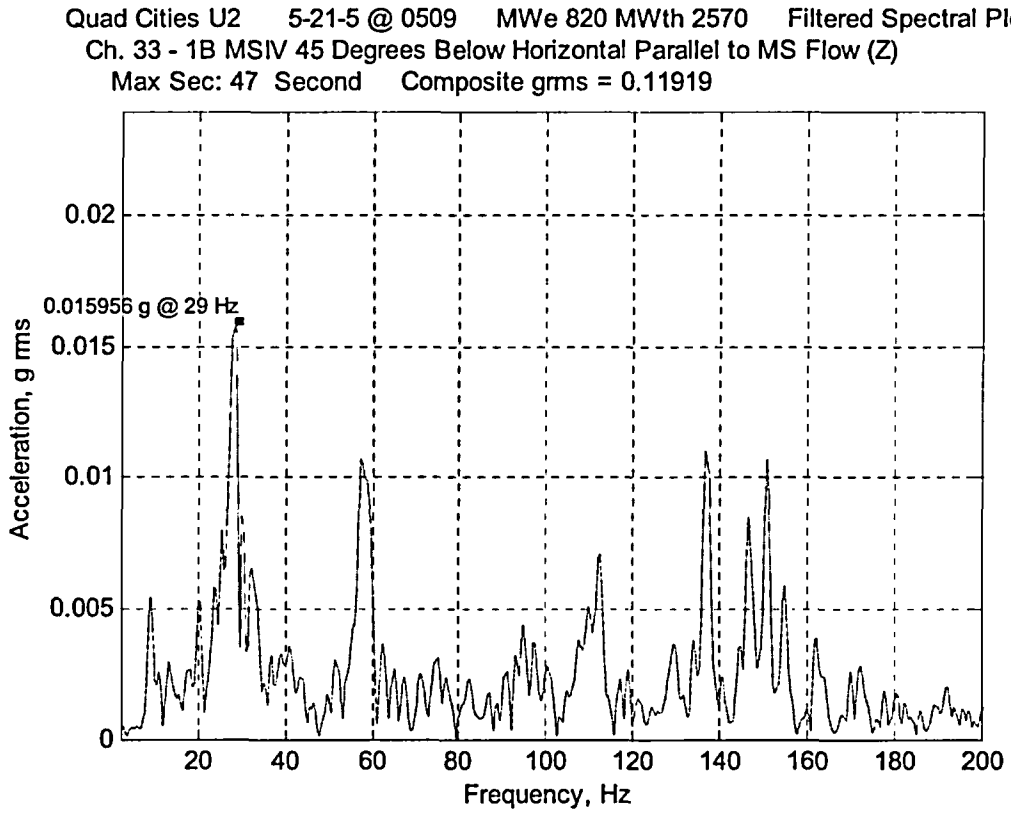
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



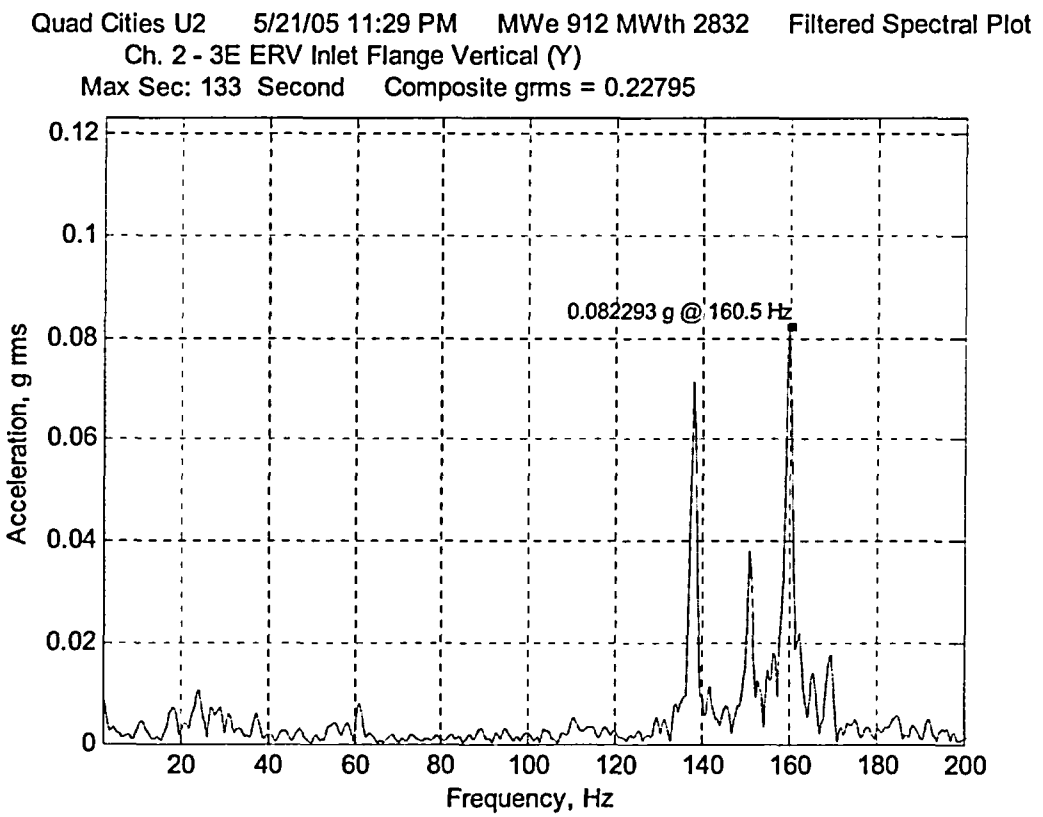
EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth



EC 355702
Attachment 2
Data at 820 MWe / 2570 MWth

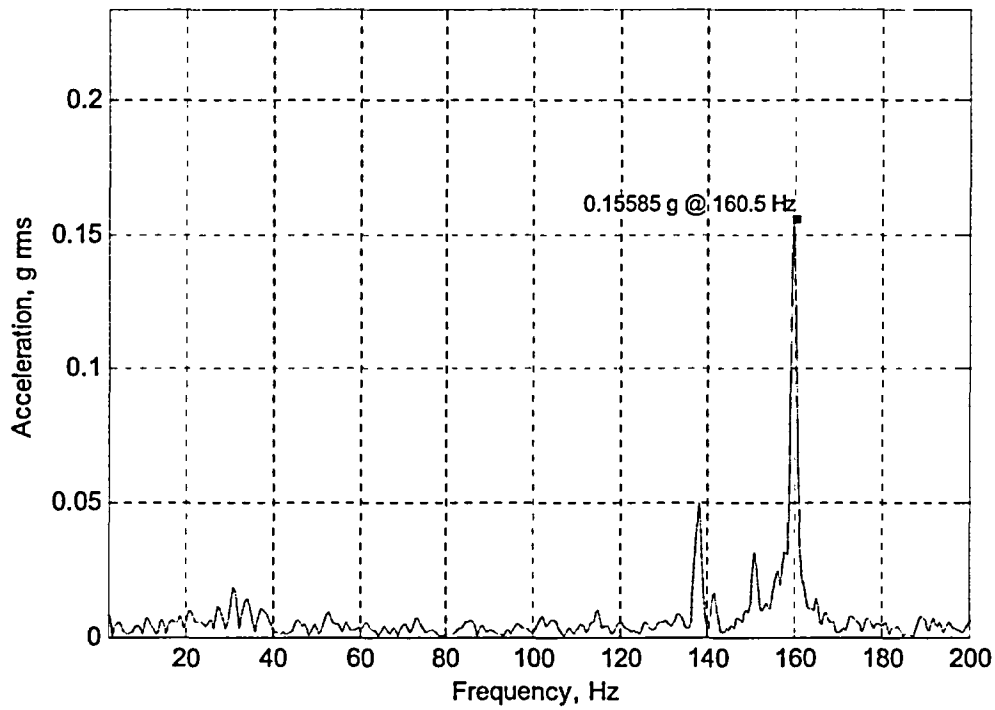


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

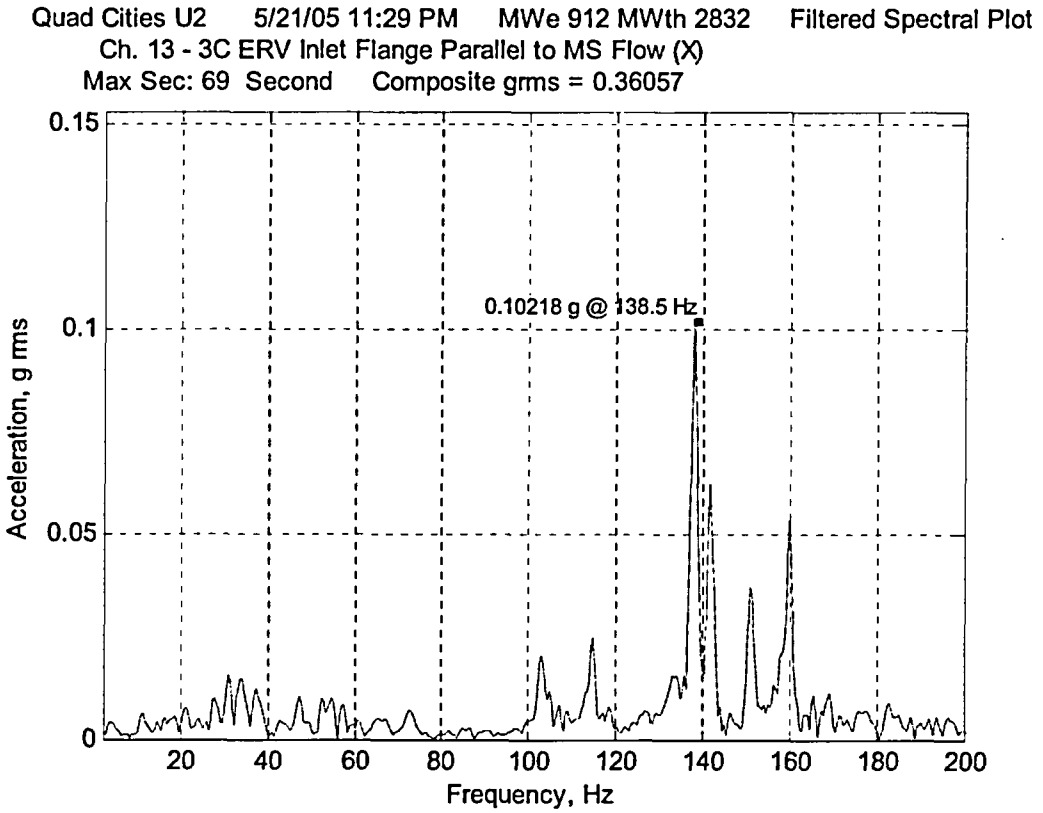


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

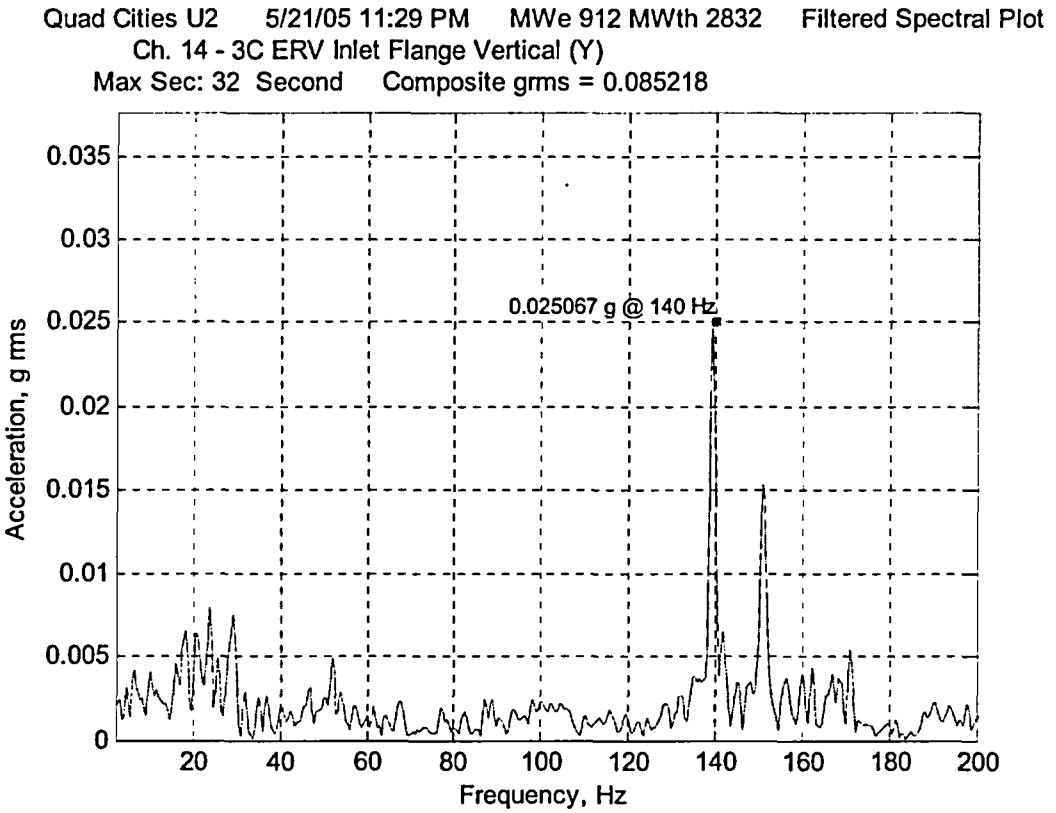
Quad Cities U2 5/21/05 11:29 PM MWe 912 MWth 2832 Filtered Spectral Plot
Ch. 8 - 3B ERV Inlet Flange Vertical (Y)
Max Sec: 45 Second Composite grms = 0.3145



EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

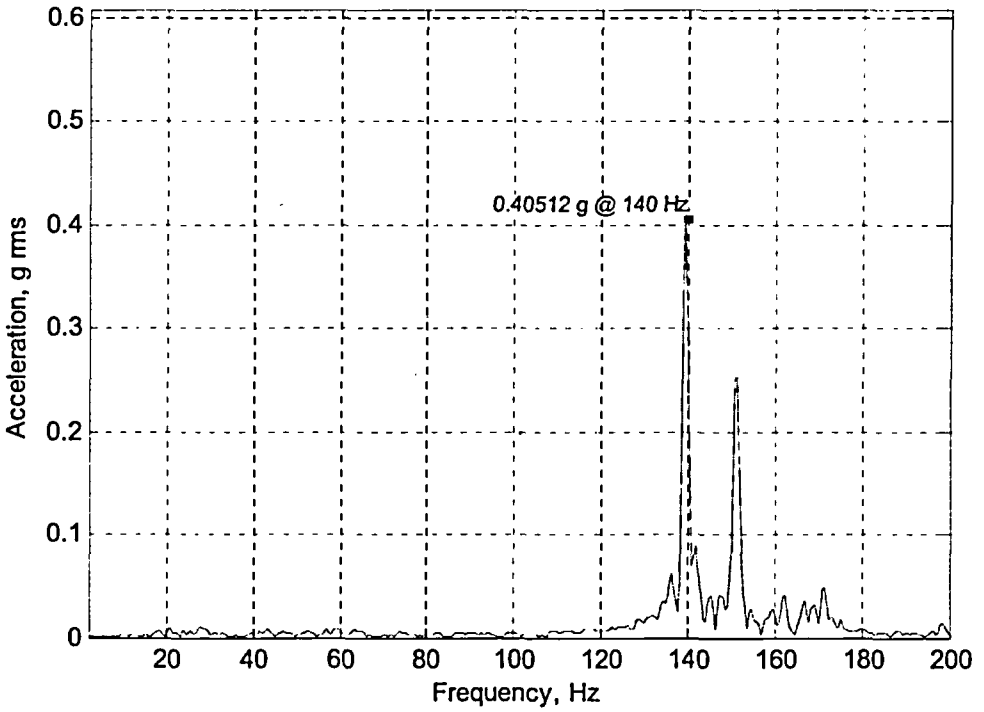


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth



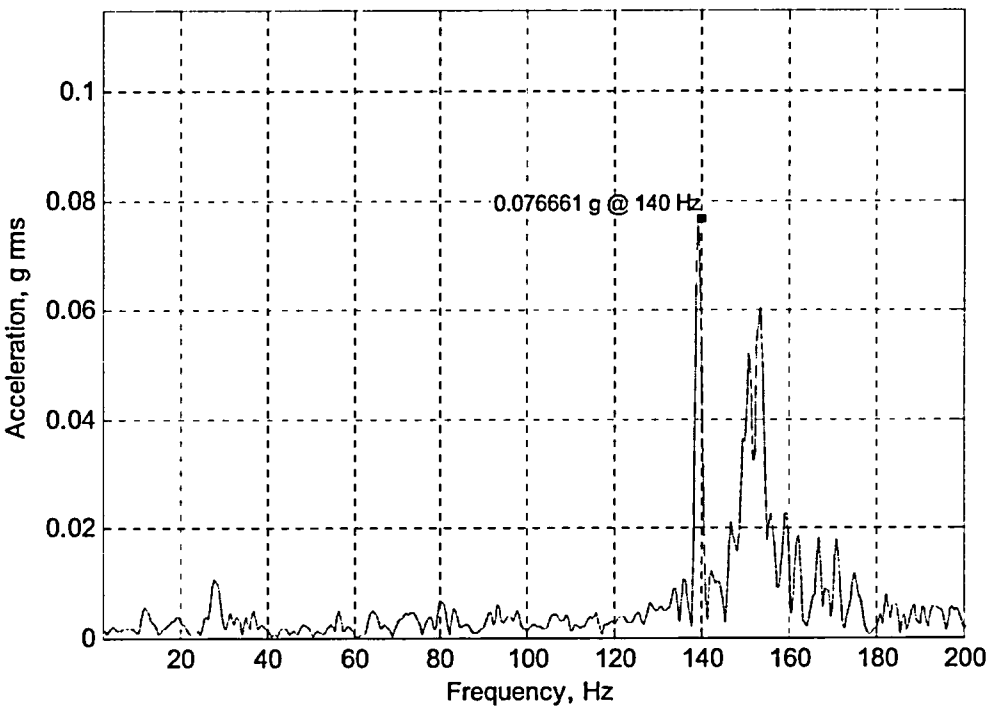
EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

Quad Cities U2 5/21/05 11:29 PM MWe 912 MWth 2832 Filtered Spectral Plot
Ch. 15 - 3C ERV Inlet Flange Perpendicular to MS Flow (Z)
Max Sec: 71 Second Composite grms = 0.74919

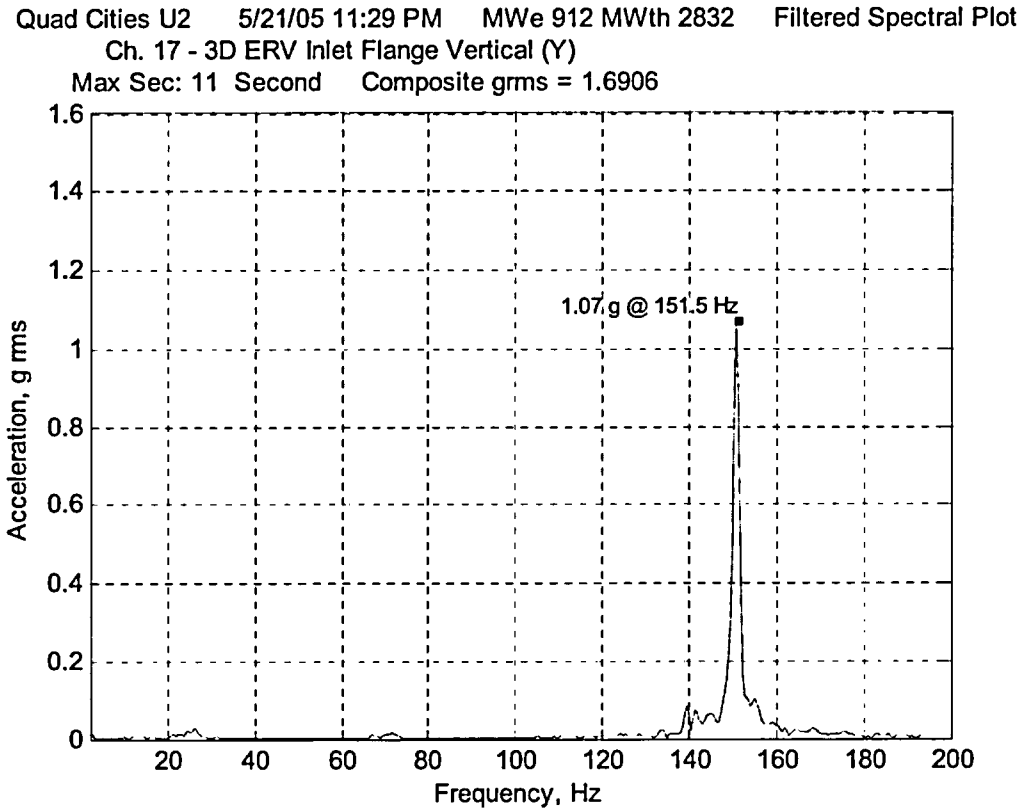


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

Quad Cities U2 5/21/05 11:29 PM MWe 912 MWth 2832 Filtered Spectral Plot
Ch. 16 - 3D ERV Inlet Flange Parallel to MS Flow (X)
Max Sec: 94 Second Composite grms = 0.2694

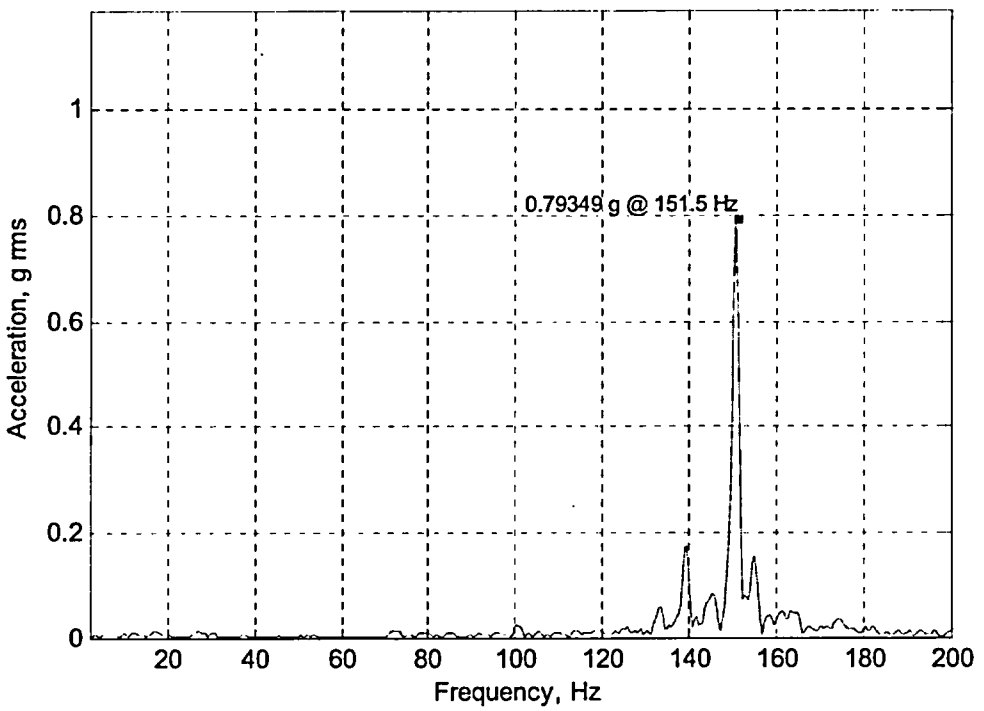


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

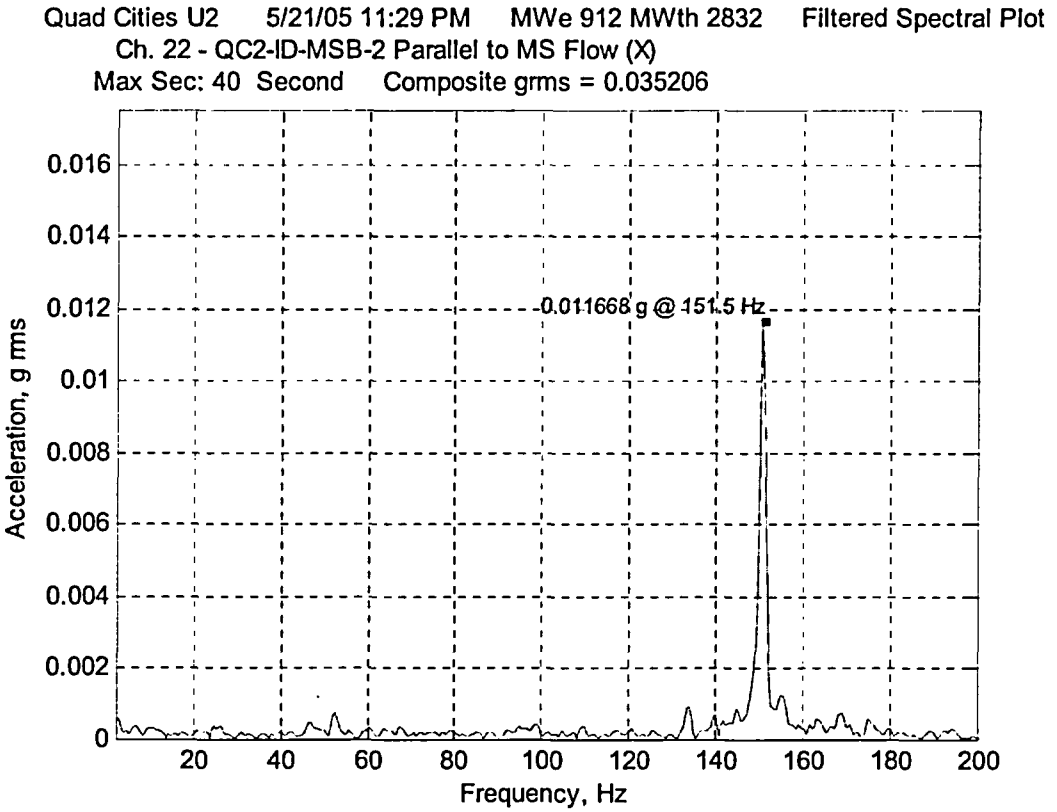


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

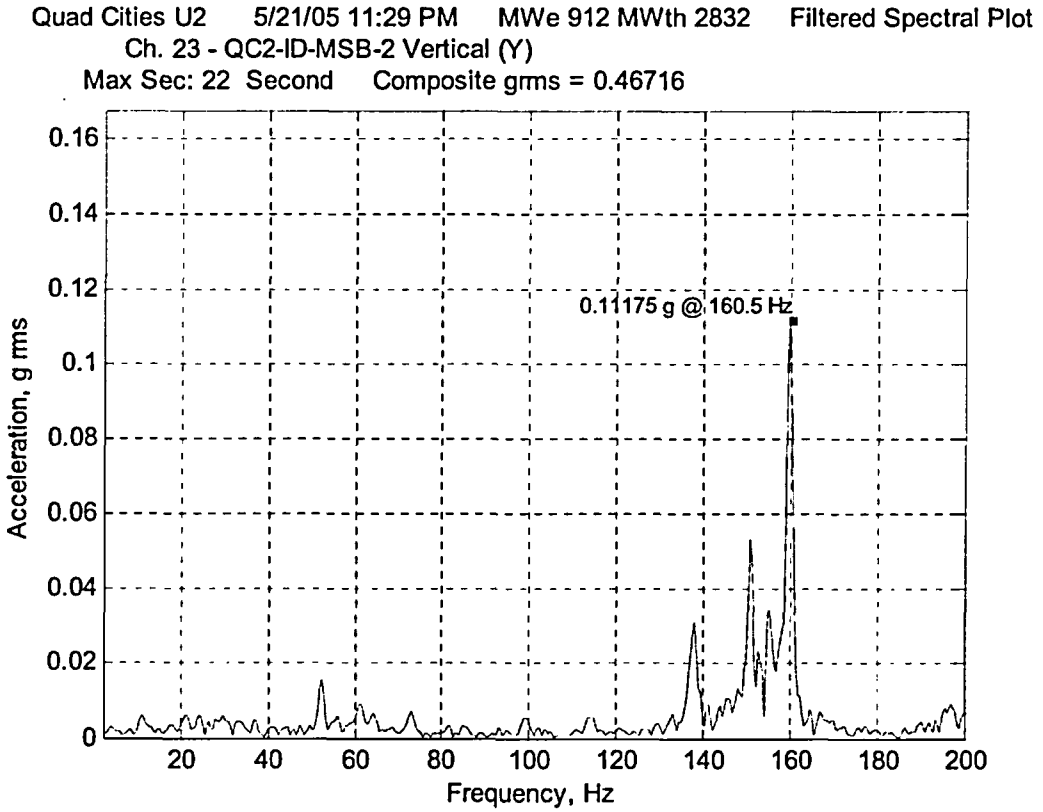
Quad Cities U2 5/21/05 11:29 PM MWe 912 MWth 2832 Filtered Spectral Plot
Ch. 18 - 3D ERV Inlet Flange Perpendicular to MS Flow (Z)
Max Sec: 39 Second Composite grms = 1.3328



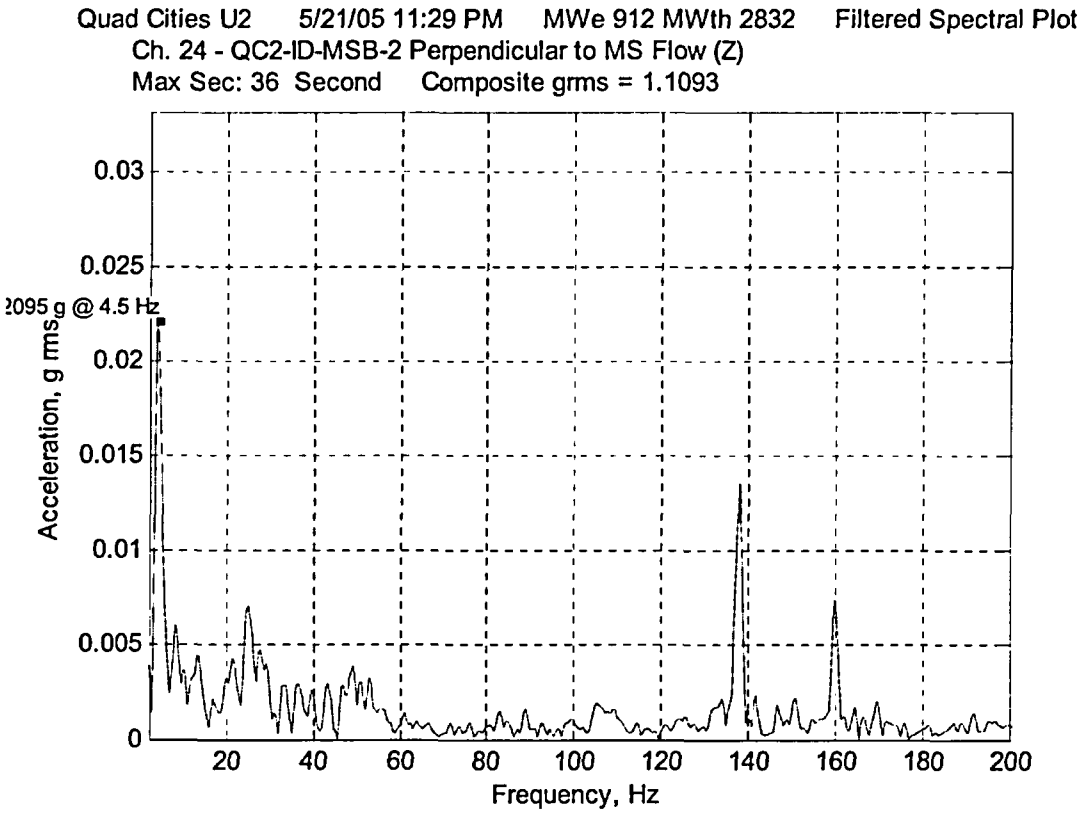
EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth



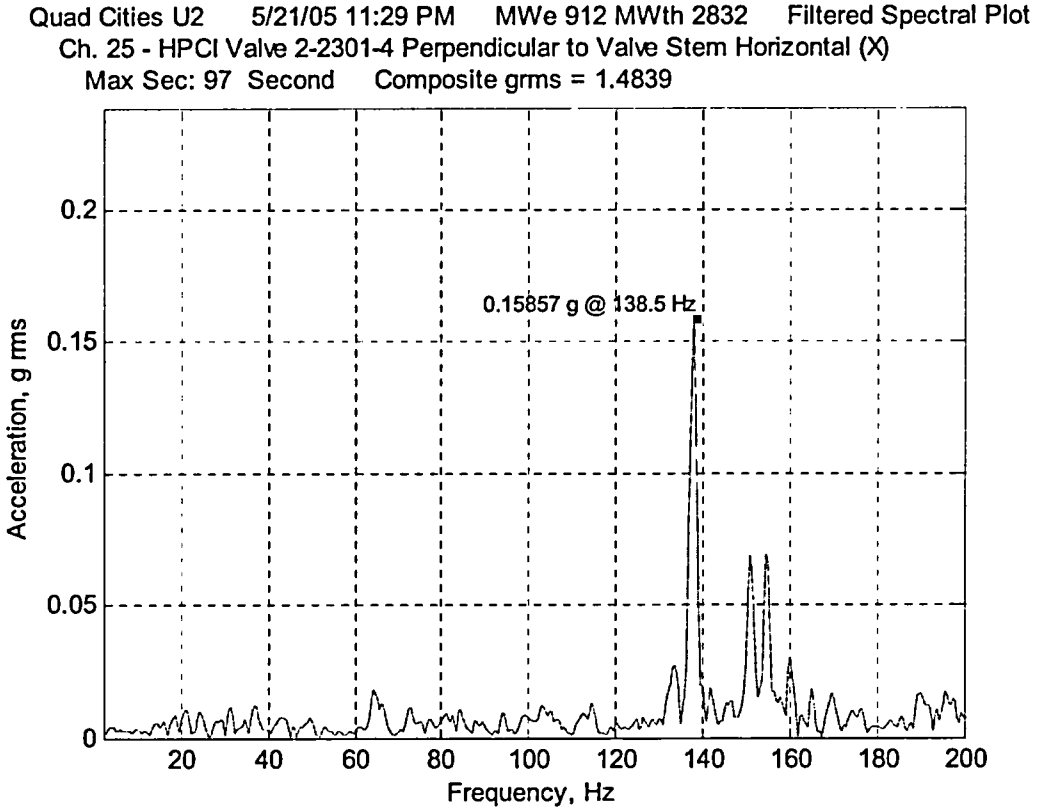
EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth



EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

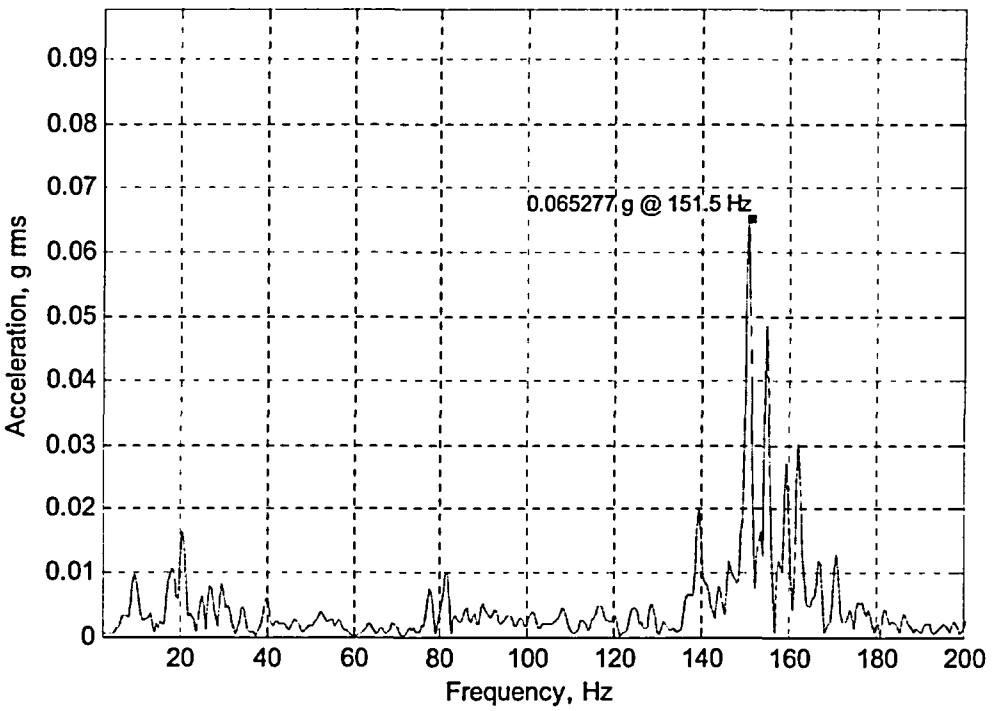


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

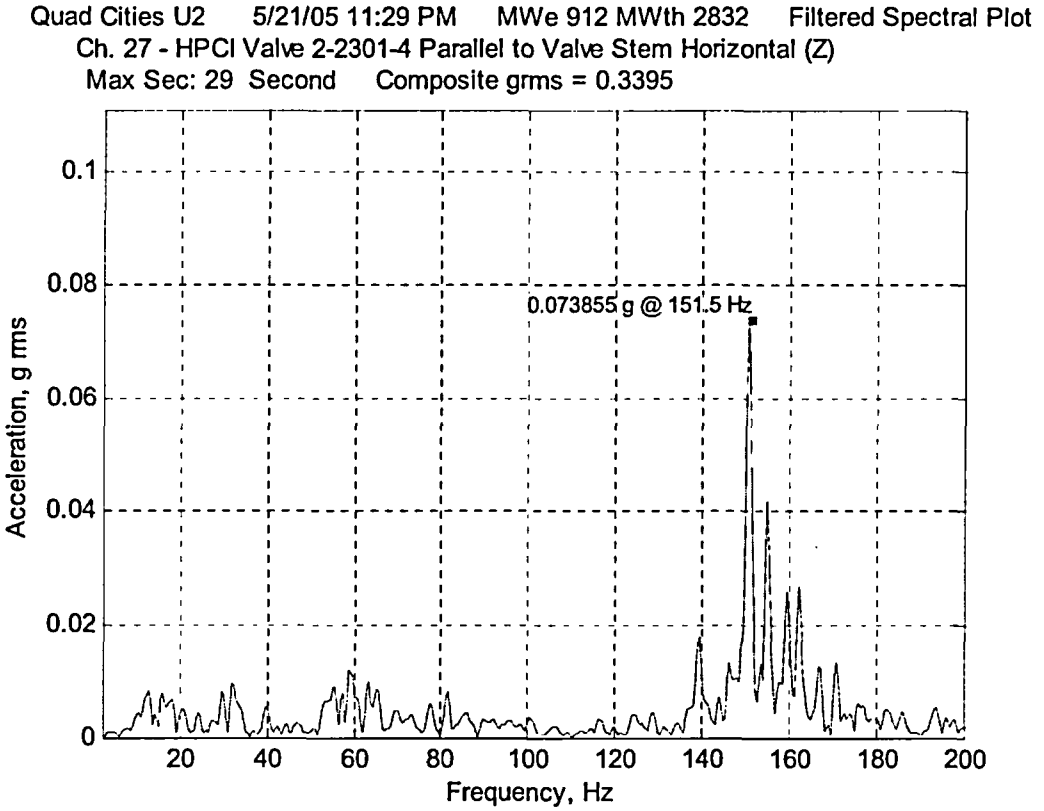


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

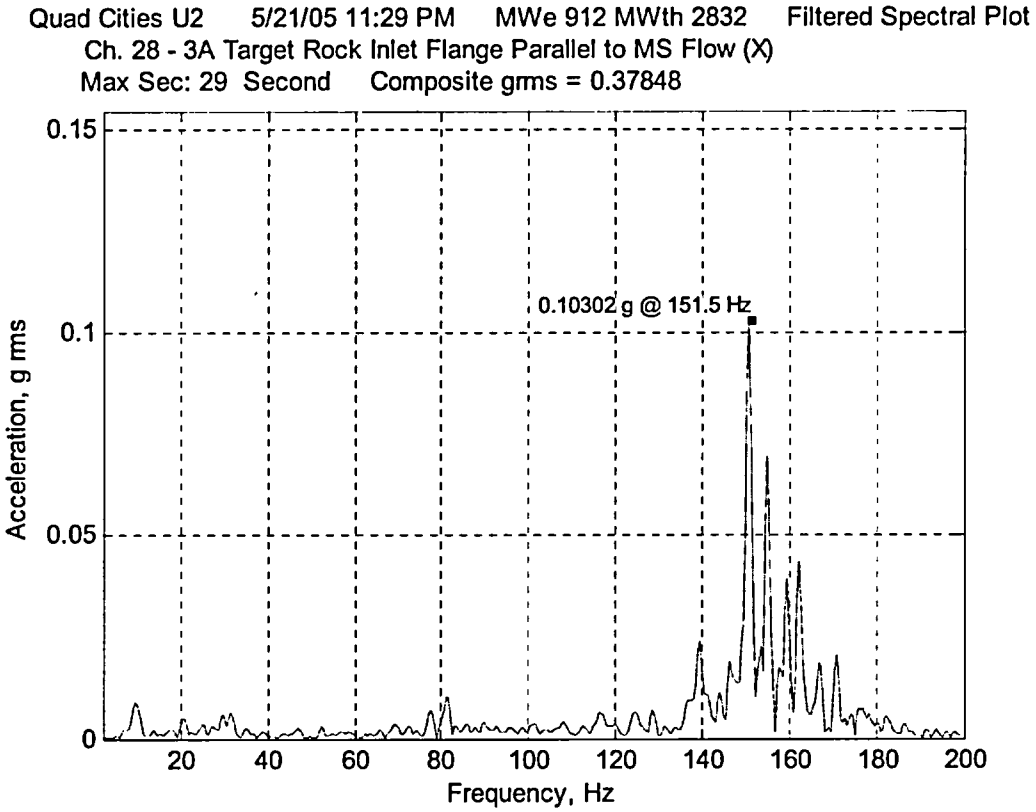
Quad Cities U2 5/21/05 11:29 PM MWe 912 MWth 2832 Filtered Spectral Plot
Ch. 26 - HPCI Valve 2-2301-4 Vertical (Y)
Max Sec: 29 Second Composite grms = 0.24091



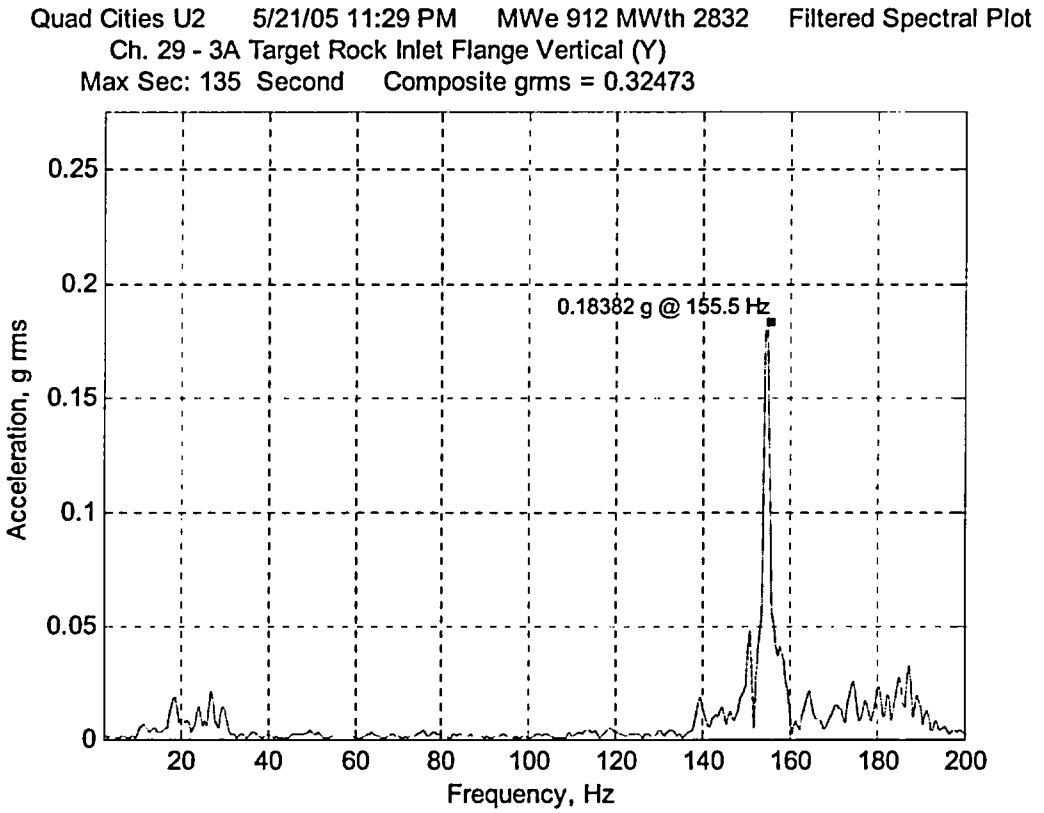
EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth



EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

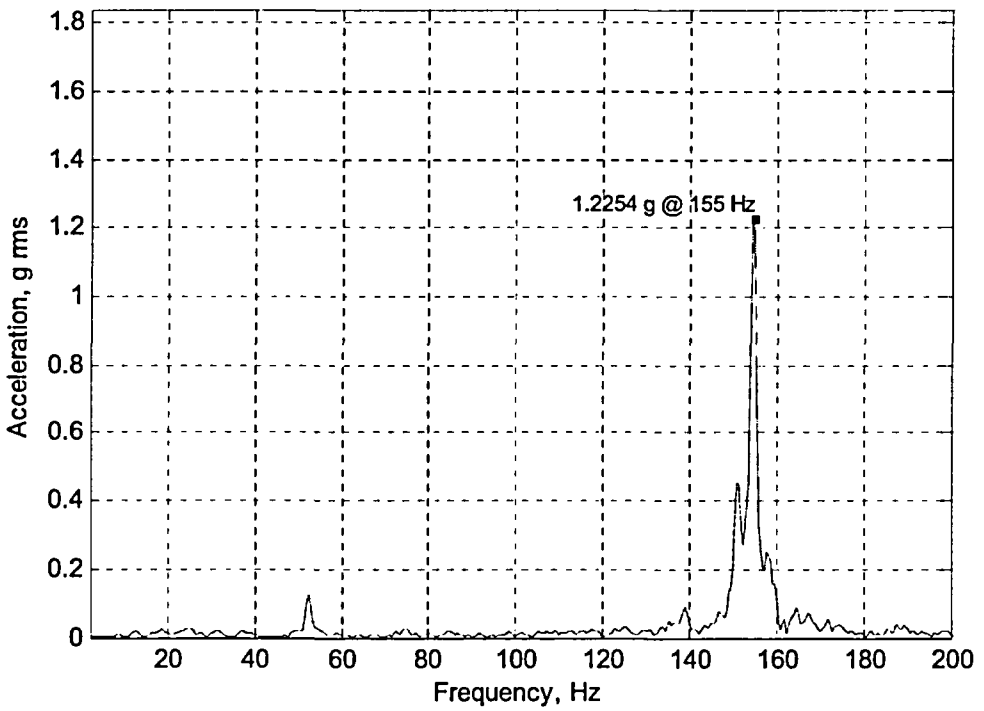


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

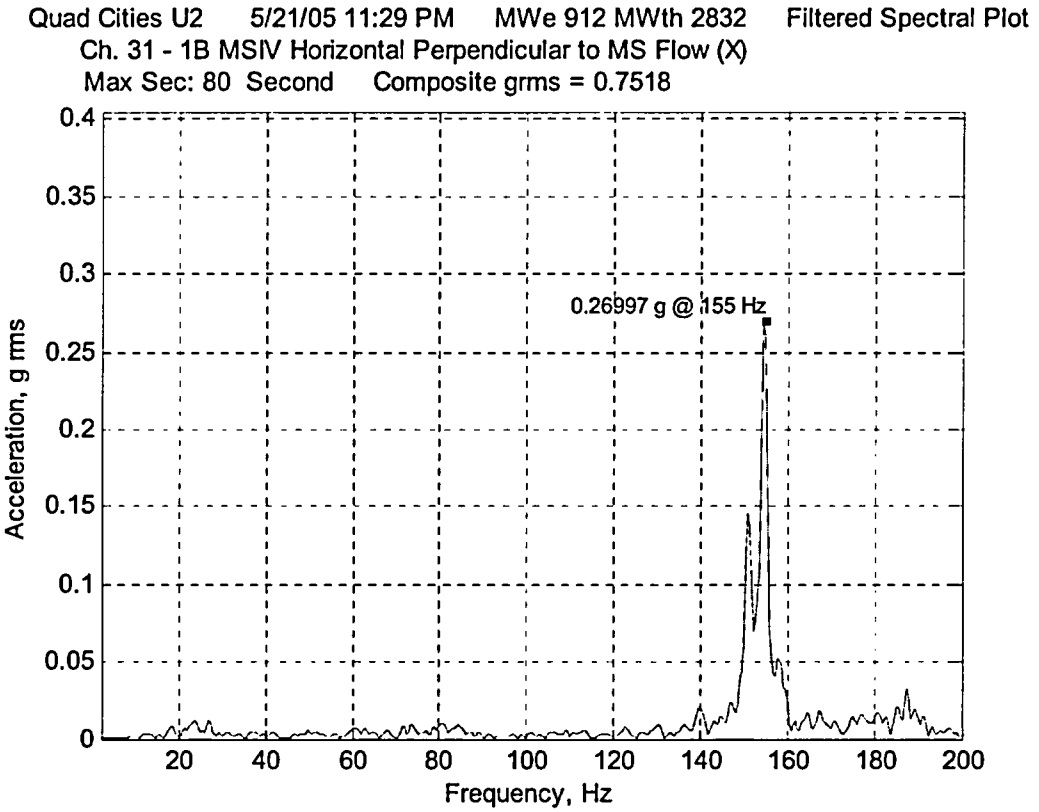


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

Quad Cities U2 5/21/05 11:29 PM MWe 912 MWth 2832 Filtered Spectral Plot
Ch. 30 - 3A Target Rock Inlet Flange Perpendicular to MS Flow (Z)
Max Sec: 4 Second Composite grms = 2.5889

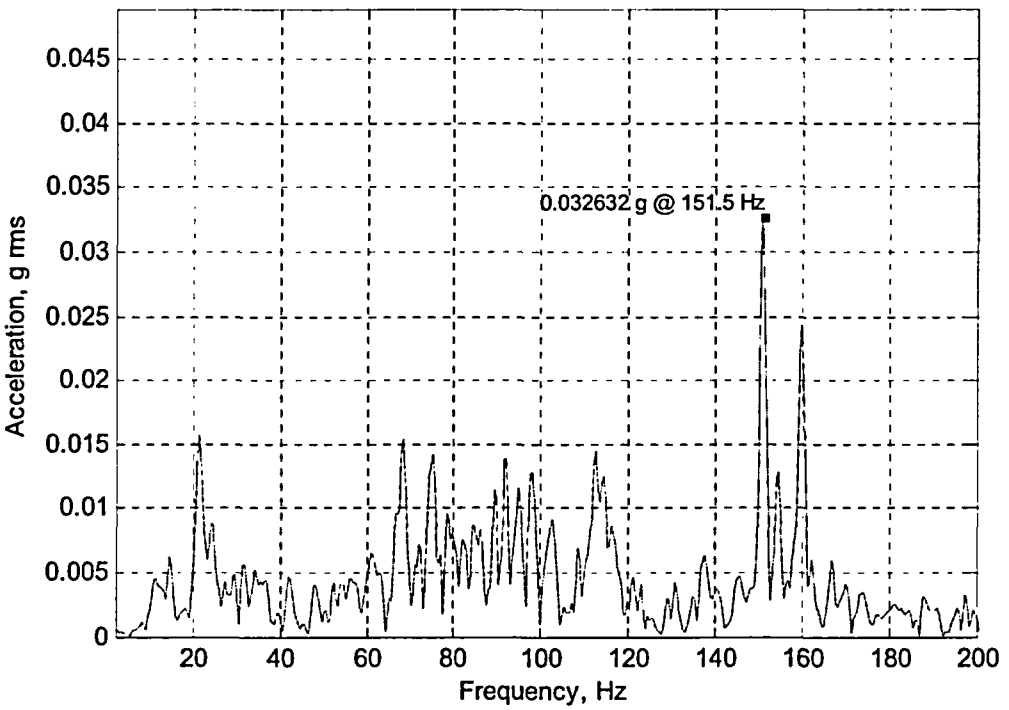


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

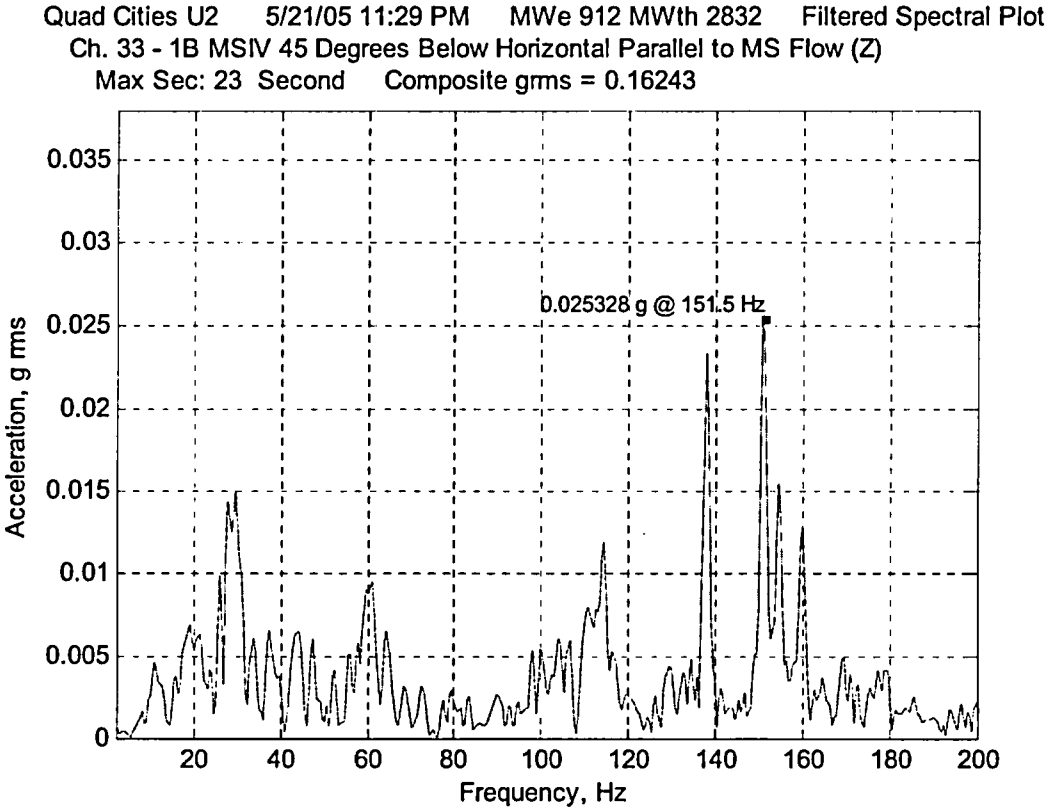


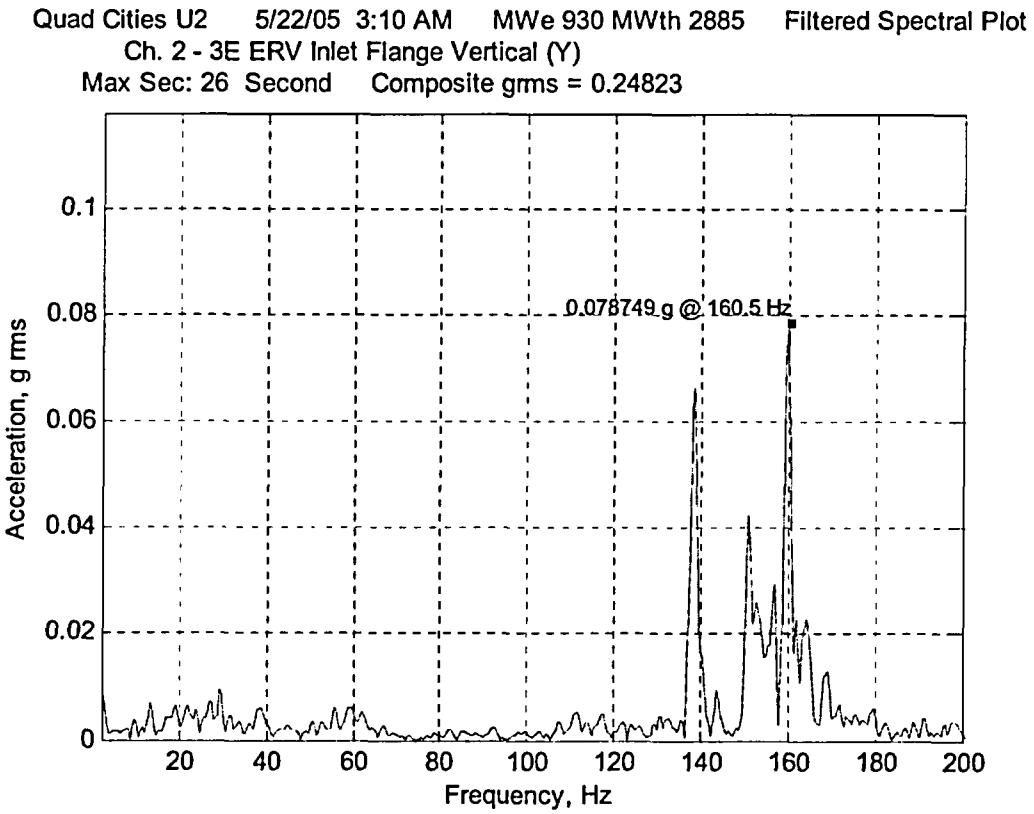
EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

Quad Cities U2 5/21/05 11:29 PM MWe 912 MWth 2832 Filtered Spectral Plot
Ch. 32 - 1B MSIV 45 Degrees Off Vertical (Y)
Max Sec: 50 Second Composite grms = 0.33845

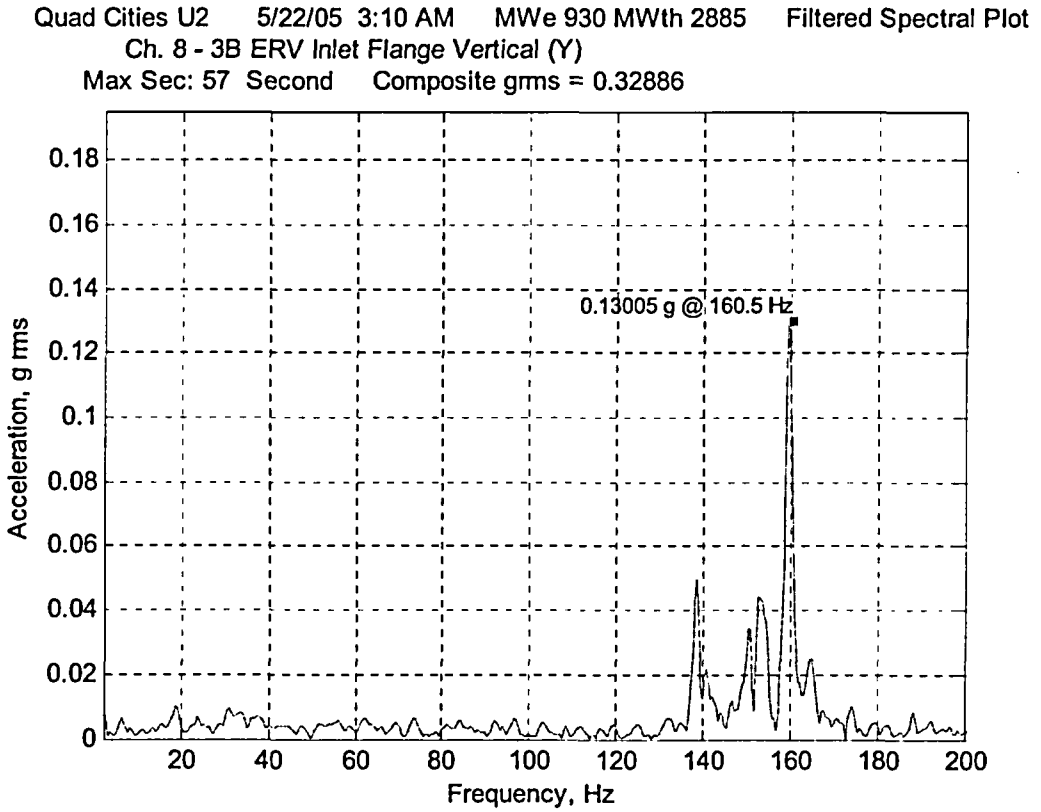


EC 355702
Attachment 2
Data at 912 MWe / 2832 MWth

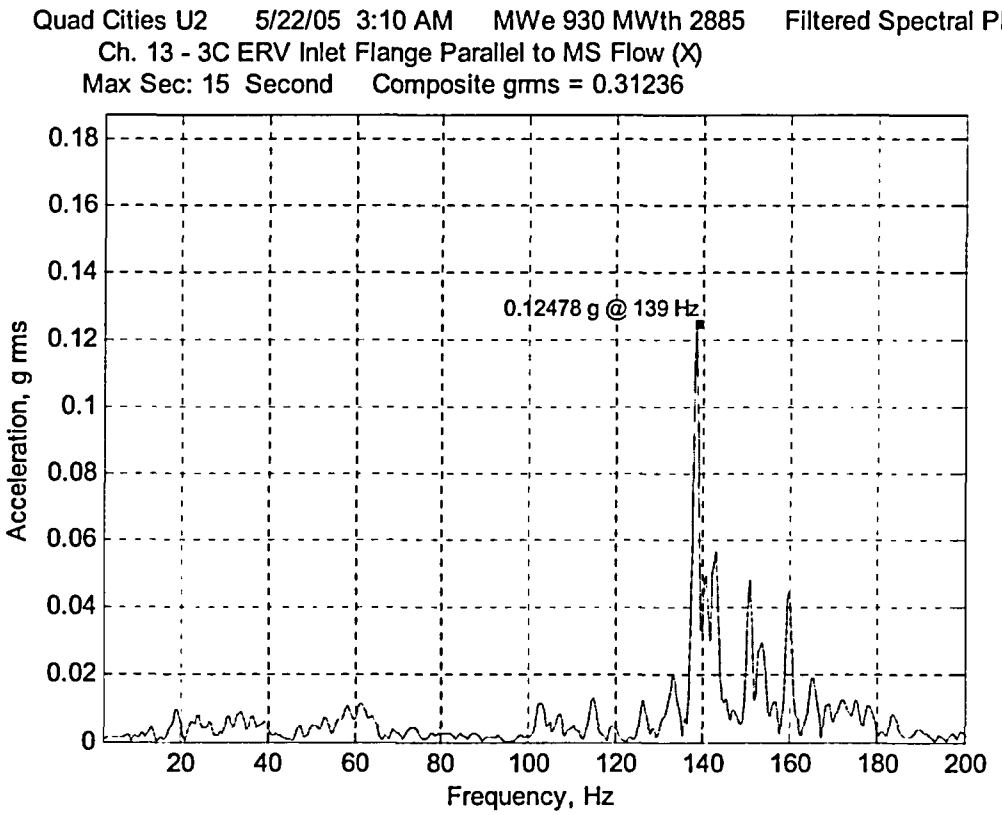



Quad Cities U2 5/22/05 3:10 AM MWe 930 MWth 2885 Filtered Spectral Plot
Ch. 2 - 3E ERV Inlet Flange Vertical (Y)
Max Sec: 26 Second Composite grms = 0.24823
0.078749 g @ 160.5 Hz
Acceleration, g rms
0.1
0.08
0.06
0.04
0.02
0
20
40
60
80
100
120
140
160
180
200
Frequency, Hz

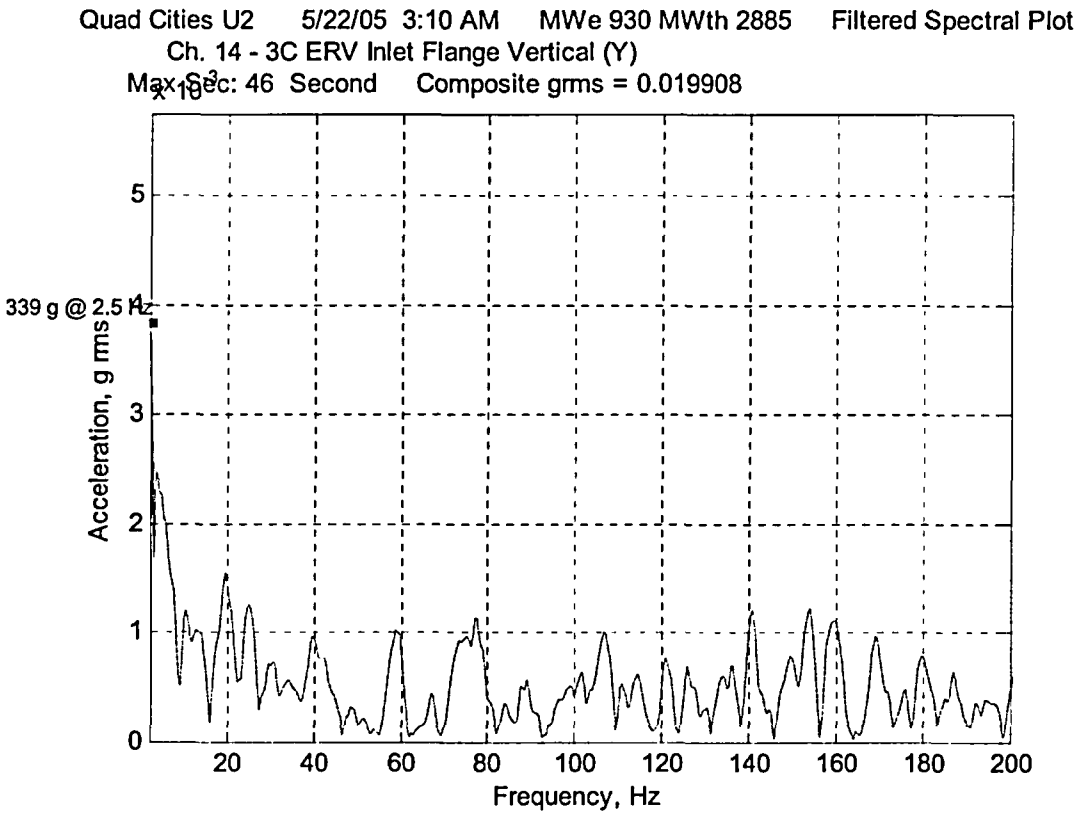
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



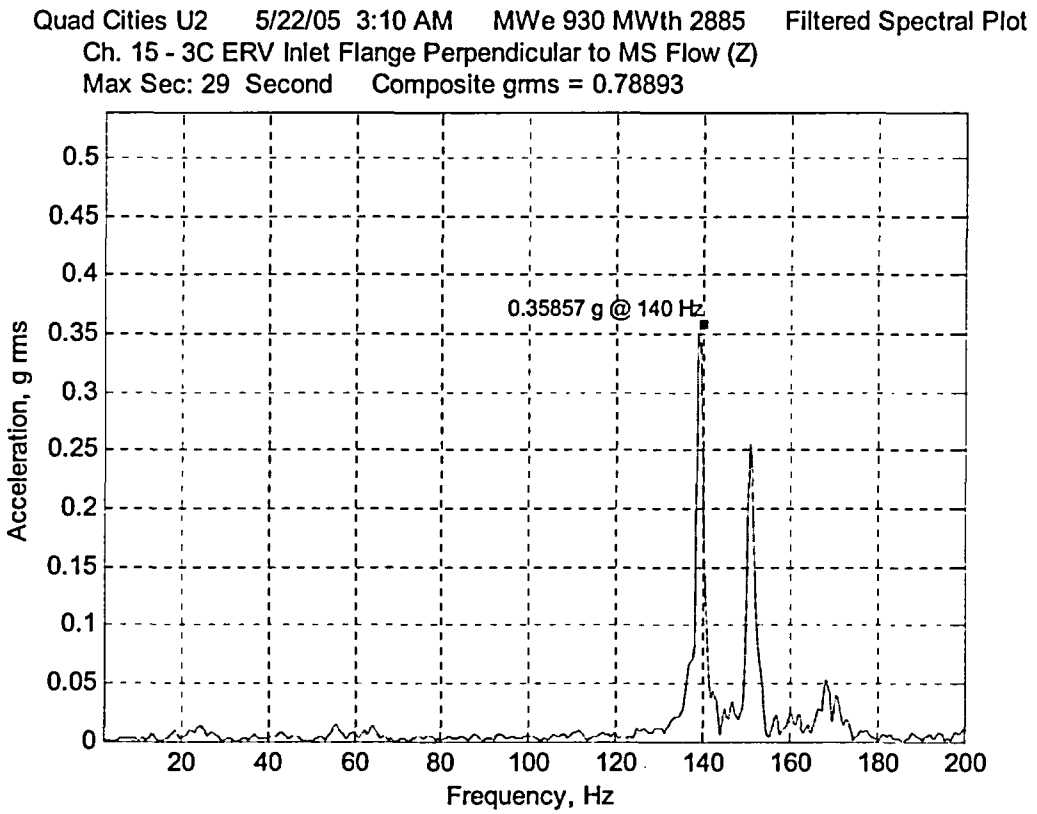
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



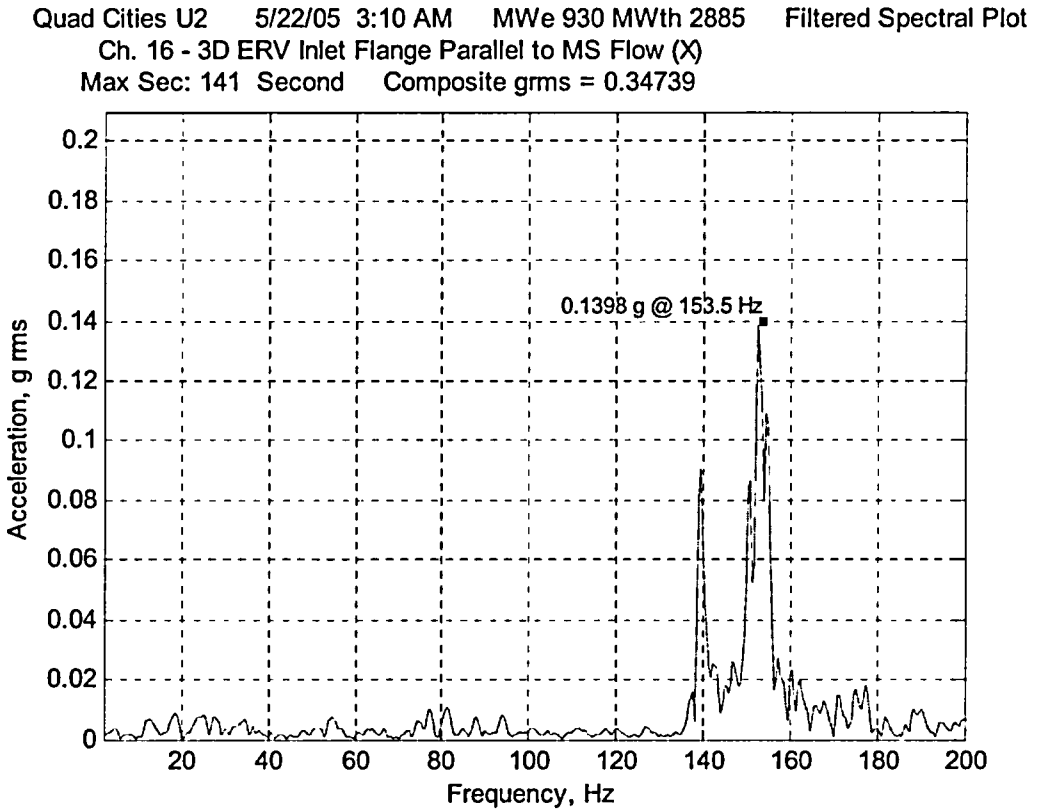
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



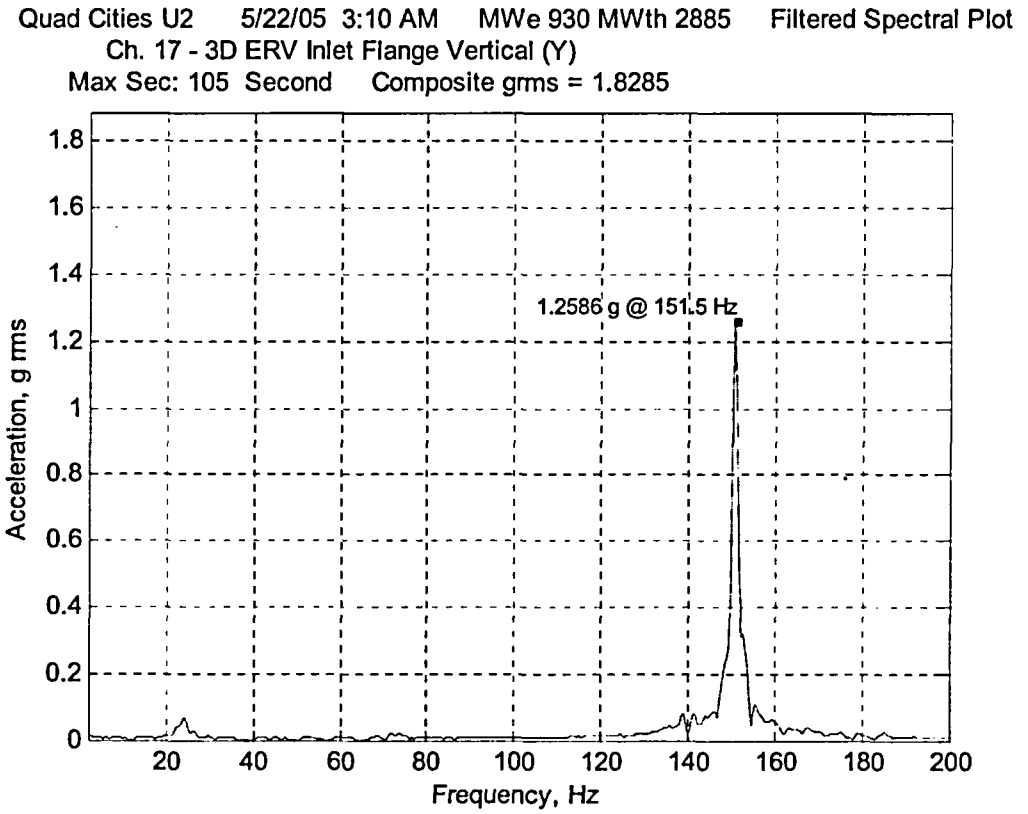
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth

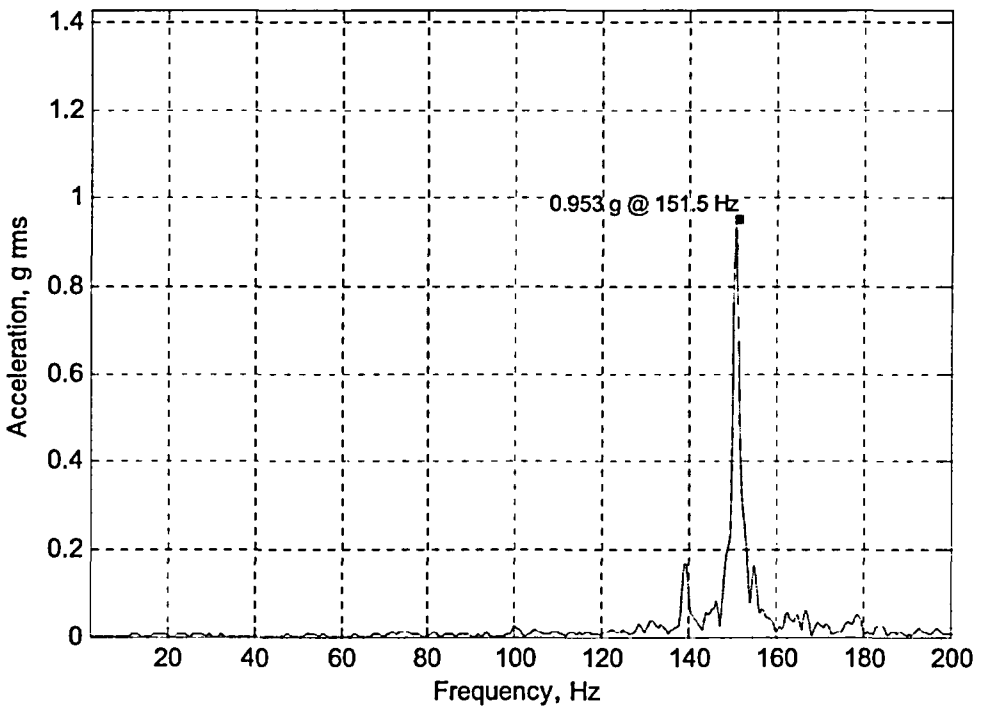


EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth

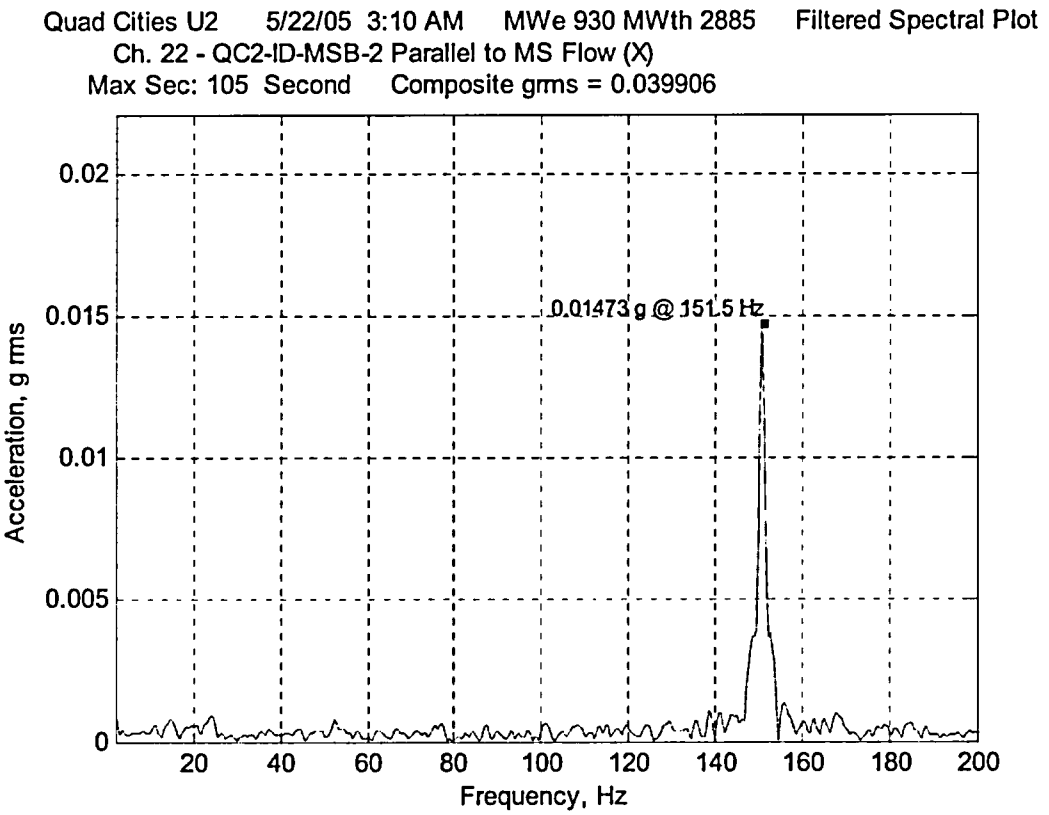


EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth

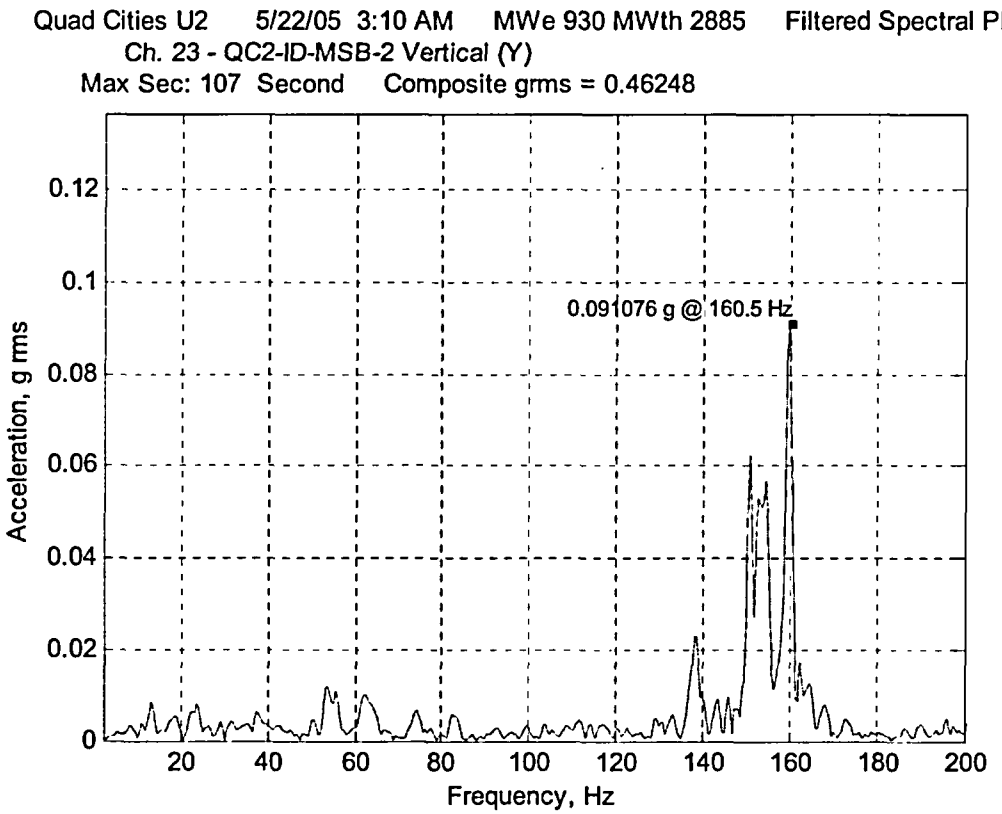
Quad Cities U2 5/22/05 3:10 AM MWe 930 MWth 2885 Filtered Spectral Plot
Ch. 18 - 3D ERV Inlet Flange Perpendicular to MS Flow (Z)
Max Sec: 23 Second Composite grms = 1.4207



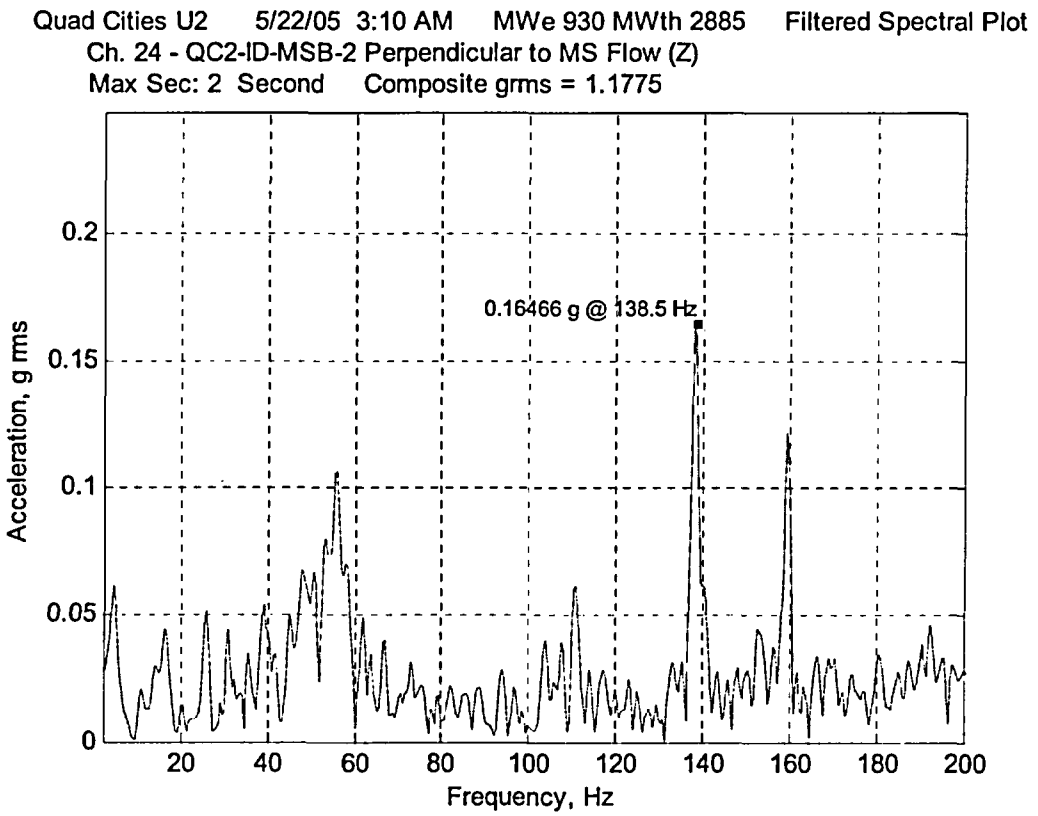
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



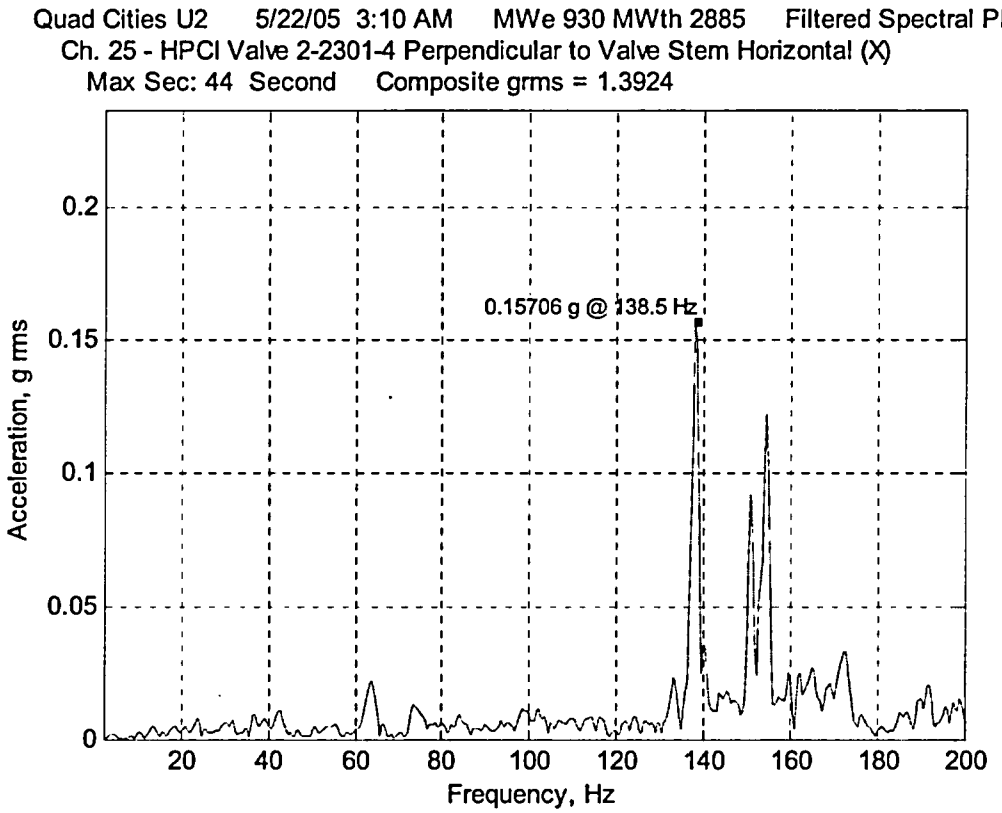
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



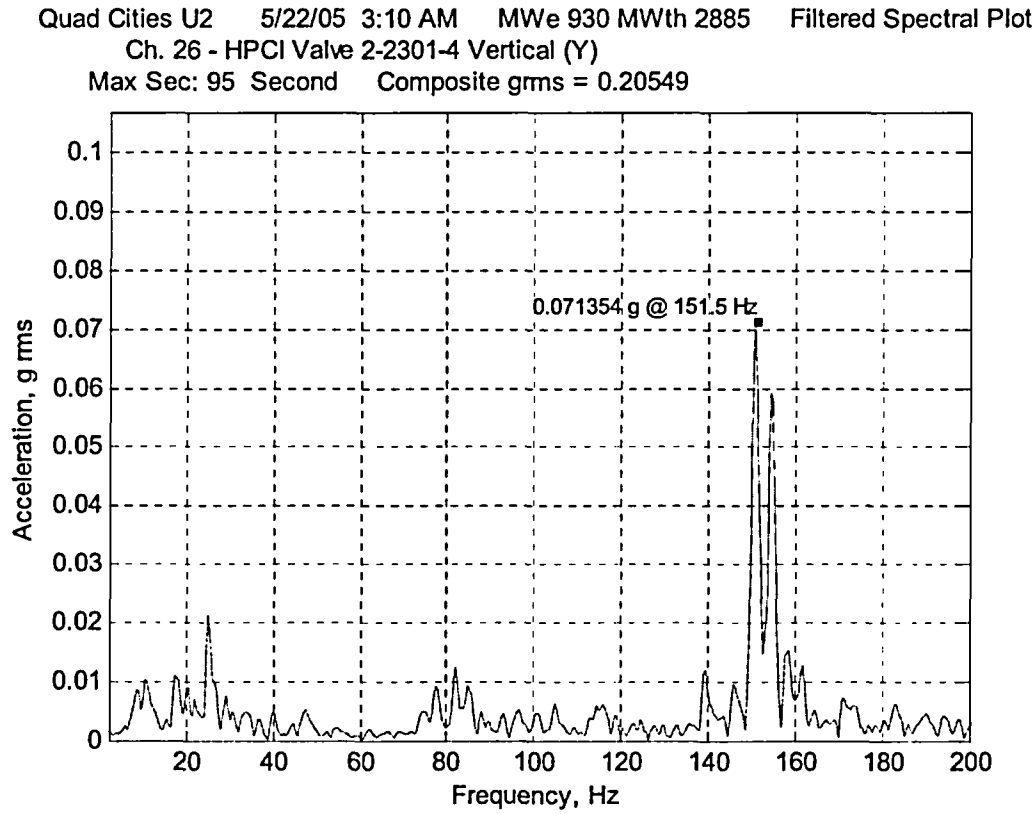
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



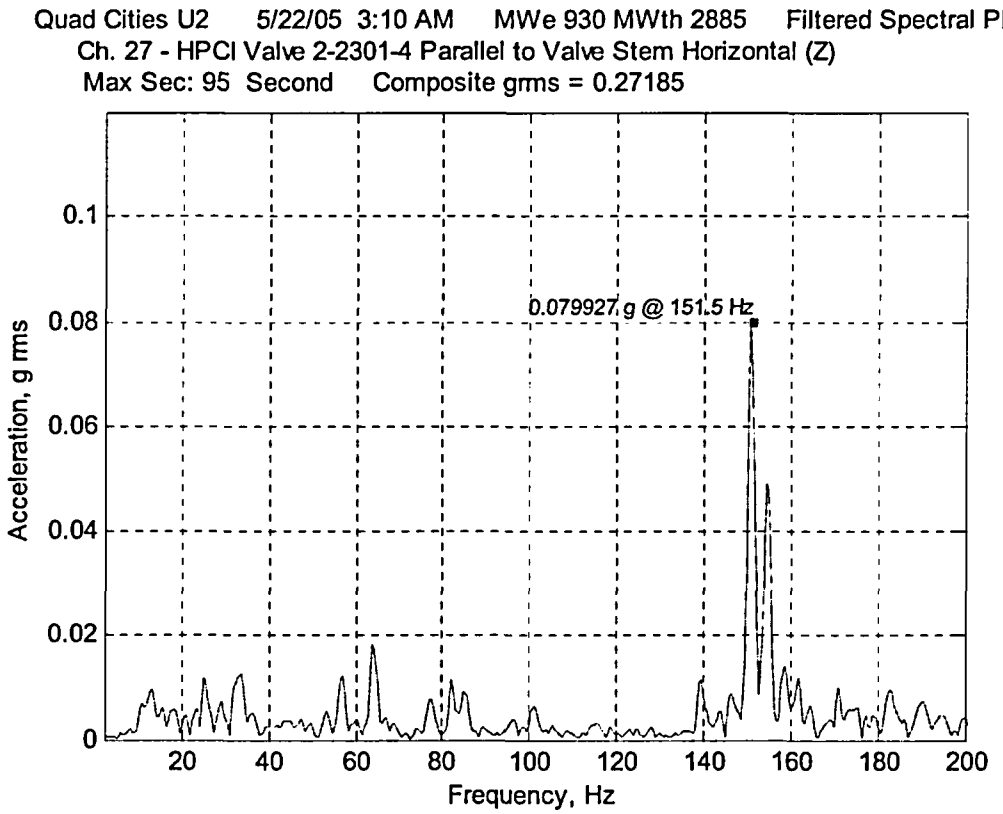
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



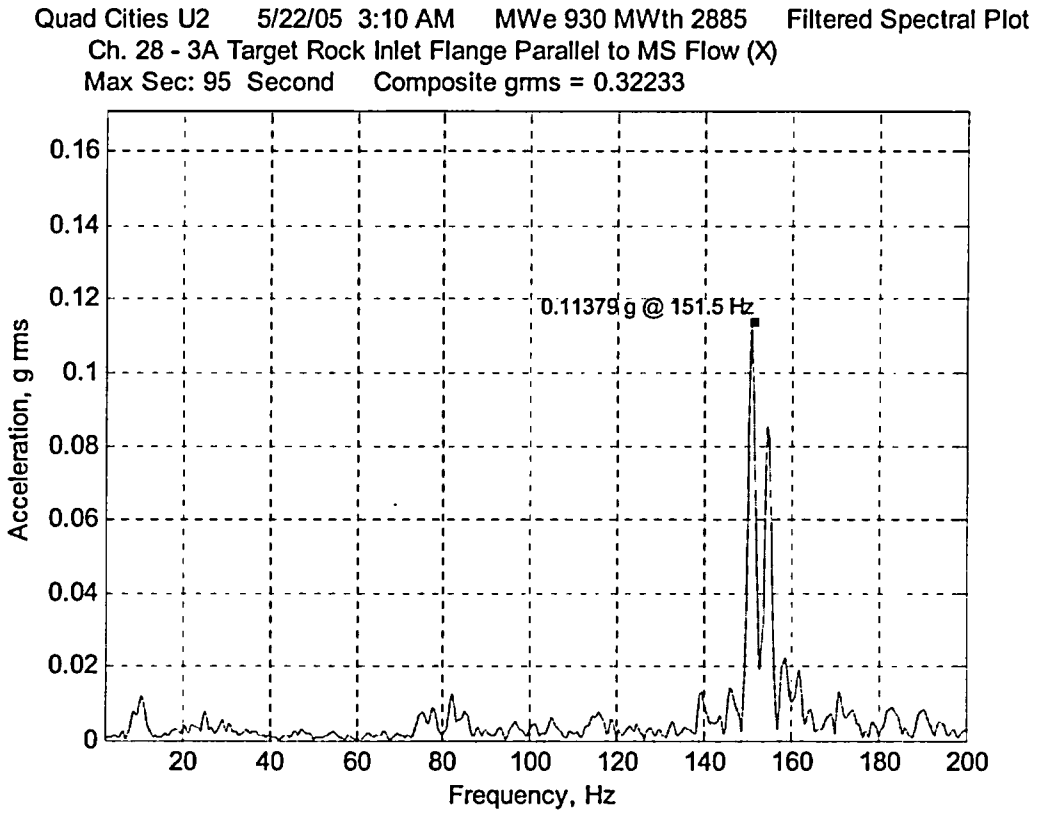
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



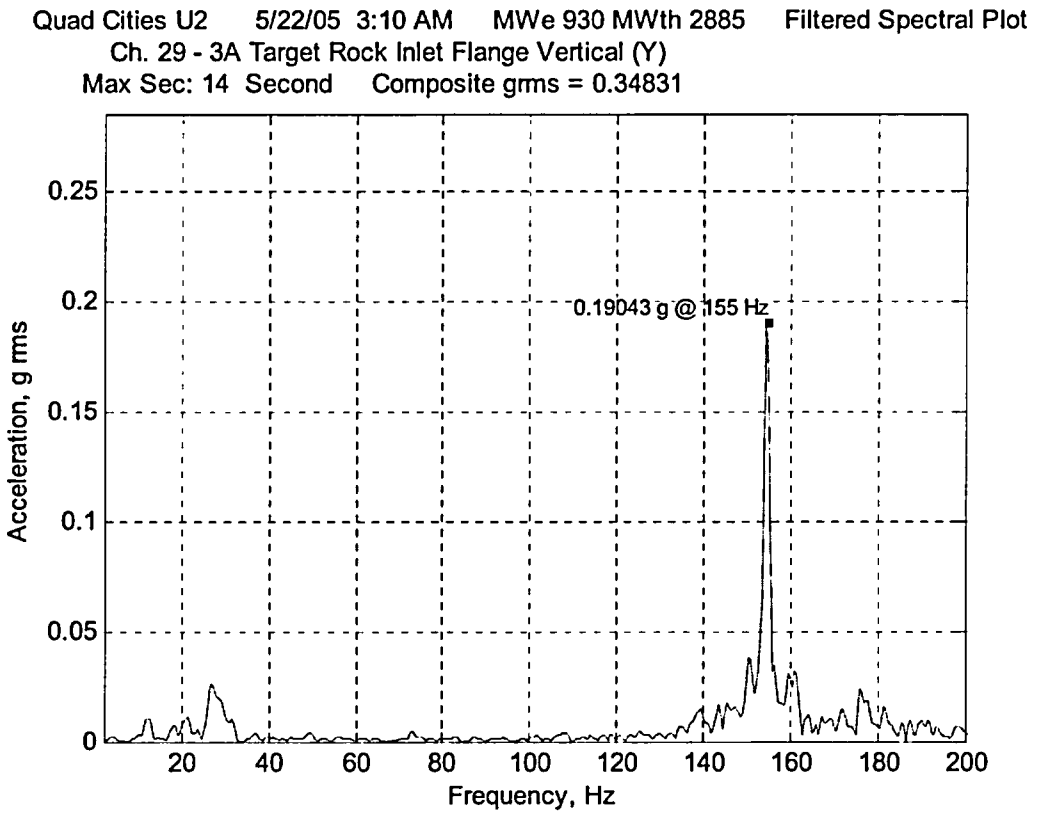
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



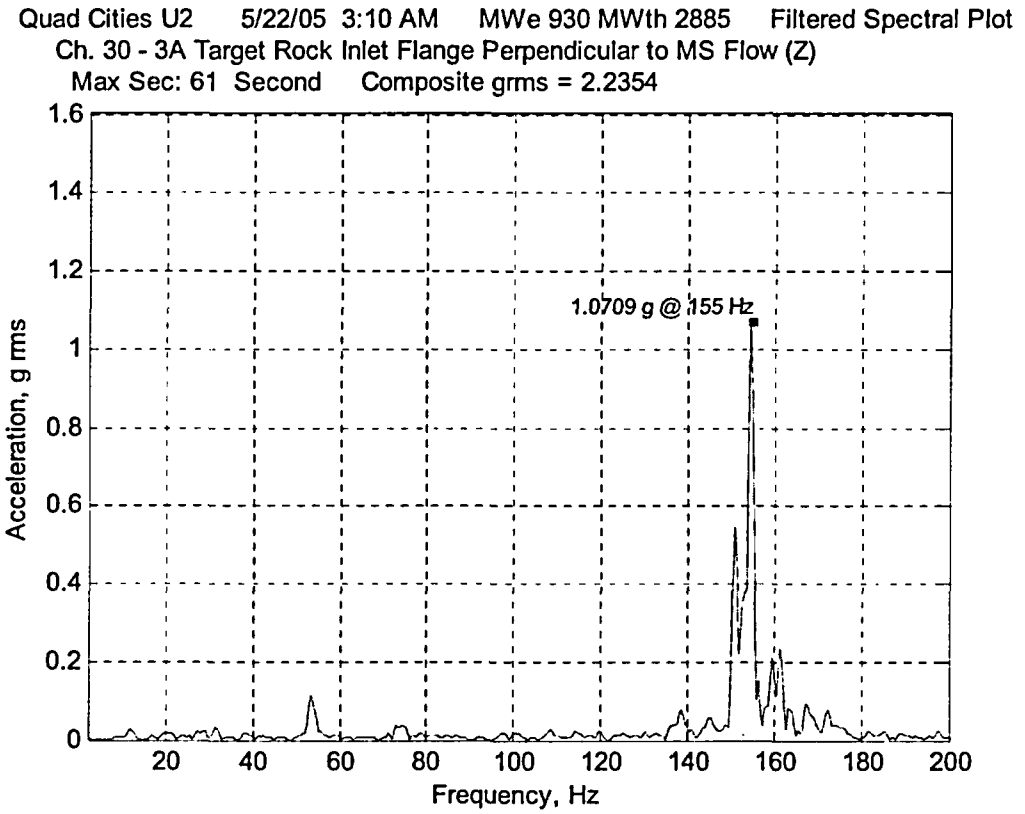
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



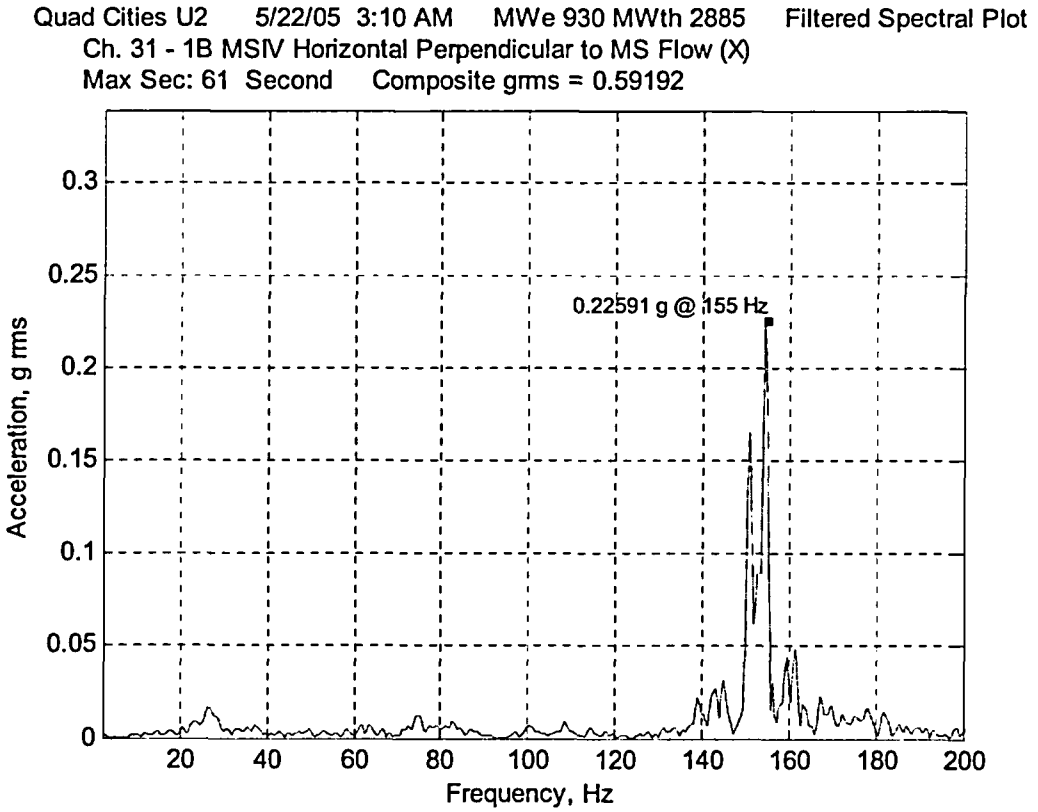
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



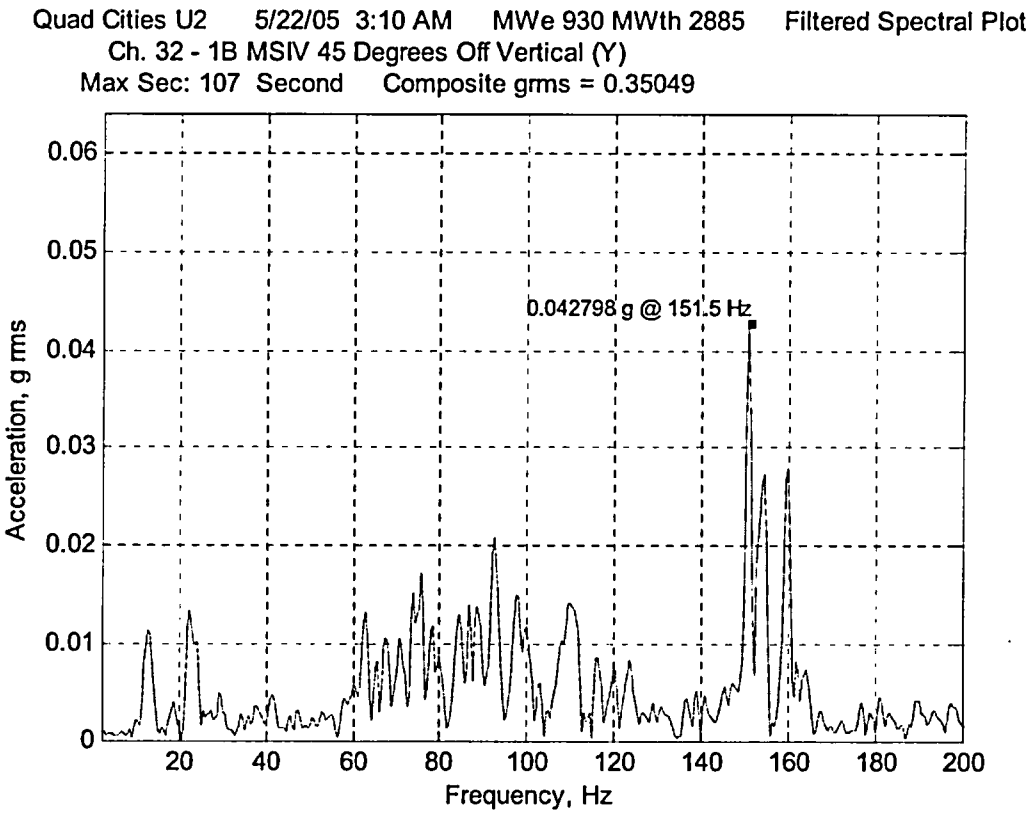
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



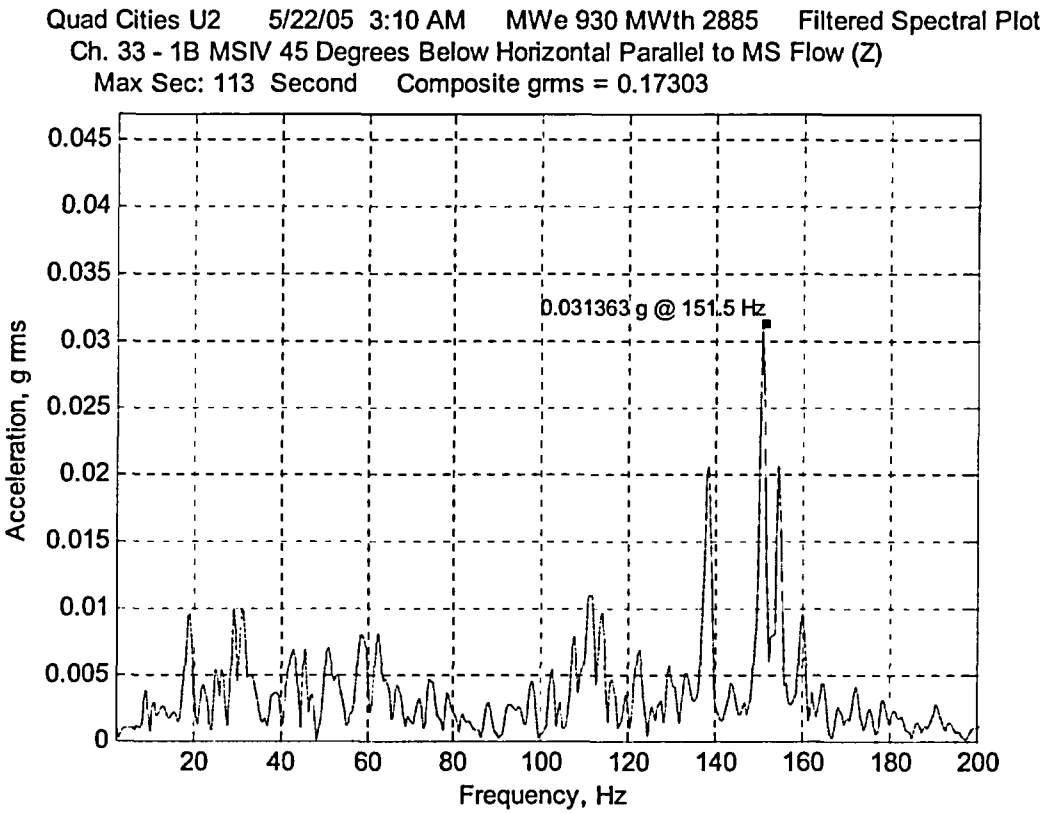
EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



EC 355702
Attachment 2
Data at 930 MWe / 2885 MWth



Q2P03 Summary of Unit 2 Vibration EOC Walk Downs

- Baseline Prior to EPU
- Loose Nuts & Historical Issues
- MS Drain Line Tie-Back redesigned
- No Nuclear Safety Concerns

EC 355702
Attachment 3
Summary of In-Plant Walkdowns

Q2P03 Summary of Unit 2 Vibration EOC Walk Downs

Monday May 9, 2005 MSIV Room, HP Heater Bay, LP Heater Bay, Drywell walk downs were complete for EHC, FW, HD and MS systems. The following issues were identified:

1) "A" and "C" moisture separator supports have loose nuts – IR 333271 & IR 333274-Q2R18 scope
2) Loose insulation on MS equalization line – IR 333339-Q2P03 scope
3) Loose insulation on crossover piping – IR 333304-Q2R18 scope
4) Loose nut on 6" steam line supply to Off Gas – IR 333348 –Q2P03 scope
5) "A" MS line has loose metal reflective cover – IR 333333 – Q2P03 scope
6) 2A RFP min flow line has support with missing nut – IR 333328 – Q2P03 scope
7) CEA plate on two supports have loose anchors – IR 333324 & 333706-Q2P03 scope
8) CEA plate on 2A and 2B MSDT spring hanger has loose anchor bolts – IR 333309 and IR 333312 –Q2P03 scope
9) 2A MSDT sub-cooling line loose clamp – IR 333281 –Q2P03 scope
10) 2B MSDT sub-cooling lines missing bolt – IR 333287 -support not required
11) 5 support rods were identified as being bent on various Turbine Drain Lines- IR 333305-repairs not required
12) Need to repair insulation on 3A target rock valve – IR 333366-Q2P03 scope
13) MSDT vent line has spring can with foreign material or deformed spring – IR 333302 – Q2P03 scope
14) 1A MS drain line tie-back support has cracked nut welds and nuts are backing off – IR 333168-Q2P03 scope
15) 2-3010 MS line has threaded rod support with both missing nuts and nuts that are loose – IR 333187 –Q2P03 scope
16) A turbine oil line has missing rod but pipe clamp still installed – IR 333357 –Q2P03 scope
17) #1 Bypass valve leaks EHC – IR 333189 –Q2P03 scope
18) All four control valve EHC hoses shall be replaced – IR 333196- Q2P03 scope
19) #2 ISV ETS connection EHC leak – IR 333205 –Q2P03 scope
20) Snubber TS # 2-56 (ISI # 3001A-M-102-3) missing clamp bolt nut - IR 334247 -Q2P03 scope

MS Line tie Back Supports
B-Line - Pictures with (1)

U-bolt failed, sheared off, with nuts still tack welded in place. Recommend this be repaired, obviously.

A-line - Pictures with (2)
U-bolt beat up pretty bad. Tack welds on back have failed and the U-bolt has been bent up and around sufficiently that there is a pretty big gap (See pictures 5 and 6). This also needs to be repaired.

D-line - Pictures with (3)
U-bolt looks pristine, but there is a pretty good gap all-around. Probably want to repair (recommend)

C-line - Pictures with (4)
U-bolt looks great. Doesn't need a repair.