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Hydride Transport Vessel Vibration and Shock Test Report

D. Gregory Tipton

Prepared by
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Albuquerque, New Mexico 87185 and Livermore, California 94550

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SAND--98-1230

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HYDRIDE TRANSPORT VESSEL VIBRATION AND SHOCK TEST REPORT

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Abstract

Sandia National Laboratories performed vibration and shock testing on a Savannah River Hydride Transport Vessel (HTV) which is used for bulk shipments of tritium. This testing is required to qualify the HTV for transport in the H1616 shipping container. The main requirement for shipment in the H1616 is that the contents (in this case the HTV) have a tritium leak rate of less than $1x10^{-7}$ cc/sec after being subjected to shock and vibration normally incident to transport. Helium leak tests performed before and after the vibration and shock testing showed that the HTV remained leaktight under the specified conditions. This report documents the tests performed and the test results.

DISCLAIMER

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HYDRIDE TRANSPORT VESSEL VIBRATION AND SHOCK TEST REPORT

1.0 Introduction

Sandia National Laboratories (SNL) performed vibration and shock testing on a Savannah River Hydride Transport Vessel (HTV). This testing is required to qualify the HTV as contents for shipment in the H1616 shipping container. Qualification requirements for the H1616 are described in the specification SS393217 [1]. The HTV was packaged inside an H1616-1 shipping container and subjected to 30 hours and 10 minutes of random vibration and 16 handling shocks. These tests were a follow-on to similar tests performed by SNL in 1992 [2]. This report documents the vibration and shock tests and test results.

2.0 Test Requirements

The testing was performed in accordance with the statement of work provided by Savannah River (SR) which can be found in Appendix A. The requirements in the statement of work were derived from the qualification specification SS393217. The basic requirement was that the HTV be subjected to vibration and shock normally incident to transport. In addition, the HTV was to be helium leak tested following the tests with an acceptable leak rate of less than 1×10^{-7} std cc/s helium.

The vibration and shock test specifications used for the testing are defined in *Transportation Environments of the AL-SX (H1616)* [3]. These test specifications and test durations were compiled into a test plan and a test procedure that served as the test control documents. Both the test plan and procedure can be found in Appendix B. The durations that were used for the tests represent the worst-case for shipment of the HTV as determined by SR. Table 1 lists the tests that were performed.

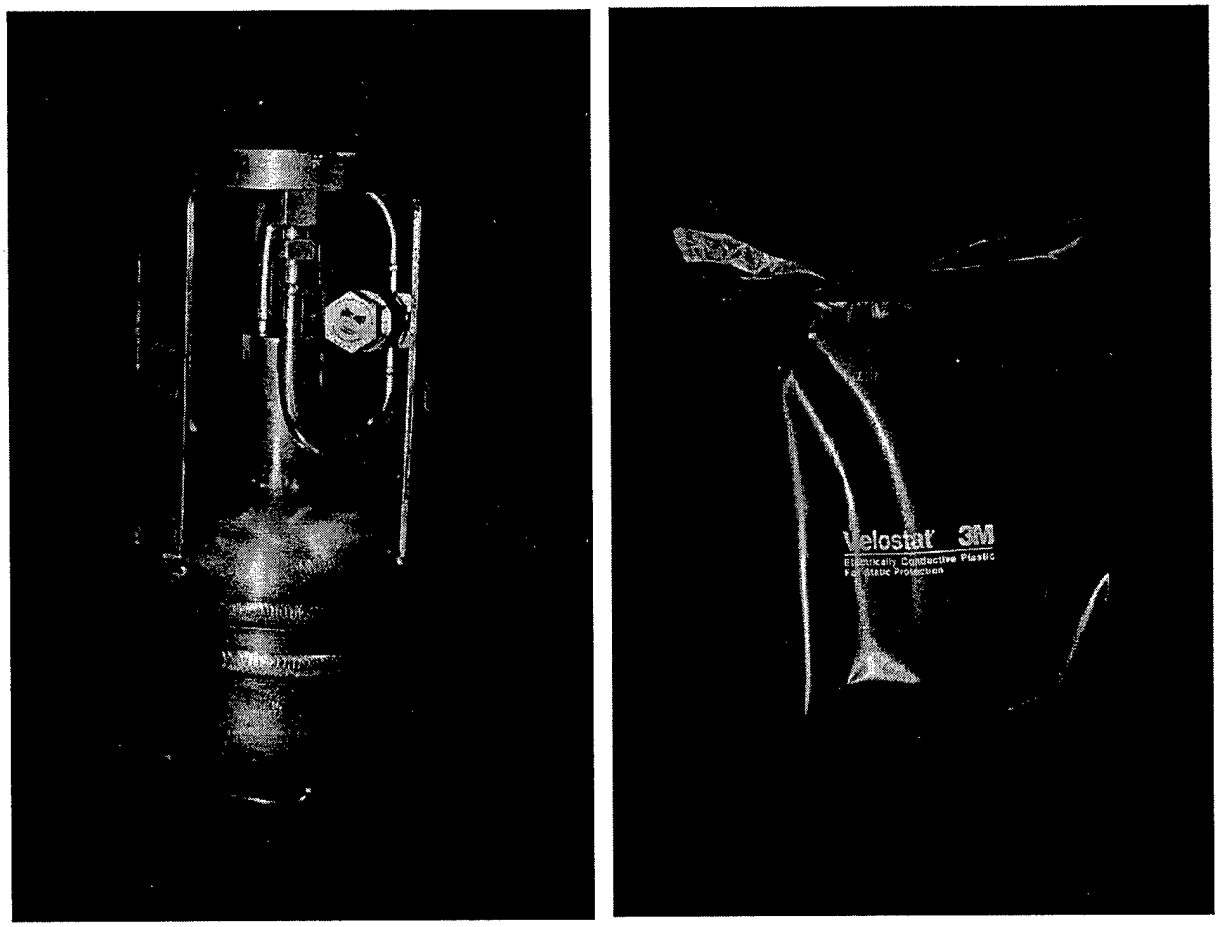
Table 1: Summary of Vibration and Shock Tests

Test Environment	Test Duration	Test Specification[a]
Road	9.75 hours	Figure A.1, vertical
Aircraft Cruise	20 hours	Figure A.6, vertical
Aircraft Takeoff/Land	5 sequences @ 5 min each	Figure A.7, vertical
Handling Shock	16 shocks	Handling Shock, vertical[b]

a. Figure from Appendix A of SAND91-2204 (Reference 3 to this report).
b. This shock is defined in the Department 9742 computer for generating shocks.

3.0 Test Description

The HTV used for the testing was a prototype supplied by Savannah River (Prototype #3 - see Figure 1(a)). The HTV was wrapped in a Velostat bag as in actual shipments (see Figure 1(b)). Testing was performed with the HTV packaged in a production H1616-1 container (overpack SN 13261) in a vertical orientation, which is the orientation used for shipment (see Figure 2). Figure 3 shows a schematic of the HTV packaged inside an H1616-1 as assembled prior to the testing.



(a) (b)

Figure 1. (a) Hydride Transport Vessel (HTV) Used for the Vibration and Shock Testing (b) HTV Wrapped Inside of the Velostat Bag.

The vibration test duration was what an HTV would be exposed to for transport from the user to the final destination including all foreseeable air flights, takeoff/landings, and transfers. Since the HTV is free to migrate inside the containment vessel of the H1616-1, only the initial and final orientations were known. Thus, the HTV received excitation in many different orientations due to the migration, as would occur in an actual shipment. All of the vibration and shock testing was done at ambient temperature.

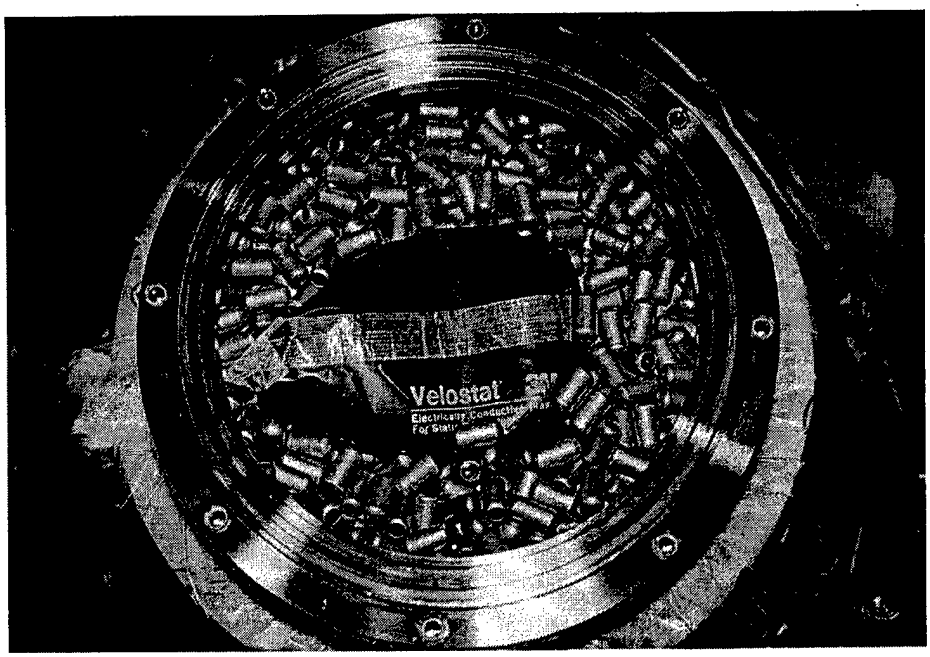


Figure 2. HTV Inside the H1616 Containment Vessel Prior to the Tests.

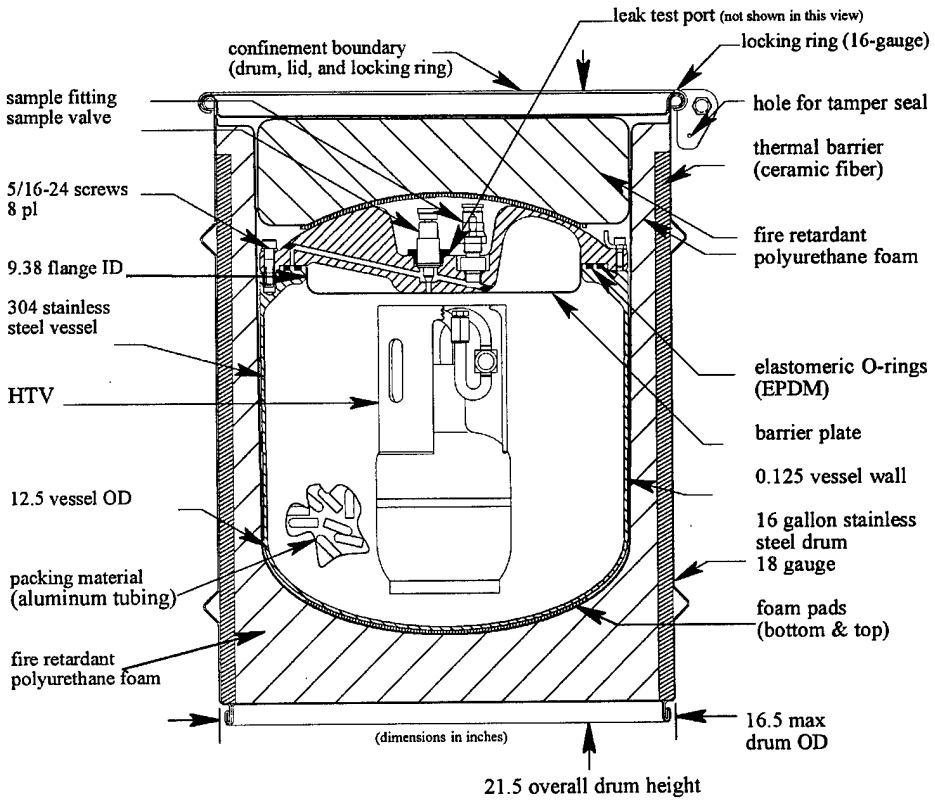


Figure 3. HTV Packaged Inside an H1616-1 Shipping Container.

Prior to the vibration and shock tests, the HTV was pressurized to 203 psig of helium (requirement of 200 ± 5 psig) then helium leak tested. Both valves on the HTV were torqued to 20 ± 1 in-lb. Following the vibration and shock tests, the HTV was leak tested and pressure checked to determine if helium had grossly leaked from the HTV. Figure 4 shows the H1616 test unit mounted to the vibration table.

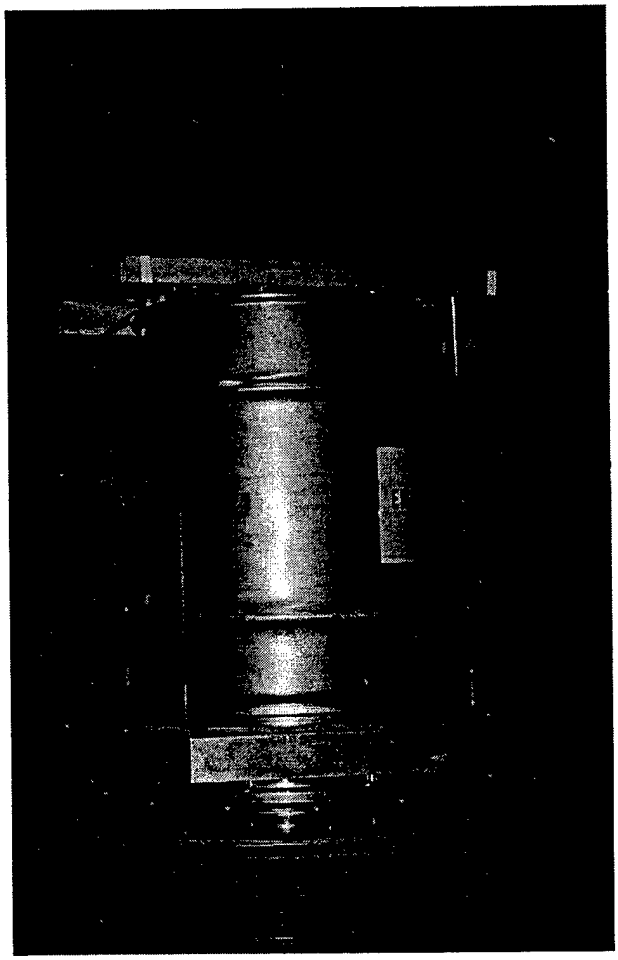


Figure 4. H1616 (with HTV) Mounted to the Vibration Table Prior to the Testing.

4.0 Test Results

All of the testing was performed between 3/5/98 and 3/13/98. All data sheets were completed during the testing and can be found in Appendix B. Savannah River requested that both valves be torqued to 20 ± 1 in-lb instead of one valve being torqued to 15/ +1-0 and the other to 20 ± 1 in-lb. This change was requested after the test procedure was approved, thus the procedure was changed and initialed by the project leader.

Department 9742 completed the vibration and shock testing as specified in the test plan. Control accelerometer data is illustrated in Appendix C for the random vibration and shock tests.

No significant amount of helium was detected in the containment vessel upon disassembly indicating that the HTV had not grossly leaked during the testing. An evacuated envelope helium leak test was then performed on the HTV using the H1616 containment vessel as a bell-jar. Leak test results are presented in Table 2.

Table 2: Helium Leak Test Results

Test	Helium Leak Rate (cc/sec)
Pre-test on HTV (evacuated envelope)	6.9×10^{-10} a
Post-test on HTV (evacuated envelope)	2.5×10^{-9} b

a. At test conditions of 24.4°C HTV temperature, 202.7 psig HTV pressure, and 0.01 torr CV pressure.

b. At test conditions of 23.2°C HTV temperature, 202.7 psig HTV pressure, and 0.01 torr CV pressure.

After leak testing was completed the H1616-1 containment vessel was disassembled and the HTV was pressure tested. This test was an additional check to determine that the helium was still present in the HTV. The test line was pressurized to 203 psig, and the connected valve on the HTV was opened. The subsequent pressure reading was 202 psig. This 1 psig difference can be accounted for by the 1°C difference in temperature at the time of pressurization and during this pressure test. However, the purpose of this test was only to verify the presence of helium inside the HTV.

Upon disassembly the HTV was found in a horizontal orientation (see Figure 5) and the velostat bag was ripped in numerous places (see Figure 6). Minor scratches on the containment vessel and deformed packing material were also found. Such observations were expected and have no detrimental effect on either the function of the H1616 or the HTV.

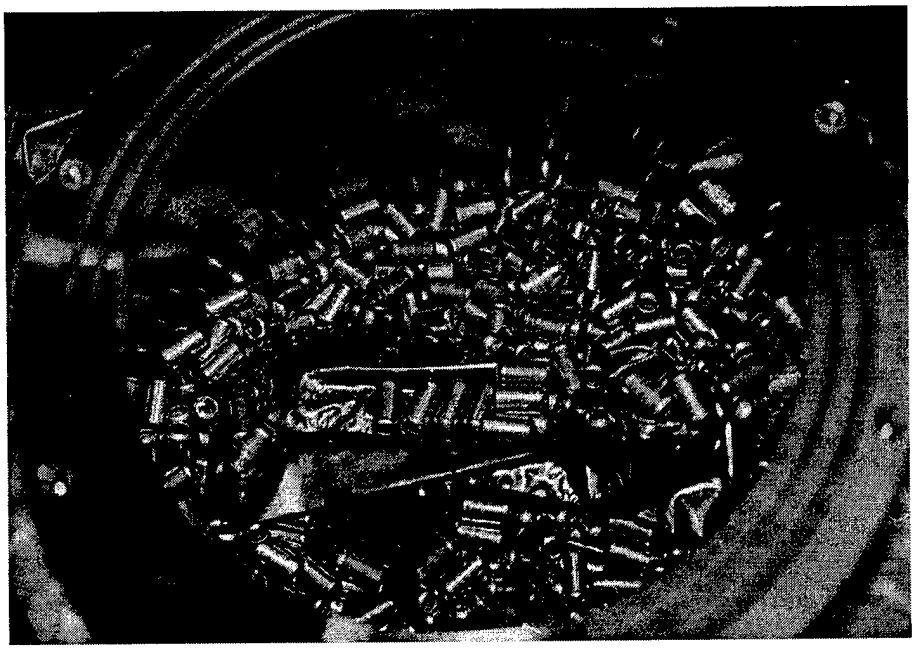


Figure 5. HTV Inside the H1616 Containment Vessel During Disassembly.

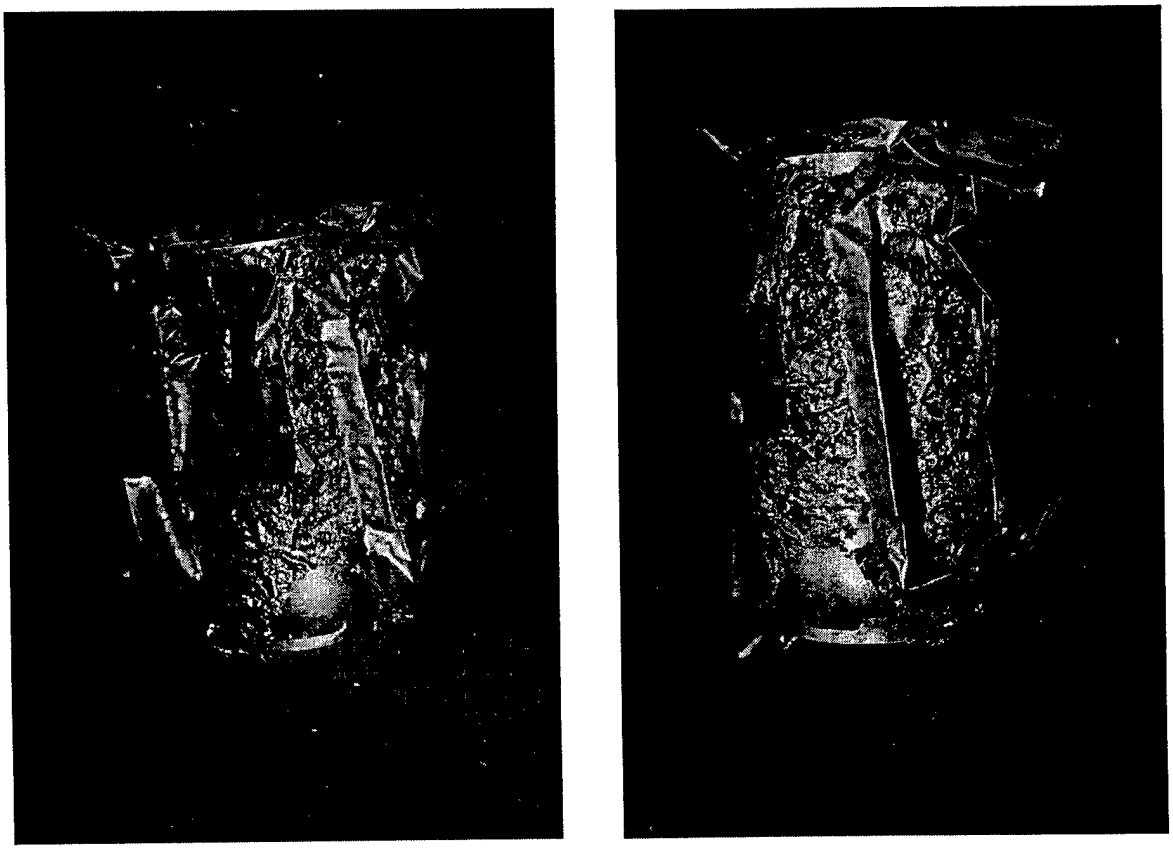


Figure 6. HTV After the Vibration and Shock Testing.

5.0 References

1. SS393217, *Reservoir Qualification, AL-SX (H1616)*, Sandia National Laboratories.

2. SAND92-2377, *Vibration and Shock Test Report for the H1616-1 Container and the Savannah River Hydride Transport Vessel*, Sandia National Laboratories, November 1992.

3. SAND91-2204, *Transportation Environments of the AL-SX (H1616)*, Sandia National Laboratories, November 1991.

Appendix A
Statement of Work

1. SCOPE OF WORK

1.1 General Description of the Service

The objective of this task is to provide vibration and shock testing necessary to qualify the Hydride Transport Vessel (HTV) for shipment in the Sandia-Albuquerque H1616 packaging. Work will essentially be a repeat of work performed by Sandia National Laboratory (SNL) in 1992 but now with the HTV valves closed to a lower torque. The previous work is documented in SAND92-2377.

1.2 Background

SNL will provide shock and vibration testing equivalent to that performed in 1992 and which will be used by WSRC as a basis for qualification of the HTV at a reduced valve closure torque.

2. REFERENCES

SAND92-2377, *Vibration and Shock Test Report for the H1616-1 Container and the Savannah River Hydride Transport Vessel*, SNL, Albuquerque, 11/92.

3. WORK REQUIREMENTS

3.1 Technical Requirements

3.1.1 Test bases are:

Sandia Specification SS393217, "Reservoir Qualification AL-SX (H1616)", paragraph 3.6, "Vibration" and paragraph 3.7, "Shock," with scenarios used to support SAND92-2377.

3.1.2 Test (not task) acceptance criteria for the HTV, derived from SS393217 paragraph 3.10, "Acceptance criteria", are:

The HTV shall remain leaktight to $< 1 \times 10^{-7}$ std cc/sec helium. If the HTV fails this criteria, each valve shall be evaluated against the criteria.

3.1.3 Test input and requirements are:

The HTV containment boundary is the vessel body and external tubing up to and including the valve seat seals.

WSRC will qualify the prototype HTV for 200 psig service by proof testing to 250±5 psig. The HTV will be provided unpressurized with the valves open and the fittings capped with plastic inserts. SNL is to return the HTV to WSRC in this same configuration. The prototype HTV contains no hazardous material, but does contain steel shot to simulate a distributed content mass.

Testing is to be done in an H1616-1 packaging provided by SNL. The HTV is to be tested with the provided Cajon VCR fittings, which include weep holes for test purposes, and be packed in a Velostat® bag.

Testing is to be done with the HTV pressurized to its maximum normal operating pressure (MNOP) of 200 psig with helium. Ambient temperature and external pressure is to be used.

The HTV containment boundary must not be disturbed until post-test leak testing has been performed and, if failed, until WSRC has been notified and has provided disposition.

WSRC will provide the valve closure torque separately. SNL must ensure that this torque is used.

WSRC will provide the HTV with lubricated valves. If SNL must remove the lubricant, Fel-Pro N-5000 or a WSRC-approved equivalent shall be reapplied to the valve threads and stem top.

3.1.4 Testing should follow this plan:

Pressurize the HTV to its MNOP, close and assemble VCR fittings.

Leak test the HTV. If it fails, stop work and notify WSRC for disposition.

Package the HTV in the H1616 and measure background helium.

Perform the vibration and shock testing as specified in paragraph 3.1.1.

Test for helium in the H1616 to assess if the HTV grossly leaked during vibration and shock testing.

Unload the H1616 and visually inspect the HTV and H1616 for damage or unusual conditions.

Leak test the HTV and verify that it has remained pressurized. If the general test fails, test each valve separately. If leak failure occurs, do not disturb the containment boundary (valves) until dispositioned by WSRC.

3.2 WSRC Furnished Materials, Equipment, or Services

WSRC will provide the HTV prototype with plastic shipping cap and plug and Cajon VCR test cap and plug and gaskets. SNL shall return these to WSRC.

3.3 Quality Requirements

All Measuring and Test Equipment (M&TE) shall be calibrated and traceable to NIST. SNL deliverables shall identify the M&TE used and associated calibration and expiration dates.

The WSRC engineer coordinating the testing shall approve the SNL test procedures prior to work being performed. Approvals may be by FAX or e-mail.

3.4 Site Conditions

All work will be conducted at SNL-Albuquerque.

3.5 Period of Performance/Schedule

All work will be completed within 3 months of contract award.

3.6 Personnel Qualifications/Certification

Persons performing leak testing shall be qualified per SNL practice.

3.7 Deliverables

A documented test report describing the test requirements and criteria, test parameters, test procedures, personnel performing work, implementation, results, and assessment to the criteria.

4. ACCEPTANCE OF SERVICES

4.1 Final Acceptance Method

The WSRC engineer coordinating the testing shall document acceptance of the SNL test report.

4.2 Inspection/Testing Requirements

WSRC receipt inspection will ensure all documents are delivered.

WSRC Surveillances and Audits

WSRC reserves the right to conduct onsite surveillances and audits.

Appendix B
Test Plan & Test Procedure

PLAN FOR TESTING THE H1616 AND THE SAVANNAH RIVER HYDRIDE TRANSPORT VESSEL

PREPARED BY: _____ 3/2/98
D. G. Tipton, 2165 — DATE
H1616 Project Leader

REVIEWED BY: _____ 3/2/98
R. E. Glass, 2165 — DATE
H1616 Systems Engineer

_____ 3-2-98
R. S. Pacheco, 2165 — DATE
H1616 Q. A. Engineer

APPROVED BY: _____ 3/4/98
T. D. Hernandez, 2165 — DATE
Department Manager

See attached sheet DGT 3/5/98
M. N. Van Alstine — DATE
WSRC Test Coordinator
WSRC/SNL LIAISON

H1616/HYDRIDE TRANSPORT VESSEL TEST PLAN

1 REVISIONS and DISTRIBUTION

Table 1. Issue Summary

Issue	Date	Comments
A	10/5/92	Original
B	3/2/98	New issue for re-qualification testing of the HTV

Table 2. Distribution for Information Copies

Name	Organization	Copies
D.G. Tipton	SNL 2165	1
T.D. Hernandez	SNL 2165	1
J.J. Molina	SNL 2165	1
R.E. Glass	SNL 2165	1
R.S. Pacheco	SNL 2165	1
AL-SX File 21.2	SNL 2165	1
D. Powers	SNL 9742	1
M.N. VanAlstine	WSRC L8640	1

Table 3. Controlled Copies

Copy	Rev	Date	Org.	2165 Project Task
1	B	B.J. Joseph	2165	Technical Support Personnel

The signatures below verify receipt of Controlled Copies of this procedure.

Controlled Copy #1 received by: _____ date: 3/5/98

2 INTRODUCTION

This test plan describes vibration and shock tests that will be performed for qualification of the Savannah River Site hydride transport vessel (HTV) for transport in the H1616 shipping container. The H1616 packaging will contain an HTV pressurized with helium. The objective of the tests is to satisfy Requirements 3.6 and 3.7 in Sandia Specification SS393217, *Reservoir Qualification AL-SX (H1616)*. Thus, the H1616 and hydride vessel contents will be subjected to vibration and shock normally incident to transport, and helium leak tests will determine if the hydride vessel remains leaktight during and following the simulated transportation environments. The hydride vessel, manufactured from stainless steel and standard fittings and valves, is designed and procured by Westinghouse Savannah River Company (WSRC) and will not contain hazardous materials. These tests are a follow on to similar testing performed on the HTV in 1992.

3 TEST UNIT

The H1616 test unit will be an H1616-1 since this will be the main mode of transport for the HTV. The total weight of the H1616-1 with the HTV will be ~131 lb. The HTV (Figure 1) will be supplied by WSRC. The HTV consists of a body of 4.56-inch maximum diameter which is the pressure vessel. An impact protector that also serves as a lifting device is welded to the body and protects two Nupro valves and related tubing. The HTV weighs approximately 10 lb. The HTV will be pressurized to 200±5 psig of helium for the tests. The maximum allowable pressure of the HTV is 945 psig at 600°C, and the HTV used in this test will be proof tested to 250±5 psig by WSRC prior to shipment to Sandia (results to be included with shipment).

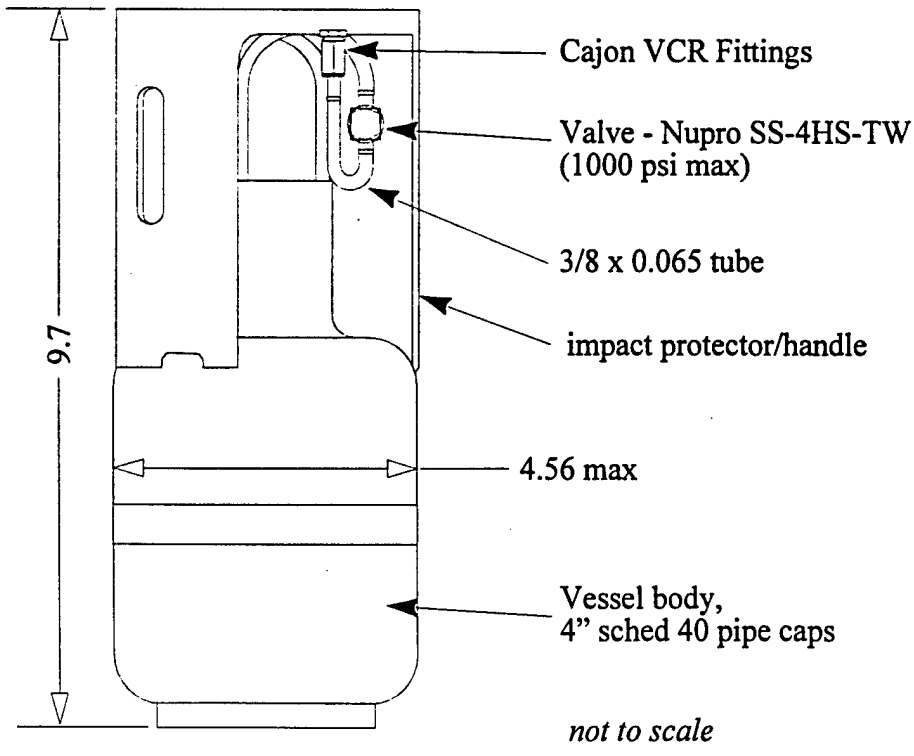


Figure 1. Hydride Transport Vessel

The HTV will be filled with steel shot to simulate the contents. Since the HTV will be totally contained within the H1616 containment vessel, there will be no hazard if the HTV releases its pressure. The H1616-1 containment vessel is rated for 298 psig per the ASME Boiler and Pressure Vessel Code, and has a burst pressure of 1014 psig.

There are two Nupro valves (SS-4HS-TW) on the HTV. One valve has a male VCR fitting at the end of the connected tubing, the other has a female VCR fitting at the end of the connected tubing. The valves shall be torqued for the testing to 15 +1/-0 (valve with associated female VCR fitting) and 20 $\pm$ 1 in-lb (valve with associated male VCR fitting).

4 TEST REQUIREMENTS

The test requirements are generated from the transport scenario listed in Table 4. The scenario was developed by WSRC and is specific to the HTV.

Table 4. Transport Scenario

From	To	Transport Mode/Duration
Facility 1	Facility 2	Road / 8 hr
Facility 2	Airport 1	Road / 1 hr
Airport 1	Airport 2	Air / 3 hr
Airport 2	Airport 3	Air / 3 hr
Airport 3	Airport 4	Air / 3 hr
Airport 4	Airport 5	Air / 8 hr
Airport 5	Airport 6	Air / 3 hr
Airport 4	Interim Storage	Road / 45 min

The transport scenario listed in Table 4 is translated into specific transportation environments listed in Table 5. Since the HTV can migrate into any position in the H1616 containment vessel, only vertical vibration and shock spectra shall be used. The vertical spectra are, in general, more severe than those in the longitudinal or transverse directions.

Table 5. Transport Environments

Transport Environment	Test Duration	Test Specification[a]
Road	9.75 hr	Figure A.1, vertical
Aircraft Cruise	20.0 hr	Figure A.6, vertical
Aircraft Takeoff/Land	5 sequences @ 5 min ea	Figure A.7, vertical
Handling Shock	16 shocks	Handling Shock, vertical[b]

a.See Appendix A of SAND91-2204 for these figures.
b.Handling shock time history is shown in Figure D.4 at the end of this plan.

5 VIBRATION and SHOCK TESTS

5.1 Test Parameters

A total of 30 hours 10 minutes of vibration testing and 16 shocks shall be conducted by Department 9742 at the vibration facility in Building 860. The H1616 shall be secured to the vibration table in the vertical configuration. Testing shall be done at ambient temperature. The testing can be conducted in any order.

5.2 Test Sequence

Table 6. Test Sequence Steps

Step	Description
1	Perform pressurized envelope leak test on HTV.[a]
2	Pressurize HTV with 200±5 psig helium.
3	Secure HTV in a velostat bag with tape.
4	Load HTV in H1616 with longest dimension vertical (with a vertical orientation of H1616).
5	Perform evacuated envelope helium leak test on the HTV while in the H1616.[a]
6	Complete assembly of the H1616 containment vessel and perform pressurized envelope helium leak test. Assemble H1616 overpack.
7	Transport H1616 to test facility in Building 860.
8	Conduct vibration and shock test.
9	Transport H1616 to building 809.

Table 6. Test Sequence Steps

Step	Description
10	Perform evacuated envelope helium leak test on the HTV while in the H1616.[a]
11	Perform pressurized envelope helium leak test to verify integrity of the H1616 containment vessel following the tests.
12	Disassemble H1616, remove and inspect HTV for damage or unusual conditions, and check valve torques.[a]
13	Verify that there is pressure in the HTV.[a]
14	Vent HTV and inspect for damage.[a]
15	Verify function of valves and fittings on the HTV[a]

a.Hold point, if HTV fails evaluation notify WSRC.

5.3 Data Requirements and Documentation

Accelerometers used to gather data shall have a valid calibration certificate. All leak testing equipment, torque wrenches, and pressure gages shall be in current calibration.

Department 9742 shall provide the following:

- one PSD plot for each vibration run with a unique input,
- one shock response spectrum plot for the shock tests.

Department 2165 shall photograph the test setup during the tests and the HTV following the tests. A test report including all test documentation will be prepared and distributed to WSRC.

6 HTV LEAK TEST EVALUATIONS

The leak detector used for leak testing and associated equipment shall have valid calibration certificates. Department 2165 approved leak test procedures will be used.

6.1 Pretest Helium Leak Test

As listed in Table 6, two leak tests will be conducted on the HTV prior to the tests. The first shall be a pressurized envelope test where the mass spectrometer leak detector (MSLD) is connected to the HTV, and the HTV is evacuated. When the pressure drops to the operating level of the MSLD, the exterior of the HTV will be surrounded by a tent of helium. The MSLD will be put in the test mode, and the appropriate data recorded.

The second leak test will be an evacuated envelope leak test on the HTV, and will be conducted after loading the HTV into the H1616 containment vessel. The containment vessel will be evacuated which will subject the exterior of the HTV to a vacuum. A leak in the HTV will be detected by the MSLD via the valve and quick connect on the H1616 containment vessel.

Acceptance of all helium leak tests requires a leak rate less than or equal to 1×10^{-7} std cc/s helium.

6.2 Posttest Helium Leak Test

The evacuated envelope leak test will be repeated following the vibration and shock tests to determine if the HTV leaked during or following the tests. If the HTV leaked during the tests. More detailed investigations on each valve shall be performed to determine the source of the leak.

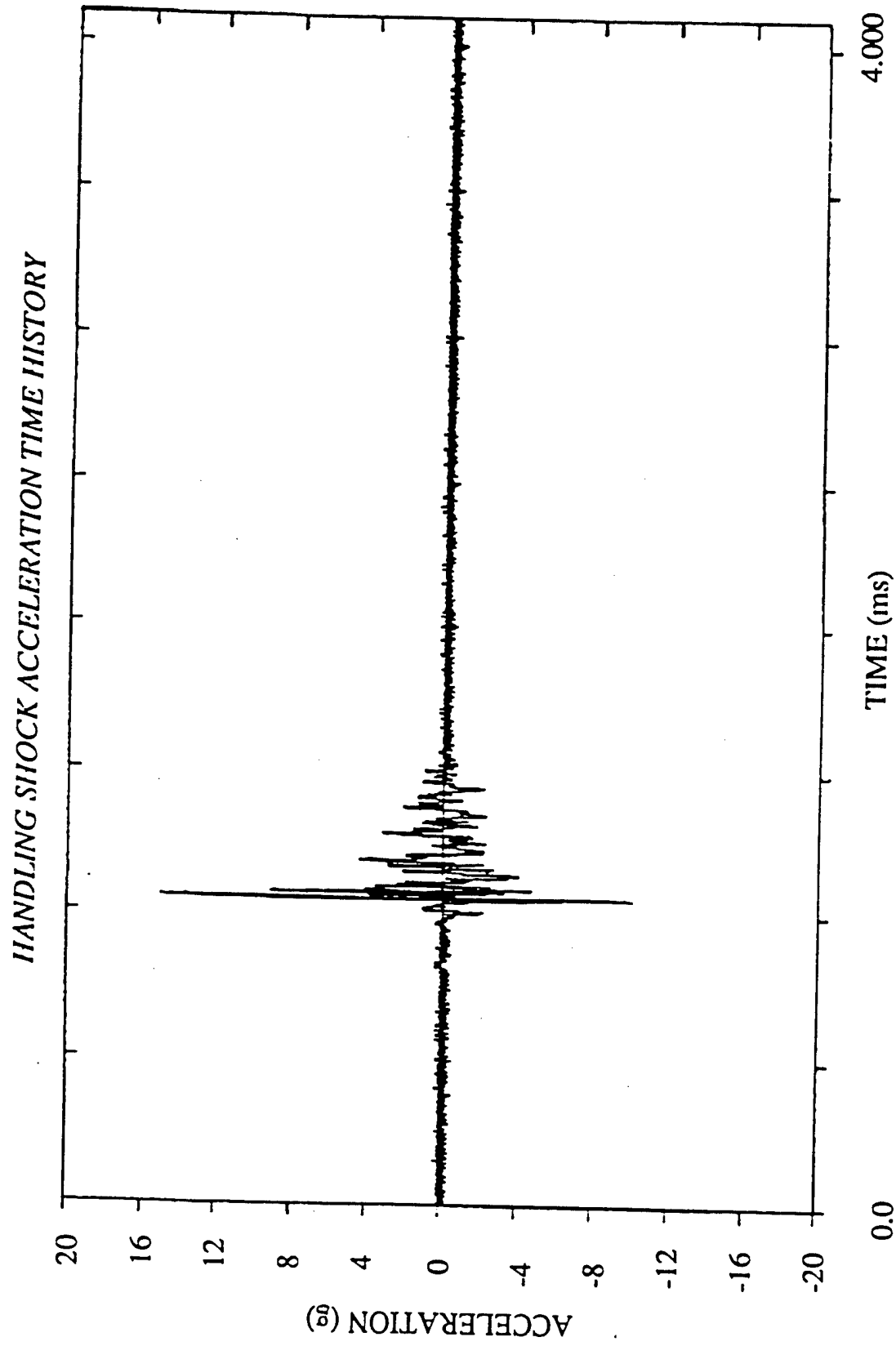


Figure D.4. Handling Shock Time History

SAVANNAH RIVER
HYDRIDE TRANSPORT VESSEL
QUALIFICATION TEST PROCEDURE

Prepared by: _____ March 4, 1998
B. J. Joseph, Technical Support Personnel — Date

Reviewed by: _____ 3/4/98
D. G. Tipton, Project Leader — Date

_____ 5 March 98
R. E. Glass, H1616 Systems Engineer — Date

_____ 3-4-98
R. S. Pacheco, Quality Engineer — Date

Approved by: _____ 3/6/98
T. D. Hernandez, 2165 Department Manager — Date

TABLE OF CONTENTS

ISSUE SUMMARY

Issue	Date	Prepared by	Purpose of Issue
A	3/98	B. J. Joseph	Original Test Procedure

DISTRIBUTION

INFORMATION COPIES

Name	Department	2165 Project Task
T. D. Hernandez	2165	Department Manager
D. G. Tipton	2165	Project Leader
R. E. Glass	2165	H1616 Systems Engineer
J. J. Molina	2165	Technical Support Personnel
R. S. Pacheco	2165	Quality Engineer
D. Powers	9742	Mfg. & Rapid Prototyping Dept.
M. N. Van Alstine		WSRC Test Coordinator WSRC/SNL Liaison

CONTROLLED COPY

Copy	Revision	Name	Department	2165 Project Task
1	A	B. J. Joseph	2165	Technical Support Personnel

The signatures below verify the receipt of the Controlled Copy of this procedure.

Controlled Copy #1 received by: B. J. Joseph Date: March 4, 1998

The original of this procedure is to be filed in the Department 2165 H1616 Project File 21.2.

1.0 SCOPE

1.1 Purpose

The purpose of this procedure is to define the steps to be taken to conduct and document the tests listed in the Plan for Testing the H1616 and the Savannah River Hydride Transport Vessel (H1616/HTV Vibration). The purpose of the tests is to conduct vibration and shock tests on an H1616 shipping container containing a Savannah River Hydride Transport Vessel (HTV). These tests are being conducted to determine if the HTV can pass qualification tests specified in SS393217, *Reservoir Qualifications AL-SX (H1616)* with lower valve torques. The H1616 and HTV will be subjected to vibration and shock tests, and helium leak tests will determine if the Savannah River Hydride Transport Vessel remains leaktight following the simulated transportation environments. The following steps describe the procedure to be followed, by H1616 Technical Support Personnel at Sandia National Laboratories, to helium leak test, pressurize, assemble the H1616-1 container, conduct vibration and shock tests, helium leak tests, and disassemble the H1616 and HTV.

2.0 APPLICABILITY

This procedure applies to the testing of the H1616 Container and Savannah River Hydride Transport Vessel by Sandia National Laboratories (SNL) personnel.

Any changes in this procedure are to be explained and initialed by either the Technical Support Personnel or the Project Leader.

3.0 RESPONSIBILITIES

Department Manager ——— T. D. Hernandez, Department 2165

Project Leader ——— D. G. Tipton, Department 2165

H1616 Systems Engineer ——— R. E. Glass, Department 2165

Quality Engineer ——— R. S. Pacheco, Department 2165

Technical Support Personnel ——— B. J. Joseph, Department 2165

Technical Support Personnel ——— J. J. Molina, Department 2165

It is the responsibility of the Technical Support Personnel to helium leak test and assemble the H1616-1 Container and HTV, document the leak tests and assembly, and verify the completion of the SAVANNAH RIVER HYDRIDE TRANSPORT VESSEL QUALIFICATION TEST PROCEDURE.

It is the responsibility of the Technical Support Personnel to have the H1616-1 Container assembled, delivered to the test facility, oversee the vibration and shock tests, and verify the completion of the H1616-1/HTV NORMAL VIBRATION & SHOCK TEST DATA SHEET.

Technical Support Personnel are responsible for advising Manufacturing & Rapid Prototyping Department (9742) personnel of the Environment, Safety, and Health (ES&H) requirements pertaining to the H1616-1/HTV Container.

It shall be the responsibility of the Manufacturing & Rapid Prototyping Department (9742) personnel to position and rig the H1616-1/HTV Container and perform the tests as specified in the Plan for Testing the H1616 and the Savannah River Hydride Transport Vessel (H1616/HTV Vibration). Personnel safety, test facility equipment preparation, planning, and scheduling at the test facility are the responsibility of the Manufacturing & Rapid Prototyping Department (9742) support personnel.

4.0 REFERENCES

Environment, Safety, and Health (ES&H) requirements are referenced in the following documents:

OP471818 — Activity Specific ES&H Operating Procedure (ES&H OP): Department 2165 Light Electrical/Mechanical Operations

SNL7A00677-001 — Sandia National Laboratories Preliminary Hazard Screening (PHS) Department 2165 Container Light Lab

SNL7A00717-001 — Sandia National Laboratories Preliminary Hazard Screening (PHS) Department 2165 Container Testing

Additional testing and quality requirements are referenced in the following documents:

10 CFR Part 71 — Nuclear Regulatory Commission Code of Federal Regulations Packaging and Transportation of Radioactive Material

— 5165 Quality Program for Container Projects, 11/11/94

H1616/HTV Vibration — Plan for Testing the H1616 and the Savannah River Hydride Transport Vessel

Leak testing requirements are referenced in the following documents:

ANSI N14.5-1987 — American National Standard for Leakage Tests on Packages for Shipment of Radioactive Materials

5.0 H1616-1 CONTAINER ASSEMBLY INSTRUCTIONS

5.1 Pretest Conditions

The following steps describe the procedure being followed, by Technical Support Personnel at Sandia National Laboratories, to helium leak test, pressurize, assemble the H1616-1 Container, conduct vibration and shock tests, helium leak tests, and disassemble the H1616 and HTV.

When parts of the individual assemblies are examined and obvious visual defects that effect test safety are observed the defective parts are to be marked defective and segregated to prevent them from being used.

5.2 Equipment Required

Test Equipment Required

Temperature Indicator - Beckman Model 412A and Thermocouple (Type K)
Barometric Pressure Gage - MKS Baratron Models 122AA-00010AD and 122AA-01000AD
Mass Spectrometer Leak Detector (MSLD) - Alcatel Model ASM 110 Turbo CL
Calibrated Leak - Alcatel Model FE 24, Varian Model 0981-F8473-302, or Key Model CLS-10
Vacuum pump - Alcatel (roughing pump)
NuVac NDP-70+ Oil Free Vacuum Scroll Pump
Containment Vessel Assembly Stand

Laboratory Supplies and Equipment

Helium Supply - The tracer gas shall be oil-free high purity Helium with a dew point not warmer than -25 °F, Ultra High Purity (UHP) Helium (99.999%)
Helium Regulator
Helium manifold with pressure relief valve
Imperial Eastman Impolene (tubing)
MSLD Leak Test Line
Leak Test Adapter
Cajon plug and cap (supplied by WSRC)
Purge and Pressurization Line
Plastic Bag
Isopropyl Alcohol and Personal Protective Gloves
Kimwipes and Cotton Wipers
Cotton Applicators
Torque Wrenches - 200 pound inch, 75 pound inch, and 80 pound feet ranges
Hand Tools -
- 1/4" and 3/8" square drive ratchets
- 7/16", 9/16", 5/8", 3/4" and 1 1/4" deep sockets
- 1/4" and 3/8" square drive extension bars
- 1/4" hex head drivers

5.3 H1616-1 Container Components

Part Number	Description
393254	H1616-1 Container Assembly
395543	Insert Cover Assembly, H1616
394825	Overpack, H1616
394269	Drum Assembly, H1616
394393	Locking Ring, H1616
394389	Lug, Locking Ring, H1616
396548	Bolt and Nut, Locking Ring, H1616
BPF-3/8	Plug, Polyethylene, .375 Diameter Hole
394801	Vessel Assembly, H1616-1
393153	Body, H1616-1, Containment Vessel
394789	Screw, Vessel, H1616
394820	Lid Assembly, H1616-1
394840	Lifting Bail, H1616 Container
394764	Lid, H1616-1, Containment Vessel
399045	Plug, Hollow Hex, SAE/MS Straight Thread
399047	Valve, Bellows, H1616
880364	Fitting, Stem, Male Q/C, .562-18UNF-2A
880363	Cap, Stem Protector, Quick-Connect
394838	O-ring, Outer, H1616-1 Containment Vessel
394839	O-ring, Inner, H1616-1 Containment Vessel
394788	Shell, Extruded, H1616 Packing
Contents	Savannah River Hydride Transport Vessel 3M Velostat bag

5.4 HTV Pressurized Envelope Helium Leak Test Instructions

The leak test procedure to be used corresponds to paragraph A3.10.2 Pressurized Envelope procedure referenced in the American National Standards Institute (ANSI) standard N14.5-1987 as stated below:

Evacuate the test item with the built-in MSLD roughing pump or an auxiliary pump, and operate the MSLD according to the manufacturer's instructions. Enclose the item in an envelope, such as a plastic bag, then purge and pressurize the envelope to slightly above atmospheric pressure.

Zero and calibrate the Helium Mass Spectrometer Leak Detector (MSLD) per the manufacturer's instructions. Record all required data on the HTV Pressurized Envelope Helium Leak Test Data Sheet.

Close the Nupro valve (rotate clockwise) on the HTV with the associated female VCR fitting and torque the valve to ~~15 in-lb. + 1/ - 0 in-lb.~~ 20 in-lb. ± 1 in-lb. DGT

Open the Nupro valve (rotate counter clockwise) on the HTV with the associated male VCR fitting.

Attach a Leak Test Adapter to the Nupro valve on the HTV with the associated male VCR fitting.

Attach the MSLD Leak Test Line to the Leak Test Adapter on the HTV.

Enclose the HTV in a plastic bag and close or seal the bag.

Evacuate the HTV cavity to the standard operating pressure for the MSLD.

After the MSLD has stabilized, read and record the background helium reading on the HTV Pressurized Envelope Helium Leak Test Data Sheet.

Place the Purge and Pressurization Line from the Helium Manifold in the plastic bag.

Purge and pressurize the plastic bag with helium to slightly greater than atmospheric pressure.

After the MSLD has stabilized, read and record the helium leak reading on the HTV Pressurized Envelope Helium Leak Test Data Sheet.

Vent the MSLD per the manufacturer's instructions.

Remove the plastic bag from the HTV.

Remove the MSLD Leak Test Line from the Leak Test Adapter on the HTV.

Recalibrate the MSLD per the manufacturer's instructions and record all required data on the HTV Pressurized Envelope Helium Leak Test Data Sheet.

5.5 HTV Pressurization Instructions

Prepare the Helium Pressurization System for attachment to the HTV by purging the Pressurization Line with helium.

Attach a thermocouple to the HTV Vessel Body.

Attach the Helium Pressurization Line to the Leak Test Adapter on the HTV.

Pressurize the HTV to 200 ± 5 psig with helium and allow the pressure to stabilize.

Document the pressure and temperature readings of the HTV on the HTV Evacuated Envelope Helium Leak Test Data Sheet.

Close the Nupro valve (rotate clockwise) on the HTV with the associated male VCR fitting and torque the valve to 20 ± 1 in-lb.

Remove the Helium Pressurization Line from the Leak Test Adapter on the HTV.

Remove the Leak Test Adapter from the Nupro valve on the HTV with the associated male VCR fitting.

Install the Cajon plug and cap provided by WSRC in the appropriate mating fittings on the HTV per the manufacturer's instructions.

5.6 H1616-1 Containment Vessel Assembly Instructions

Document the serial number of the Lid Assembly, H1616 (394820) on the H1616-1 Container Assembly Data Sheet.

Clean the interior and O-ring sealing surfaces of the Lid Assembly, H1616 using isopropyl alcohol. Examine the containment vessel lid and O-ring sealing surfaces for visual defects.

Weigh the Lid Assembly, H1616 and document the weight on the H1616-1 Container Assembly Data Sheet.

Document the serial number of the Body, H1616-1, Containment Vessel (393153) on the H1616-1 Container Assembly Data Sheet.

Clean the interior of the Body, H1616-1 using isopropyl alcohol. Examine the interior for visual defects.

Weigh the Body, H1616-1, Containment Vessel and document the weight on the H1616-1 Container Assembly Data Sheet.

Install 1 to 2 inches of Shell, Extruded, H1616 Packing (394788) in the Body, H1616-1, Containment Vessel.

Weigh the HTV and document the weight on the H1616-1 Container Assembly Data Sheet.

Cut out the lower corners of the 3M Velostat bag to create approximately ¼ inch openings to ensure a leak path through the bag.

Place the HTV in a 3M Velostat bag and seal the bag with tape.

Install the HTV on top of the Shell, Extruded, H1616 Packing in the Body, H1616-1, Containment Vessel (in a vertical orientation).

Fill the Body, H1616-1, Containment Vessel with Shell, Extruded, H1616 Packing to within two (2) inches of the top flange on the containment vessel body.

Weigh the Body, H1616-1, Containment Vessel and Shell, Extruded, H1616 Packing and document the weight on the H1616-1 Container Assembly Data Sheet.

Place a Plastic Bag in the Containment Vessel Assembly Stand.

Place the Body, H1616-1, Containment Vessel in the Plastic Bag in the Containment Vessel Assembly Stand.

Clean the Body, H1616-1, Containment Vessel, flange area and O-ring grooves using isopropyl alcohol. Examine the areas for visual defects.

Clean the inner and outer O-rings (394839 and 394838) using isopropyl alcohol. Examine the O-rings for visual defects.

Install the inner and outer O-rings in the O-ring grooves in the Body, H1616-1, Containment Vessel.

Install the Lid Assembly, H1616 on the Body, H1616-1, Containment Vessel and verify that the vessel screw holes are aligned.

Install the eight (8) Vessel Screws (part number 394789). Tighten the screws using a 1/4" hex head driver and 3/8" square drive ratchet. Torque the screws to 20 ± 2 pound feet, using a 1/4" hex head driver and 3/8" square drive torque wrench in a diametrically opposed, alternating sequence.

5.7 HTV Evacuated Envelope Helium Leak Test Instructions

The leak test procedure to be used corresponds to paragraph A3.10.1 Evacuated Envelope procedure referenced in the American National Standards Institute (ANSI) standard N14.5-1987 as stated below:

Purge and pressurize the test item with helium at slightly greater than atmospheric pressure. Enclose the test item in an envelope, such as a well-sealed metal box. Evacuate the envelope with the MSLD built-in roughing pump or an auxiliary pump, and operate the MSLD according to the manufacturer's instructions.

Zero and calibrate the Helium Mass Spectrometer Leak Detector (MSLD) per the manufacturer's instructions. Record all required data on the HTV Evacuated Envelope Helium Leak Test Data Sheet.

Attach the Leak Test Line from the MSLD to the Fitting, Stem, Male Q/C, .562-18UNF-2A (880364) on the lid of the Containment Vessel.

Open (rotate counter clockwise) the Valve, Bellows, H1616 (399047) on the lid of the Containment Vessel.

Evacuate the Containment Vessel cavity to the standard operating pressure for the MSLD.

Read and record the MSLD leak reading on the HTV Evacuated Envelope Helium Leak Test Data Sheet.

5.8 H1616-1 Containment Vessel Pressurized Envelope Helium Leak Test Instructions

Enclose the H1616-1 Containment Vessel in a plastic bag and close or seal the bag.

Read and record the background helium reading on the H1616-1 Containment Vessel Pressurized Envelope Helium Leak Test Data Sheet.

Place the Purge and Pressurization Line from the Helium Manifold in the plastic bag.

Purge and pressurize the plastic bag with helium to slightly greater than atmospheric pressure.

After the MSLD has stabilized, read and record the helium leak reading on the H1616-1 Containment Vessel Pressurized Envelope Helium Leak Test Data Sheet.

Vent the MSLD per the manufacturer's instructions.

Remove the plastic bag from the H1616-1 Containment Vessel.

Close the Valve, Bellows, H1616 (399047). Tighten the Hex on the Valve, Bellows using a 5/8" socket and 3/8" square drive torque wrench. Torque the Hex to 30 ± 2 pound inches.

Remove the MSLD Leak Test Line from the Fitting, Stem, Male Q/C, .562-18UNF-2A (880364) on the lid of the Containment Vessel.

Attach the Cap, Stem Protector, Quick-Connect (880363) to the Fitting, Stem, Male Q/C, .562-18UNF-2A.

Recalibrate the MSLD per the manufacturer's instructions and record all required data on the H1616-1 Containment Vessel Pressurized Envelope Helium Leak Test Data Sheet.

5.9 H1616-1 Container Assembly Instructions

Visually examine the Overpack (394825) for punctures and dents and verify that the 15 Plugs, Polyethylene, .375 Diameter Hole are in place.

Document the serial number of the Overpack on the H1616-1 Container Assembly Data Sheet.

Visually examine the interior of the Overpack and verify that the Pad, Vessel (394823) is bonded to the bottom of the Overpack Liner (394824).

Weigh the Overpack and document the weight on the H1616-1 Container Assembly Data Sheet.

Visually examine the H1616 Insert Cover Assembly (395543) and verify that the vessel pad is bonded to the bottom surface.

Document the serial number of the Insert Cover Assembly.

Weigh the Insert Cover Assembly and document the weight on the H1616-1 Container Assembly Data Sheet.

Install the Insert Cover Assembly on top of the Containment Vessel Assembly.

Weigh the Overpack Lid, H1616 Locking Ring (394393), and Bolt and Nut, Locking Ring, H1616 (396548) and document the weight on the H1616-1 Container Assembly Data Sheet.

Install the Overpack Lid, H1616 Locking Ring, and Bolt and Nut, Locking Ring, H1616 on the Overpack.

Tighten the Bolt and Nut, Locking Ring, H1616 using a 9/16" deep socket and then torque the assembly to 70 ± 10 pound inches.

Weigh the H1616-1 Container and document the weight on the H1616-1 Container Assembly Data Sheet.

6.0 H1616-1/HTV VIBRATION AND SHOCK TEST INSTRUCTIONS

6.1 Pretest Conditions

The following steps describe the procedure followed, by Technical Support Personnel at Sandia National Laboratories, to conduct vibration and shock tests on the H1616-1/HTV.

6.2 Equipment Required

Test Equipment Required

Data Acquisition System - Vibration Testing Facility

Vibration Test Facility

Vibration Test Tiedown Fixtures

6.3 Vibration and Shock Test Instructions

The Normal Vibration Test of the H1616-1/HTV shall be conducted in the Manufacturing & Rapid Prototyping Department (9742) Vibration Test Facility in Area I, Sandia National Laboratories, Albuquerque, N.M.

H1616-1/HTV test personnel shall advise Manufacturing & Rapid Prototyping Department (9742) personnel in the test area of the Environment, Safety, and Health requirements pertaining to the H1616-1/HTV Container and components.

The H1616-1/HTV Container shall be positioned vertically, lid up, on the vibration table and secured to the vibration table using four (4) 1.0 inch diameter rods, two (2) 2.0 inch x 2.0 inch x 0.25 inch lengths of channel, four (4) 3/8-16UNC nuts, and four (4) washers. Tighten the four (4) 3/8-16UNC nuts hand-tight, and then using a socket and torque wrench, torque the 3/8-16UNC nuts to 25 ± 5 ft-lb.

The Technical Support Personnel and Manufacturing & Rapid Prototyping Department (9742) support personnel shall ensure that the H1616-1/HTV Container is secured to the bed of the vibration test facility.

The test requirements were generated from the transport scenario and translated into specific transportation environments defined in the Plan for Testing the H1616 and the Savannah River Hydride Transport Vessel (H1616/HTV Vibration).

A total of 30 hours 10 minutes of vibration testing and 16 shock tests shall be conducted on the H1616-1/HTV Container.

The Technical Support Personnel shall record the vibration test dates and observations on the H1616-1/HTV Container Vibration Test Data Sheet.

The Technical Support Personnel shall ensure that documentary photographs of the test setup have been taken and or line drawings are made to document the test.

7.0 H1616-1 CONTAINER DISASSEMBLY INSTRUCTIONS

7.1 H1616-1 Container Disassembly Instructions

Verify that all test records and data sheets are complete, verified, and ready for filing prior to the disassembly of the H1616-1 Container.

Examine the H1616-1 Container and document any observations on the H1616-1 Container Disassembly Data Sheet.

Weigh the H1616-1 Container and document the container identification number and weight on the H1616-1 Container Disassembly Data Sheet.

Examine the Overpack Lid, H1616 Locking Ring (394393), and Bolt and Nut, Locking Ring, H1616 (396548) and document any observations on H1616-1 Container Disassembly Data Sheet.

Examine the vent holes in the H1616-1 Container and document any observations on the H1616-1 Container Disassembly Data Sheet.

Examine the exterior surfaces of the Overpack Lid and document any observations on the H1616-1 Container Disassembly Data Sheet.

Remove the Bolt and Nut, Locking Ring from the H1616 Locking Ring, examine the components, and document any observations on H1616-1 Container Disassembly Data Sheet.

Remove the H1616 Locking Ring from the Overpack (394825), examine the Locking Ring, and document any observations on the H1616-1 Container Disassembly Data Sheet.

Remove the Overpack Lid from the Overpack, examine the Lid, and document any observations on the H1616-1 Container Disassembly Data Sheet.

Remove the Insert Cover Assembly (395543) from the Overpack, examine the Insert Cover Assembly, and document any observations on H1616-1 Container Disassembly Data Sheet.

Examine the top surface of the Lid Assembly, H1616-1 (394820) and document any observations on H1616-1 Container Disassembly Data Sheet.

Remove the H1616-1 Container Containment Vessel from the Overpack.

Examine the exterior surface of Containment Vessel and document any observations on the H1616-1 Container Disassembly Data Sheet.

7.2 HTV Evacuated Envelope Helium Leak Test Instructions

The leak test procedure to be used corresponds to paragraph A3.10.1 Evacuated Envelope procedure referenced in the American National Standards Institute (ANSI) standard N14.5-1987 as stated previously.

Zero and calibrate the Helium Mass Spectrometer Leak Detector (MSLD) per the manufacturer's instructions. Record all required data on the HTV Evacuated Envelope Helium Leak Test Data Sheet.

Attach the Leak Test Line from the MSLD to the Fitting, Stem, Male Q/C, .562-18UNF-2A (880364) on the lid of the Containment Vessel.

Open (rotate counter clockwise) the Valve, Bellows, H1616 (399047) on the lid of the Containment Vessel.

Evacuate the Containment Vessel cavity to the standard operating pressure for the MSLD.

Read and record the MSLD leak reading on the HTV Evacuated Envelope Helium Leak Test Data Sheet.

7.3 H1616-1 Containment Vessel Pressurized Envelope Helium Leak Test Instructions

Enclose the H1616-1 Containment Vessel in a plastic bag and close or seal the bag.

Read and record the background helium reading on the H1616-1 Containment Vessel Pressurized Envelope Helium Leak Test Data Sheet.

Place the Purge and Pressurization Line from the Helium Manifold in the plastic bag.

Purge and pressurize the plastic bag with helium to slightly greater than atmospheric pressure.

After the MSLD has stabilized, read and record the helium leak reading on the H1616-1 Containment Vessel Pressurized Envelope Helium Leak Test Data Sheet.

Vent the MSLD per the manufacturer's instructions.

Remove the plastic bag from the H1616-1 Containment Vessel.

Close the Valve, Bellows, H1616 (399047). Tighten the Hex on the Valve, Bellows using a 5/8" socket and 3/8" square drive torque wrench. Torque the Hex to 30 ± 2 pound inches.

Remove the MSLD Leak Test Line from the Fitting, Stem, Male Q/C, .562-18UNF-2A (880364) on the lid of the Containment Vessel.

Attach the Cap, Stem Protector, Quick-Connect (880363) to the Fitting, Stem, Male Q/C, .562-18UNF-2A.

Recalibrate the MSLD per the manufacturer's instructions and record all required data on the H1616-1 Containment Vessel Pressurized Envelope Helium Leak Test Data Sheet.

7.4 H1616-1 Containment Vessel Disassembly Instructions

Remove the eight (8) Vessel Screws from the Lid Assembly, H1616-1.

Remove the Lid Assembly, H1616-1 from the Body, H1616-1, Containment Vessel (393153).

Remove the inner and outer O-rings from the Body, H1616-1, Containment Vessel.

Remove the Shell, Extruded, H1616 Packing (394788) from the Body, H1616-1, Containment Vessel.

Remove the HTV from the Body, H1616-1, Containment Vessel.

If the HTV Evacuated Envelope Helium Leak Test verified that the HTV is helium leak tight, proceed with the Pressure Measurement of the HTV.
If the HTV Evacuated Envelope Helium Leak Test verified that the HTV is NOT helium leak tight, notify the Savannah River Test Coordinator and obtain their concurrence to proceed by conducting HTV Pressurized Envelope Helium Leak Tests on each of the Nupro valves on the HTV.

7.5 HTV Pressure Measurement Instructions

Prepare the Helium Pressurization System for attachment to the HTV by purging the Pressurization Line with helium. Pressurize the Pressurization Line to 200 $\pm$ 5 psig with helium and allow the pressure to stabilize.

Attach a thermocouple to the HTV Vessel Body.

Attach the Helium Pressurization Line to the Leak Test Adapter on the HTV.

Open the Nupro valve (rotate counter clockwise) on the HTV with the associated male VCR fitting.

Document the pressure and temperature readings of the HTV on the H1616-1 Container Disassembly Data Sheet.

7.6 HTV Pressure Venting Instructions

Slightly open the vent valve attached to helium manifold on the Helium Pressurization System to vent the 200 psig pressure from the HTV.

Verify that the vent valve attached to helium manifold on the Helium Pressurization System is directed away from personnel working in the laboratory area.

Slightly open the vent valve attached to helium manifold on the Helium Pressurization System to vent the 200 psig pressure from the HTV.

Vent the HTV to atmospheric pressure.

Remove the Leak Test Adapter from the Nupro valve on the HTV with the associated male VCR fitting.

8.0 RECORDS

8.1 Visual Inspection

Visually examine the individual components as described in the Disassembly Instructions (Section 7) of this document and either make a sketch or attach a photograph to document any observations.

8.2 Still Photography

Photograph all major components as directed by responsible H1616 Container project personnel and any observations using a 35 mm camera. At least one photograph of each area of interest (observation) shall include a scale to better document the relative size and shape of observations.

8.3 Data Documentation

The Technical Support Personnel shall complete all Data Sheets.

Records of the tests results shall be filed in the Department 2165 H1616 File 21.2.

HTV PRESSURIZED ENVELOPE HELIUM LEAK TEST DATA SHEET

HTV Identification No.: Prototype 3 Helium Leak Test Date: March 6, 1998

Helium Leak Test Description: *HTV Pressurized Envelope Helium Leak Test*

Helium Leak Test Personnel: B. J. Joseph - WMD Container Systems Department 2165

Initials

BJJ Zero and calibrate the MSLD per the manufacturer's instructions. Notes: New Alcatel

Mass Spectrometer Leak Detector (MSLD) - Alcatel - Model No. ASM 110 Turbo CL

Calibrated Leak Mfg. By: *Alcatel* Model No.: *FE-24* Serial No.: *4864* Cal. Expiration Date: *May 25, 1998*

Calibrated Leak Rate: *4.778* E-12 Moles/s [*1.071* E-7 cm³/s STP (O° C, one ATM)]

Temperature Indicator Manufacturer Beckman Model No. 412A Serial No.: _____

Calibration Expiration Date: _____

BJJ Calibrated Leak Temperature 25 °C

Absolute Pressure Gage Mfg. By: MKS Baratron Model No. 122AA-01000AD
Serial No.: *68786-2* Calibration Expiration Date: *May 1, 1998*

BJJ Absolute Pressure 619.9 mm Hg

Correct the Calibrated Leak for temperature by using the equation furnished by the SNL Primary Standards Laboratory:
$L = 1.071 \times 10^{-7} [1 + 0.0331 /°C (T_t - 26.67)]$

BJJ Temperature Corrected Calibrated Helium Leak Rate: 1.012×10^{-7} cc/s helium.

BJJ MSLD Calibration Reading (helium): 1.0×10^{-7} cc/s helium.

BJJ MSLD Background Helium Reading: 1.5×10^{-9} cc/s helium.

BJJ Examine all of the HTV components for visual defects.
Notes: As Received

BJJ HTV Female VCR Fitting Torque: 20 in-lb HTV Male VCR Fitting Torque: Open in-lb.

BJJ Attach the MSLD Leak Test Line to the Leak Test Adapter on the HTV.
Notes: Attached Adapter

BJJ HTV Temperature: 22 °C

BJJ Background Helium reading: 4.5×10^{-9} cc/s helium

BJJ Enclose the HTV in a plastic bag. Purge and pressurize the plastic bag with ultra high purity Helium. Notes: ~ 14.8 psi

BJJ Recorded Helium Leak Rate: 4.0×10^{-9} cc/s helium.

BJJ Post-test MSLD Calibration Reading (helium): 1.0×10^{-7} cc/s helium.

The activities listed in this checklist have been completed by:

B. J. Joseph Date: March 6, 1998

H1616-1/HTV TEST UNIT ASSEMBLY DATA SHEET

H1616-1/HTV Test Unit Number: 13261 / HTV Prototype #3

H1616-1/HTV Assembly Date: March 6, 1998

H1616-1/HTV Assembly Personnel: *B. J. Joseph & J. J. Molina - WMD Container Systems Department 2165*

Lid Assembly, H1616 (394820) Serial Number: TDA-13244-E92

Lid Assembly, H1616 (394820) Weight: 26.738

Body, H1616-1, Containment Vessel (393153) Serial Number: TDA-13261-E92

Body, H1616-1, Containment Vessel Weight: 30.336

HTV Weight: 9.178

Body, H1616-1, Containment Vessel & Extruded Packing Shell Weight: 51.032

Overpack (394825) Serial Number: 13261

Overpack Weight: 40.296

H1616 Insert Cover Assembly (395543) Serial Number: BHD-01698K92-105

H1616 Insert Cover Assembly Weight: 7.250

Overpack Lid, H1616 Locking Ring (394393), Bolt and Nut, Locking Ring, H1616 (396548) Weight: 5.094

H1616-1/HTV Test Unit Weight: 130.40 lbs

The activities listed in this data sheet have been completed by:

Date: March 6, 1998

Date:

HTV EVACUATED ENVELOPE HELIUM LEAK TEST DATA SHEET

HTV Identification No.: Odyssey #3 Helium Leak Test Date: March 6, 1998

Helium Leak Test Description: *HTV Evacuated Envelope Helium Leak Test*

Helium Leak Test Personnel: B. J. Joseph - WMD Container Systems Department 2165

Initials

BJ — Zero and calibrate the MSLD per the manufacturer's instructions. Notes: New Alcatel

Mass Spectrometer Leak Detector (MSLD) - Alcatel - Model No. ASM 110 Turbo CL

Calibrated Leak Mfg. By: *Alcatel* Model No.: *FE-24* Serial No.: *4864* Cal. Expiration Date: *May 25, 1998*

Calibrated Leak Rate: *4.778* E-12 Moles/s [*1.071* E-7 cm3/s STP (O° C, one ATM)]

Temperature Indicator Manufacturer Beckman Model No. 412A Serial No.: _____

Calibration Expiration Date: _____

BJ — Calibrated Leak Temperature 25 °C

Absolute Pressure Gage Mfg. By: MKS Baratron Model No. 122AA-01000AD
Serial No.: *68786-2* Calibration Expiration Date: *May 1, 1998*

BJ — Absolute Pressure 618.2 mm Hg

Correct the Calibrated Leak for temperature by using the equation furnished by the SNL Primary Standards Laboratory:

$L = 1.071 \times 10^{-7} [1 + 0.0331 /°C (T_t - 26.67)]$

BJ — Temperature Corrected Calibrated Helium Leak Rate: 1.012×10^{-7} cc/s helium.

BJ — MSLD Calibration Reading (helium): 1.0×10^{-7} cc/s helium.

BJ — MSLD Background Helium Reading: 1×10^{-9} cc/s helium.

BJ — Examine all of the H1616-1/HTV components for visual defects.
Notes: Assembled 3/6/98

BJ — HTV Female VCR Fitting Torque: 20 in-lb HTV Male VCR Fitting Torque: 20 in-lb.

BJ — Attach the MSLD Leak Test Line to the Quick Connect on the H1616-1 Containment Vessel. Notes: _____

BJ — H1616-1 Temperature: 24 °C

BJ — Background Helium reading: 6.9×10^{-10} cc/s helium

BJ — Evacuate the HTV Cavity to less than 7.6 Torr and then pressurize the cavity to 200 ± 5 psig using ultra high purity Helium.
Evacuated to: 0.01 Torr Pressurized to: 202.7 PSI Torr Temperature: 24.4°C

BJ — Recorded Helium Leak Rate: 6.9×10^{-10} cc/s helium.

BJ — Post-test MSLD Calibration Reading (helium): 1.0×10^{-7} cc/s helium.

The activities listed in this checklist have been completed by:

B. J. Joseph Date: March 6, 1998

H1616-1 CONTAINMENT VESSEL PRESSURIZED ENVELOPE HELIUM LEAK TEST DATA SHEET

H1616-1 Containment Vessel Identification No.: 13246/13241 Helium Leak Test Date: 3/6/98

Helium Leak Test Description: *H1616-1 Containment Vessel Pressurized Envelope Helium Leak Test*

Helium Leak Test Personnel: B. J. Joseph - WMD Container Systems Department 2165

Initials

___ Zero and calibrate the MSLD per the manufacturer's instructions. Notes: New Alcatel

Mass Spectrometer Leak Detector (MSLD) - Alcatel - Model No. ASM 110 Turbo CL

Calibrated Leak Mfg. By: *Alcatel* Model No.: *FE-24* Serial No.: *4864* Cal. Expiration Date: *May 25, 1998*

Calibrated Leak Rate: *4.778* E-12 Moles/s [*1.071* E-7 cm^3/s STP (O° C, one ATM)]

Temperature Indicator Manufacturer Beckman Model No. 412A Serial No.: _____

Calibration Expiration Date: _____

___ Calibrated Leak Temperature 25 °C

Absolute Pressure Gage Mfg. By: MKS Baratron Model No. 122AA-01000AD
Serial No.: *68786-2* Calibration Expiration Date: *May 1, 1998*

___ Absolute Pressure 618.2 mm Hg

Correct the Calibrated Leak for temperature by using the equation furnished by the SNL Primary Standards Laboratory:
$L = 1.071 \times 10^{-7} [1 + 0.0331 /°C (T_t - 26.67)]$

___ Temperature Corrected Calibrated Helium Leak Rate: 1.012×10^{-7} cc/s helium.

___ MSLD Calibration Reading (helium): 1.0×10^{-7} cc/s helium.

___ MSLD Background Helium Reading: 1.0×10^{-9} cc/s helium.

___ Examine all of the H1616-1 Containment Vessel components for visual defects. Notes: Assumed - Post HTV Evaluates Envelope Leak

___ Attach the MSLD Leak Test Line to the Quick Connect Leak Test Adapter on the H1616-1 Containment Vessel. Notes: Attached to QC on Lid -

___ H1616-1 Containment Vessel Temperature: 24 °C

___ Background Helium reading: 6.4×10^{-10} cc/s helium

___ Enclose the H1616-1 Containment Vessel in a plastic bag. Purge and pressurize the plastic bag with ultra high purity Helium. Notes: Slow Increase Pressure Test After ~1 hr.

___ Recorded Helium Leak Rate: 4.0×10^{-9} cc/s helium.

___ Post-test MSLD Calibration Reading (helium): 1.0×10^{-7} @ 25°C cc/s helium.

___ Leak Rate: $< 1.0 \times 10^{-7}$ std cc/s (air).

The activities listed in this checklist have been completed by:

B. J. Joseph Date: March 6, 1998

H1616-1/HTV NORMAL VIBRATION & SHOCK TEST DATA SHEET

H1616-1/HTV Container No.: ~~Prototype~~ 3 H1616-1/HTV Container Weight: 1304 lb.

Vibration Test Personnel: *B. J. Joseph & J. Molina- WMD Container Systems Department 2165*

Test Location & Organization:

Manufacturing & Rapid Prototyping Department (9742) Vibration Test Facility, Sandia National Laboratories

Road Vibration Test Date: 3/10/98

Road Vibration Test Observations: No Obvious Changes

Aircraft Cruise Vibration Test Date: 3/10/98

Aircraft Cruise Vibration Test Observations: No Obvious Changes

Aircraft Takeoff/Land Vibration Test Date: 3/9/98

Aircraft Takeoff/Land Vibration Test Observations: No Obvious Changes

Handling Shock Test Date: 3/9/98

Handling Shock Test Observations: No Obvious Changes

The activities listed in this checklist have been completed by:

B. J. Joseph Date: 3/12/98

HTV EVACUATED ENVELOPE HELIUM LEAK TEST DATA SHEET

HTV Identification No.: PROTOTYPE #3 Helium Leak Test Date: March 12, 1998

Helium Leak Test Description: *HTV Evacuated Envelope Helium Leak Test*

Helium Leak Test Personnel: B. J. Joseph - WMD Container Systems Department 2165

Initials

R — Zero and calibrate the MSLD per the manufacturer's instructions. Notes: NEW ALCATEL

Mass Spectrometer Leak Detector (MSLD) - Alcatel - Model No. ASM 110 Turbo CL

Calibrated Leak Mfg. By: *Alcatel* Model No.: *FE-24* Serial No.: *4864* Cal. Expiration Date: *May 25, 1998*

Calibrated Leak Rate: *4.778* E-12 Moles/s [*1.071* E-7 cm^3/s STP (O° C, one ATM)]

Temperature Indicator Manufacturer Beckman Model No. 412A Serial No.: _____

Calibration Expiration Date: _____

R — Calibrated Leak Temperature 25.6 °C

Absolute Pressure Gage Mfg. By: MKS Baratron Model No. 122AA-01000AD
Serial No.: *68786-2* Calibration Expiration Date: *May 1, 1998*

R — Absolute Pressure 626.8 mm Hg

Correct the Calibrated Leak for temperature by using the equation furnished by the SNL Primary Standards Laboratory:

$L = 1.071 \times 10^{-7} [1 + 0.0331 /°C (T_t - 26.67)]$

R — Temperature Corrected Calibrated Helium Leak Rate: 1.031×10^{-7} cc/s helium.

R — MSLD Calibration Reading (helium): 1.0×10^{-7} cc/s helium.

R — MSLD Background Helium Reading: 2.0×10^{-9} cc/s helium.

R — Examine all of the H1616-1/HTV components for visual defects.
Notes: POST VIBRATION TEST

VR — HTV Female VCR Fitting Torque: N/A in-lb HTV Male VCR Fitting Torque: N/A in-lb.

R — Attach the MSLD Leak Test Line to the Quick Connect on the H1616-1 Containment Vessel. Notes: ATTACHED TO QC ON LID

R — H1616-1 Temperature: N/A °C

R — Background Helium reading: 2.5×10^{-9} cc/s helium

R — Evacuate the HTV Cavity to less than 7.6 Torr and then pressurize the cavity to 200 ± 5 psig using ultra high purity Helium. 3/6/98
Evacuated to: 0.01 Torr Pressurized to: 202.7 Torr Temperature: 24.4°C 3/6/98

R — Recorded Helium Leak Rate: 2.5×10^{-9} cc/s helium.

R — Post-test MSLD Calibration Reading (helium): 1.0×10^{-7} cc/s helium.

The activities listed in this checklist have been completed by:

_____ Date: March 12, 1998

H1616-1 CONTAINMENT VESSEL PRESSURIZED ENVELOPE HELIUM LEAK TEST DATA SHEET

H1616-1 Containment Vessel Identification No.: 13244/13261 Helium Leak Test Date: 3/12/98

Helium Leak Test Description: *H1616-1 Containment Vessel Pressurized Envelope Helium Leak Test*

Helium Leak Test Personnel: B. J. Joseph - WMD Container Systems Department 2165

Initials

RB Zero and calibrate the MSLD per the manufacturer's instructions. Notes: NEW ALCATEL

Mass Spectrometer Leak Detector (MSLD) - Alcatel - Model No. ASM 110 Turbo CL

Calibrated Leak Mfg. By: *Alcatel* Model No.: *FE-24* Serial No.: *4864* Cal. Expiration Date: *May 25, 1998*

Calibrated Leak Rate: *4.778* E-12 Moles/s [*1.071* E-7 cm^3/s STP (O° C, one ATM)]

Temperature Indicator Manufacturer Beckman Model No. 412A Serial No.: _____

Calibration Expiration Date: _____

RB Calibrated Leak Temperature 25.6 °C

Absolute Pressure Gage Mfg. By: MKS Baratron Model No. 122AA-01000AD
Serial No.: *68786-2* Calibration Expiration Date: *May 1, 1998*

RB Absolute Pressure 626.8 mm Hg

Correct the Calibrated Leak for temperature by using the equation furnished by the SNL Primary Standards Laboratory:
$L = 1.071 \times 10^{-7} [1 + 0.0331 /°C (T_t - 26.67)]$

RB Temperature Corrected Calibrated Helium Leak Rate: 1.031×10^{-7} cc/s helium.

RB MSLD Calibration Reading (helium): 1.0×10^{-7} cc/s helium.

RB MSLD Background Helium Reading: 2.0×10^{-9} cc/s helium.

RB Examine all of the H1616-1 Containment Vessel components for visual defects. Notes: POST VIBRATION TEST

RB Attach the MSLD Leak Test Line to the Quick Connect Leak Test Adapter on the H1616-1 Containment Vessel. Notes: ATTACHED TO QC ON LID

RB H1616-1 Containment Vessel Temperature: 21 °C

RB Background Helium reading: 2.5×10^{-9} cc/s helium

RB Enclose the H1616-1 Containment Vessel in a plastic bag. Purge and pressurize the plastic bag with ultra high purity Helium. Notes: ~14.8 PSI

RB Recorded Helium Leak Rate: 1.3×10^{-9} cc/s helium.

RB Post-test MSLD Calibration Reading (helium): 1.0×10^{-7} cc/s helium.

RB Leak Rate: $< 1.0 \times 10^{-7}$ std cc/s (air).

The activities listed in this checklist have been completed by:

_____ Date: March 12, 1998

H1616-1 CONTAINER DISASSEMBLY DATA SHEET

H1616-1 Container Disassembly Date: March 12, 13, 1998

Disassembly Personnel *B. J. Joseph & J. Molina- WMD Container Systems Department 2165*

Test records and data sheets are complete: Vibration Data Received 3/12/98

H1616-1 Container Observations: Overpack – No Obvious Exterior Damage Overpack Lid Interior – Circular Marks on Plastic Data Sheet Holder & Insert Assembly had Circular Marks Indicating Rotation of the Insert Assy.

HTV observations: No Obvious Damage – Velostat Bag Folded in Corner & Torn & Wires Tightened in Places –

HTV temperature: 23°C Line Pressure 202.8 psi

HTV Internal Pressure: 202.0

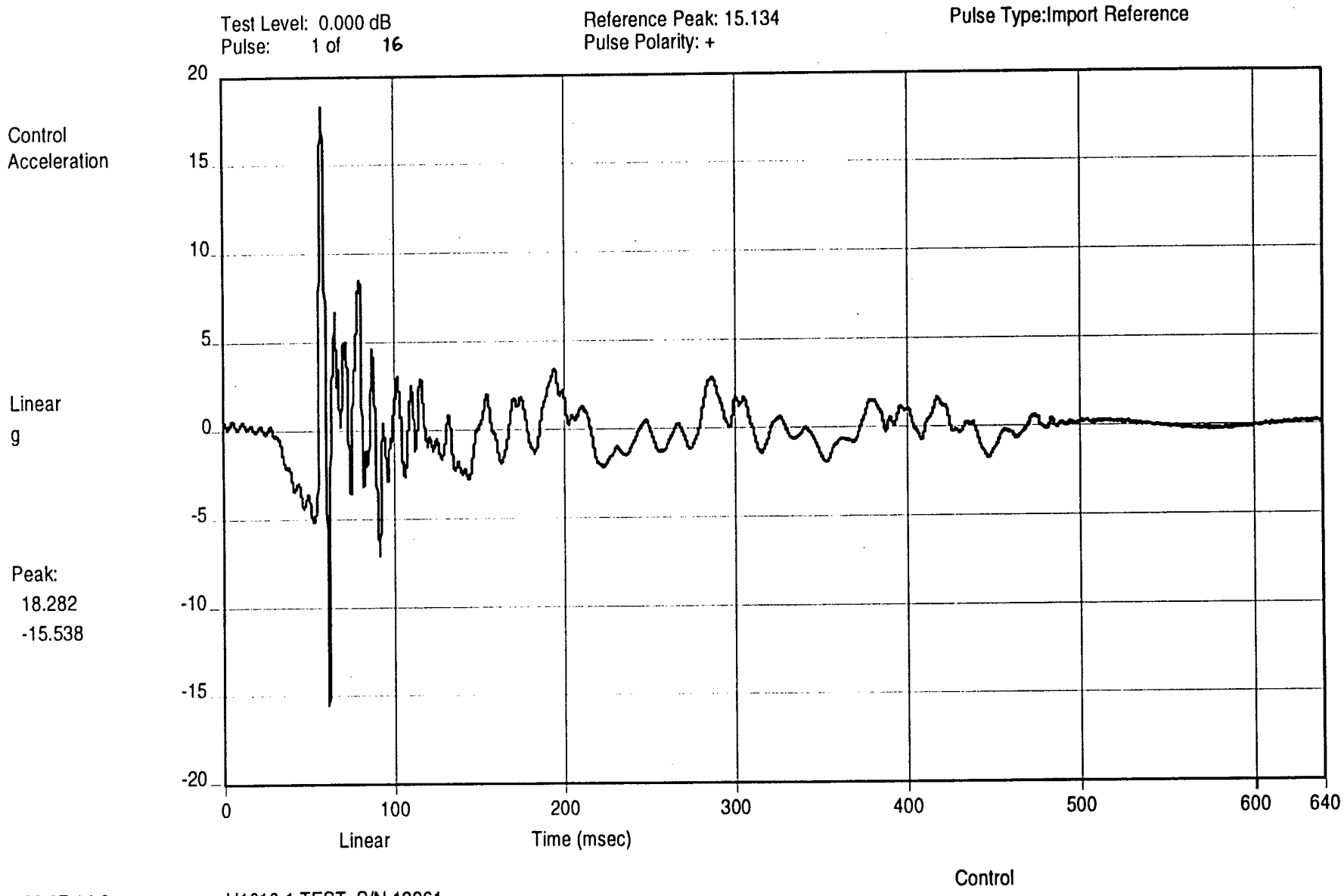
HTV Female VCR Fitting Torque: 20 in-lb

HTV Female VCR Fitting Torque: 20 in-lb.

The activities listed in this checklist have been completed by:

B. J. Joseph Date: 3/13/98

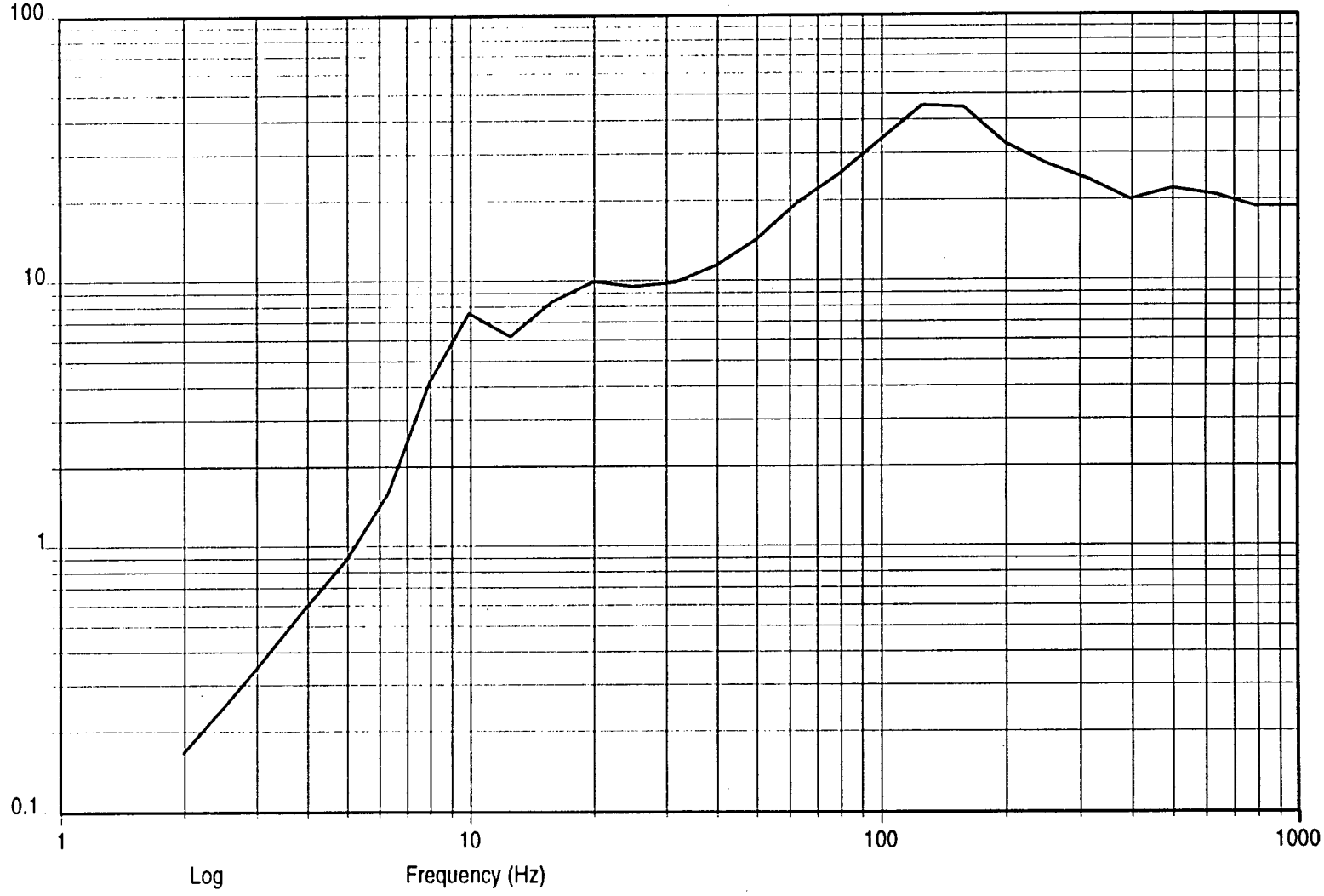
Appendix C
Control Accelerometer Data


Test Level: 0.000 dB
Pulse: 1 of 16
Reference Peak: 15.134
Pulse Polarity: +
Pulse Type:Import Reference
Control
Acceleration
Linear
g
Peak:
18.282
-15.538
20
15
10
5
0
-5
-10
-15
-20
0
100
200
300
400
500
600
640
Linear
Time (msec)
Control
08:37:14.6
Mon Mar 09 1998
H1616-1 TEST, S/N 13261
HANDLING SHOCK (VERTICAL)
Classical Shock Test Name: H1616_HAND_VERT.tmp

Test Level: 0.000 dB
Pulse: 1 of 16

Reference Peak: 15.134
Pulse Polarity: +

Pulse Type:Import Reference



Control
Maxi-Max

Log
g

Peak:
45.153
0.166

Control

08:37:14.6
Mon Mar 09 1998

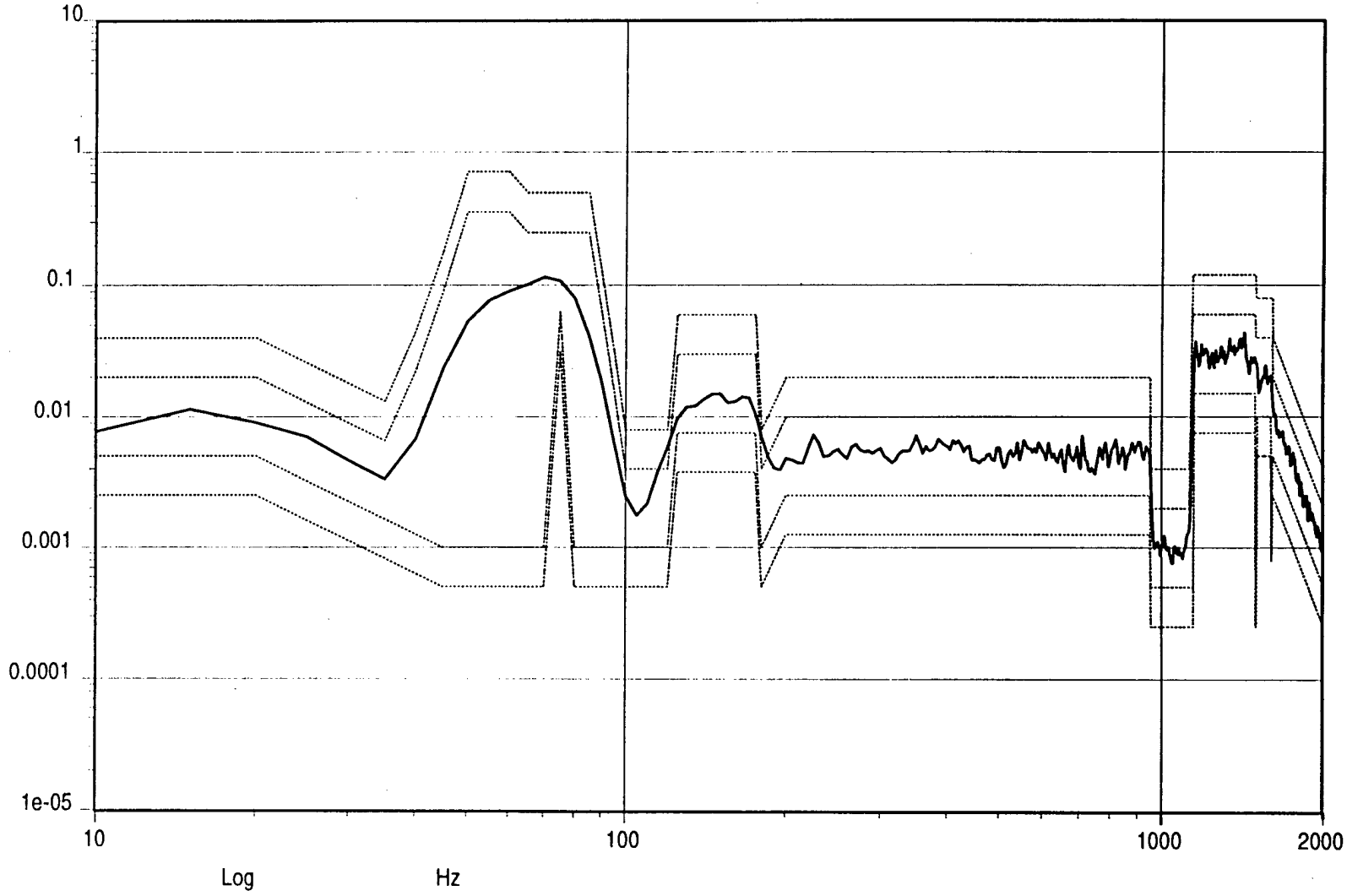
H1616-1 TEST, S/N 13261
HANDLING SHOCK (VERTICAL)

Classical Shock Test Name: H1616_HAND_VERT.tmp

Test Level: 0.000 dB
Test Time: 000:05:00

Reference RMS: 4.176
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
4.842

08:53:30
09-Mar-1998

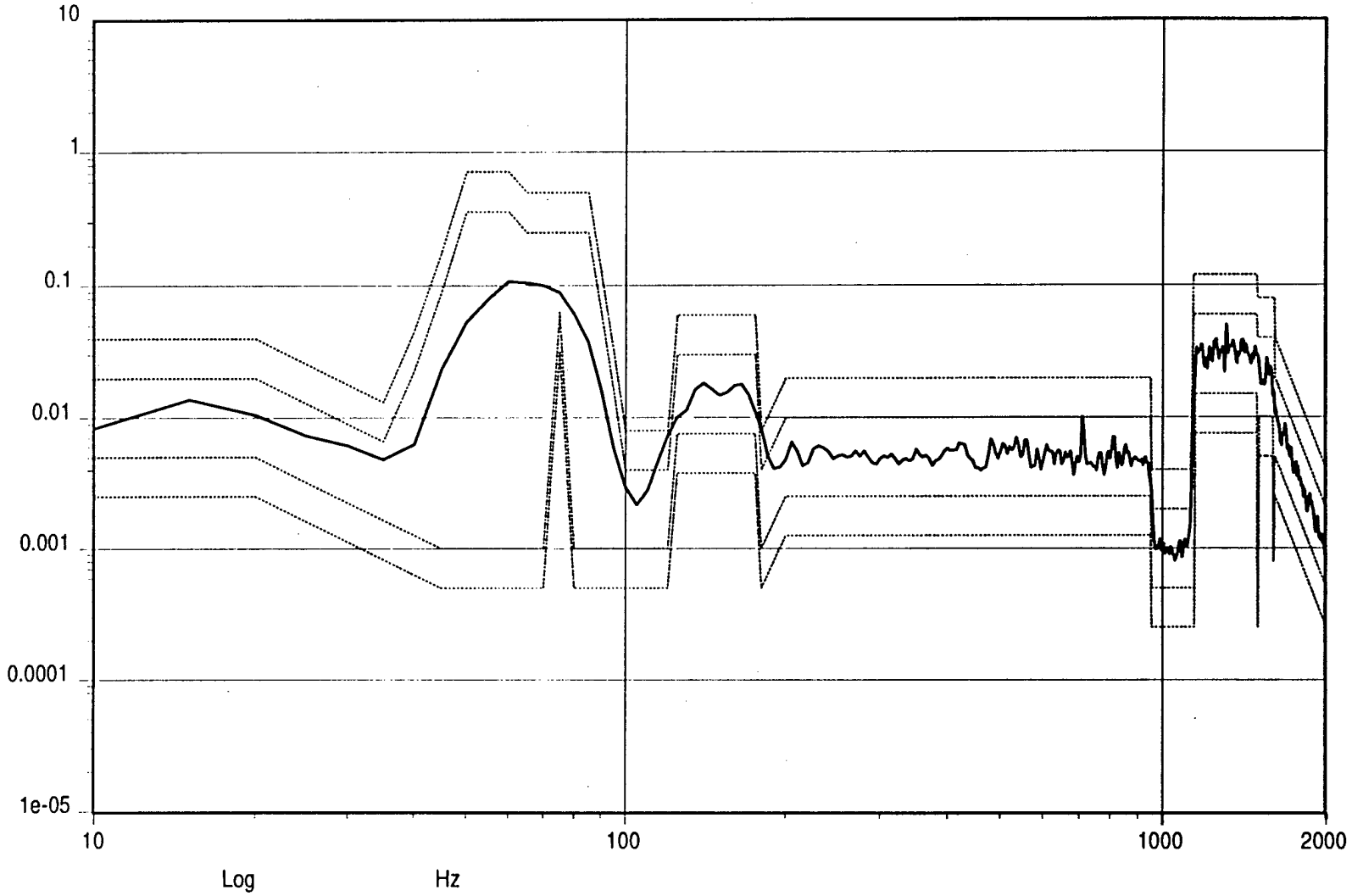
H1616-1 AIRCRAFT TAKEOFF/CLIMB/LAND
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_TCL_VERT.tmp

Test Level: 0.000 dB
Test Time: 000:05:00

Reference RMS: 4.176
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
4.887

09:01:36
09-Mar-1998

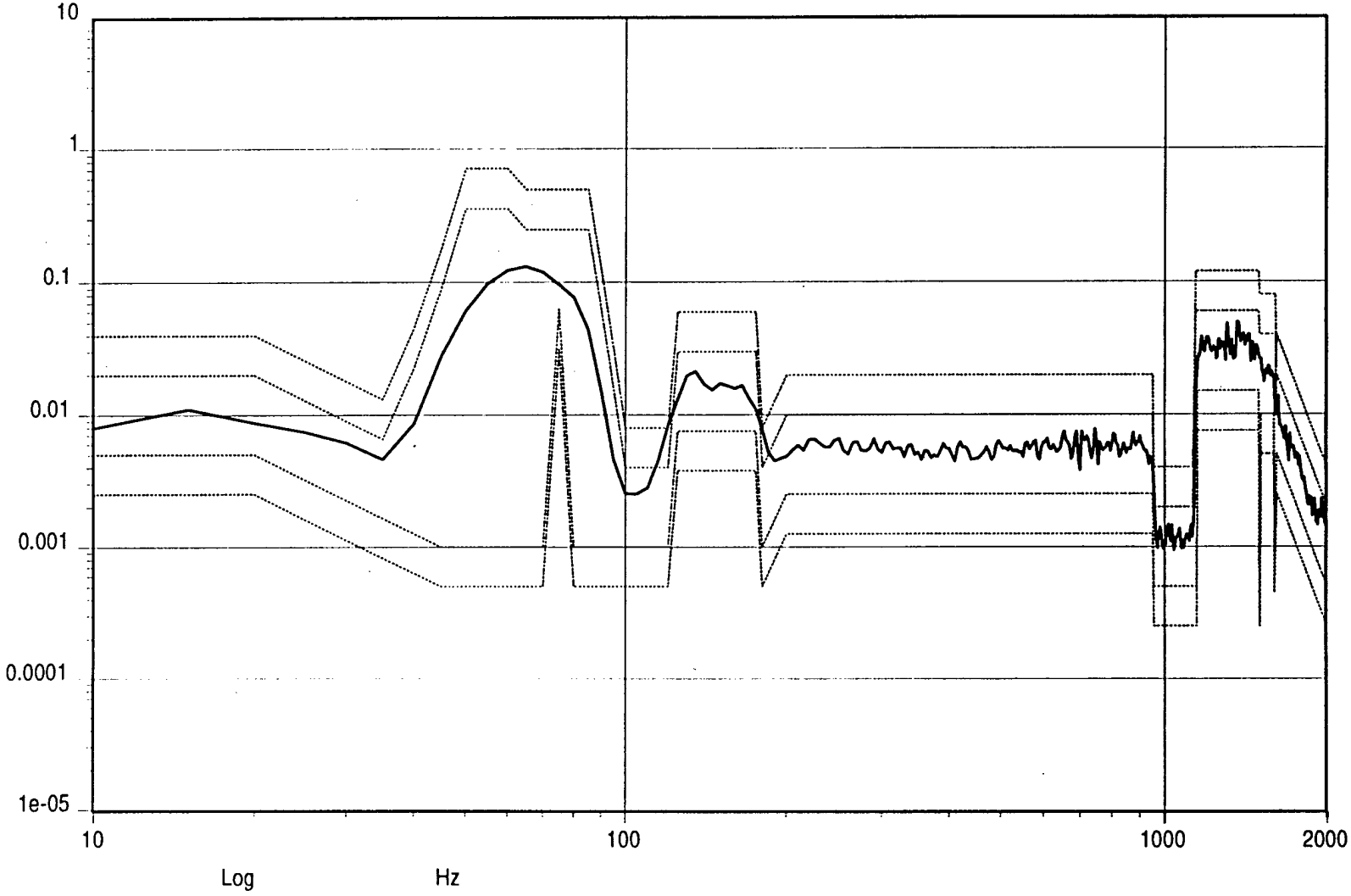
H1616-1 AIRCRAFT TAKEOFF/CLIMB/LAND
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_TCL_VERT.tmp

Test Level: 0.000 dB
Test Time: 000:05:00

Reference RMS: 4.176
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
5.071

09:23:21
09-Mar-1998

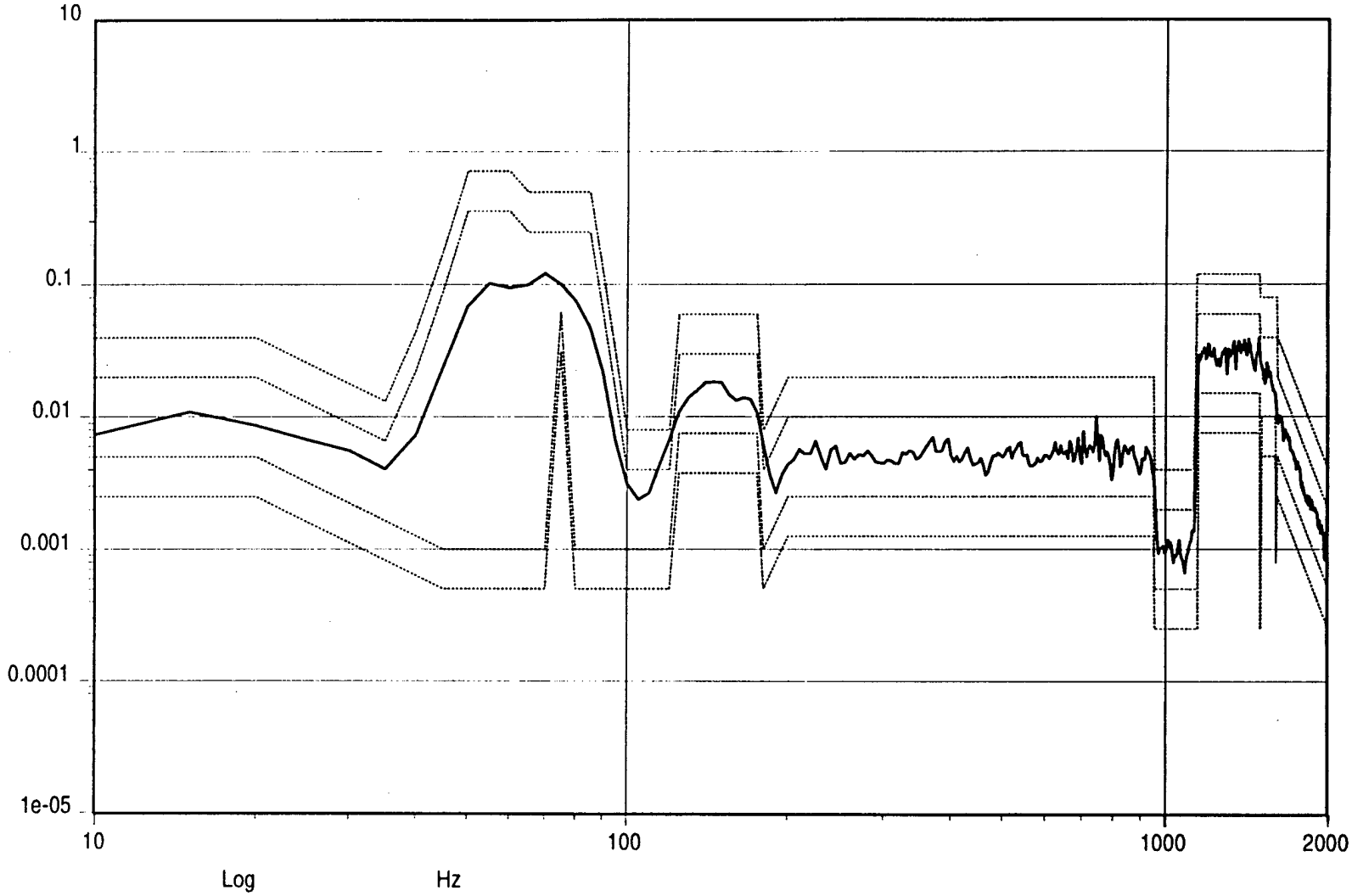
H1616-1 AIRCRAFT TAKEOFF/CLIMB/LAND
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_TCL_VERT.tmp

Test Level: 0.000 dB
Test Time: 000:05:00

Reference RMS: 4.176
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
4.859

09:30:35
09-Mar-1998

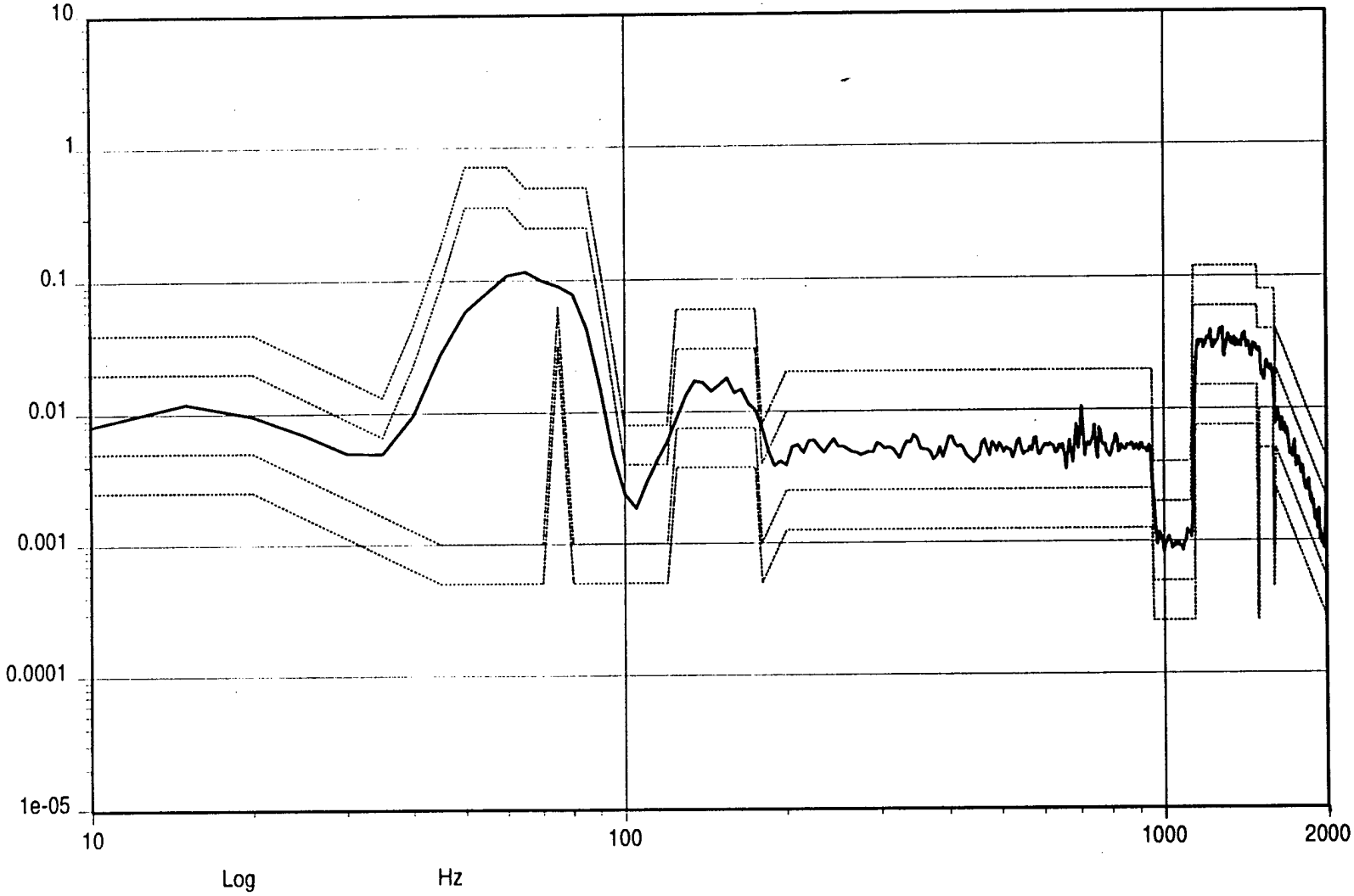
H1616-1 AIRCRAFT TAKEOFF/CLIMB/LAND
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_TCL_VERT.tmp

Test Level: 0.000 dB
Test Time: 000:05:00

Reference RMS: 4.176
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
4.887

09:37:05
09-Mar-1998

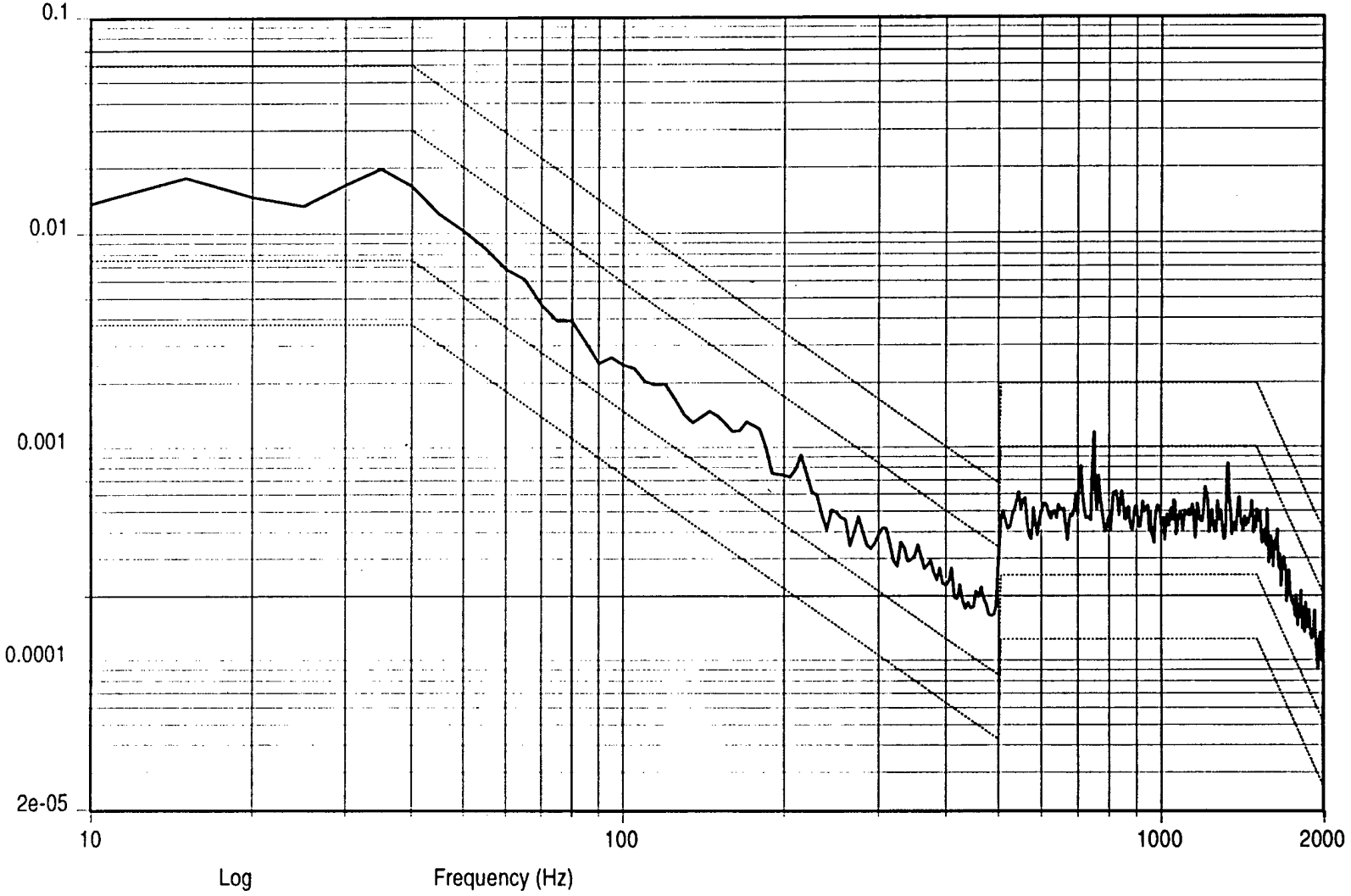
H1616-1 AIRCRAFT TAKEOFF/CLIMB/LAND
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_TCL_VERT.tmp

Test Level: 0.000 dB
Test Time: 009:45:00

Reference RMS: 1.332
Clipping: 3.00 Sigma

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000 Hz



Control

Log
g²/Hz

DOF 120

RMS:
1.328 g

09:28:00
10-Mar-1998

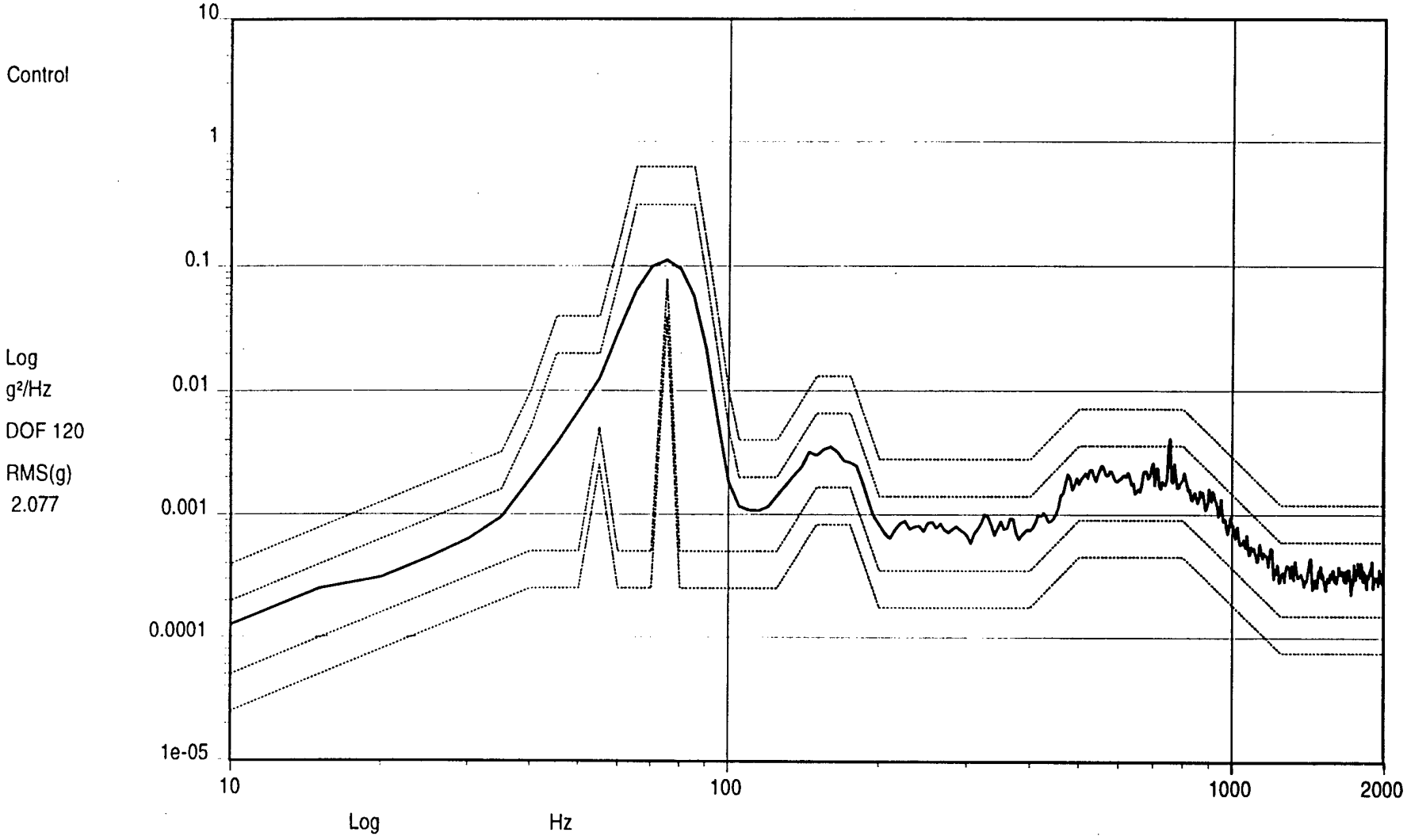
H1616-1 ROAD VIBRATION TEST SPECIFICATION
VERTICAL-AXIS, S/N 13261

Test Name: H1616_ROAD_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



10:40:21
10-Mar-1998

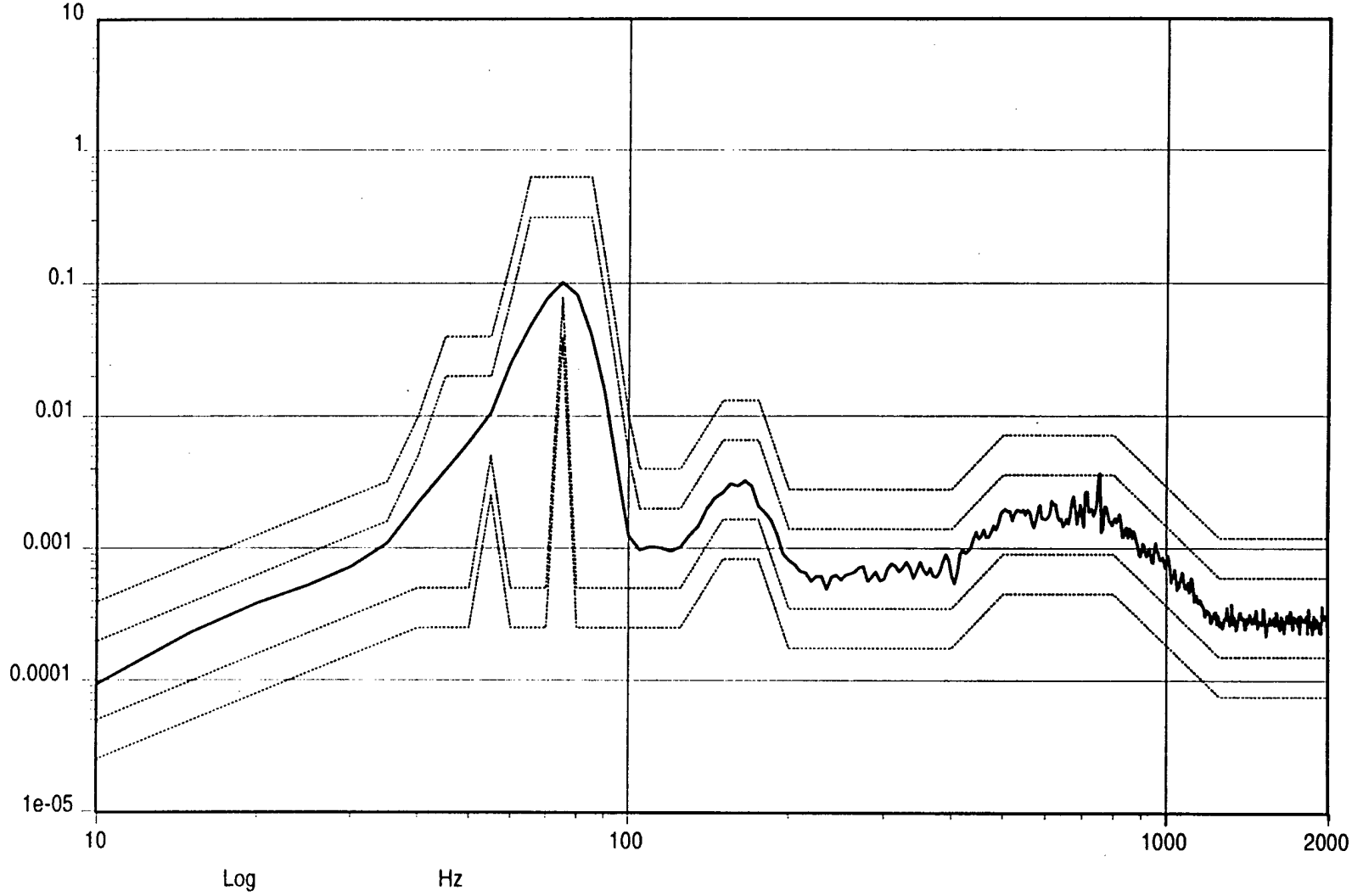
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



11:42:01
10-Mar-1998

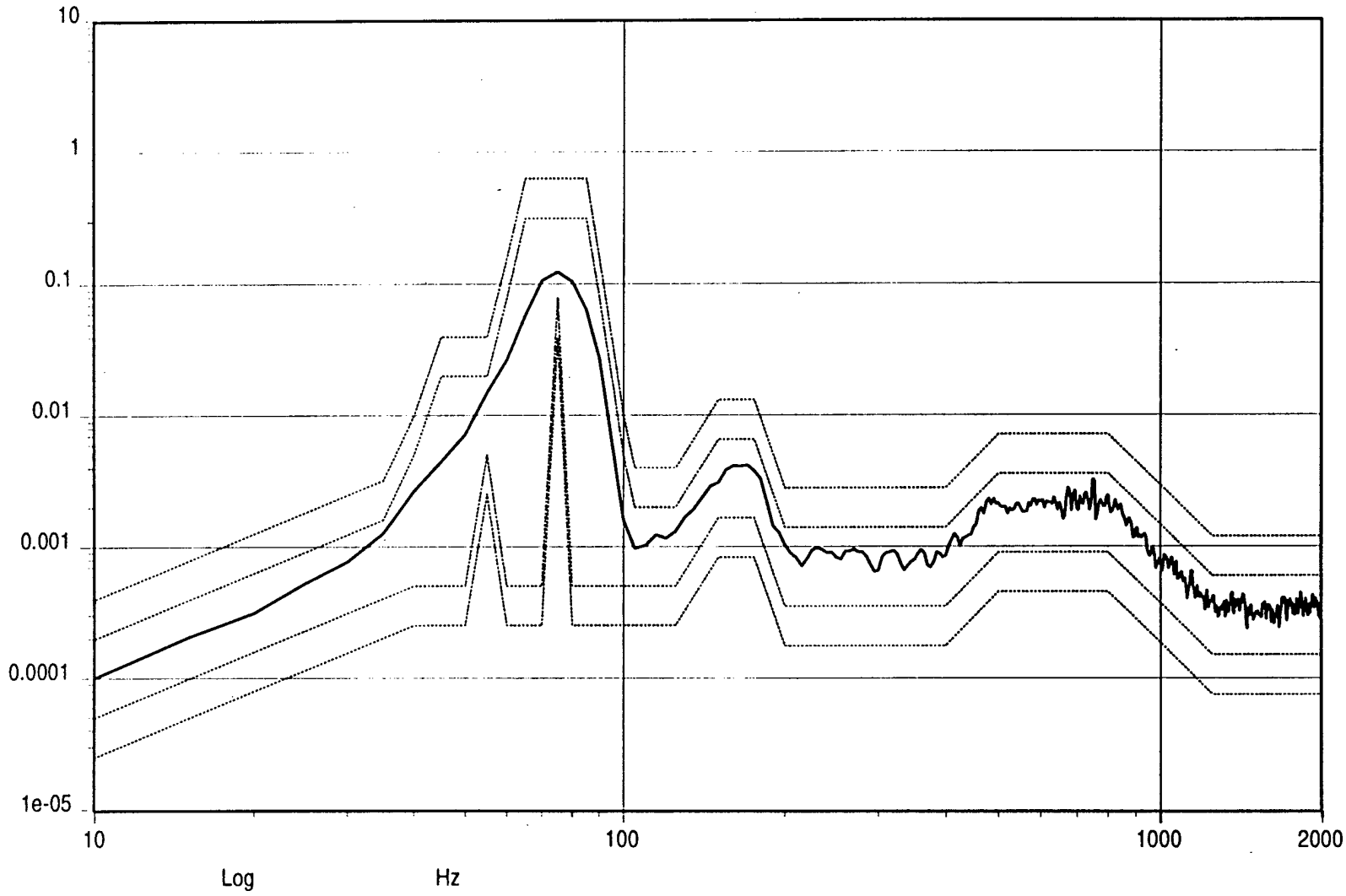
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



12:43:36
10-Mar-1998

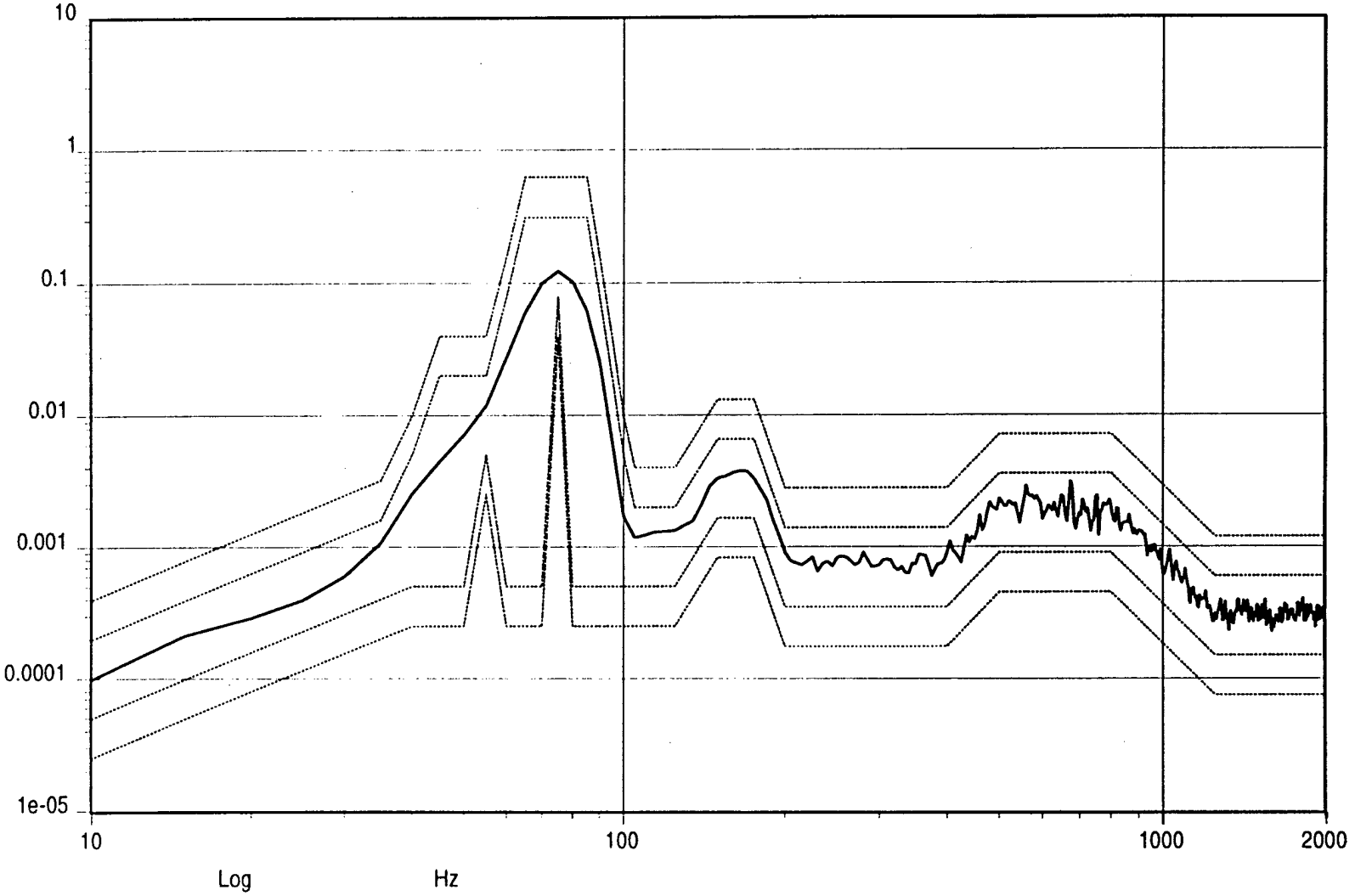
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
2.102

13:45:01
10-Mar-1998

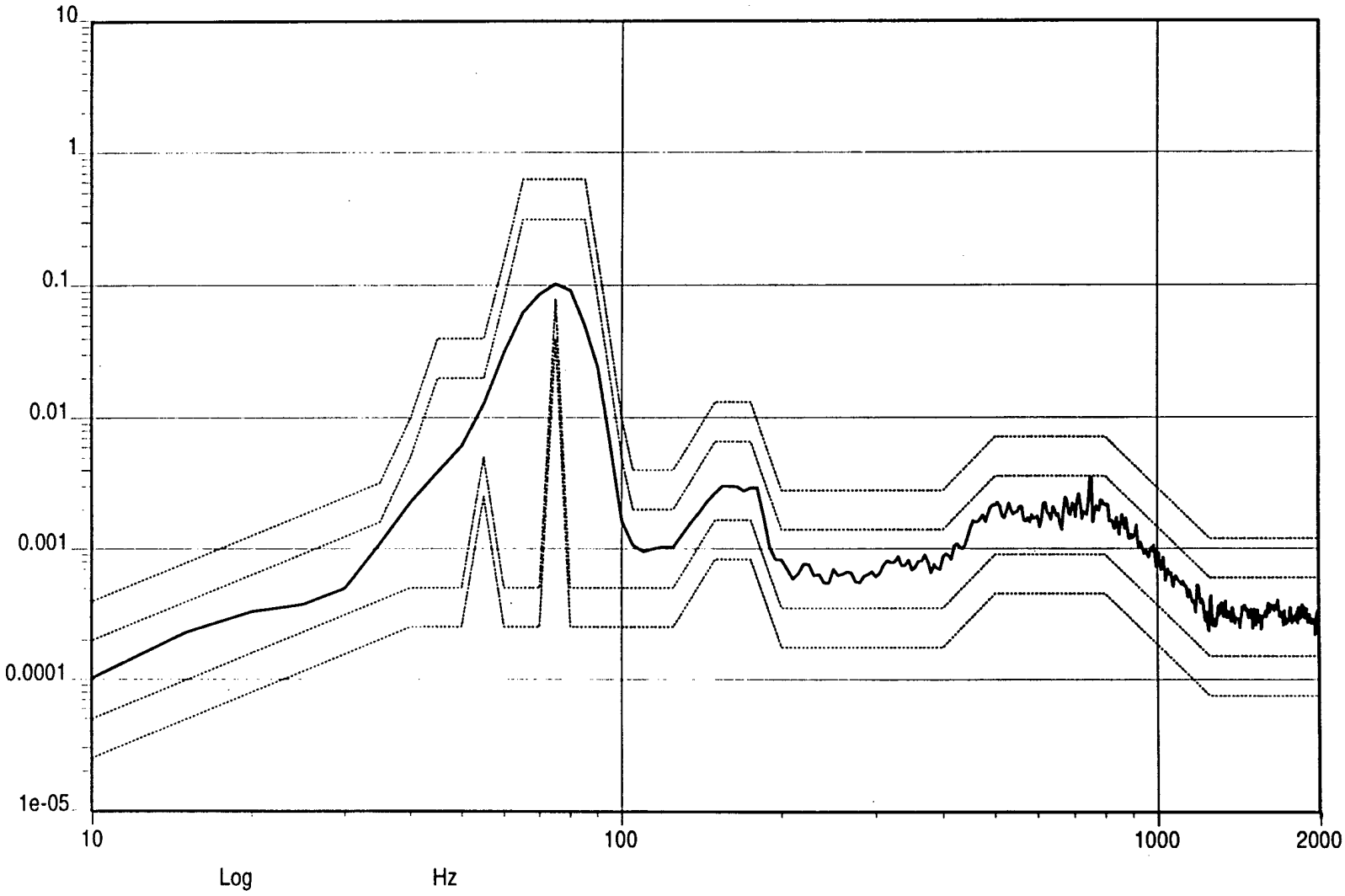
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



15:11:31
10-Mar-1998

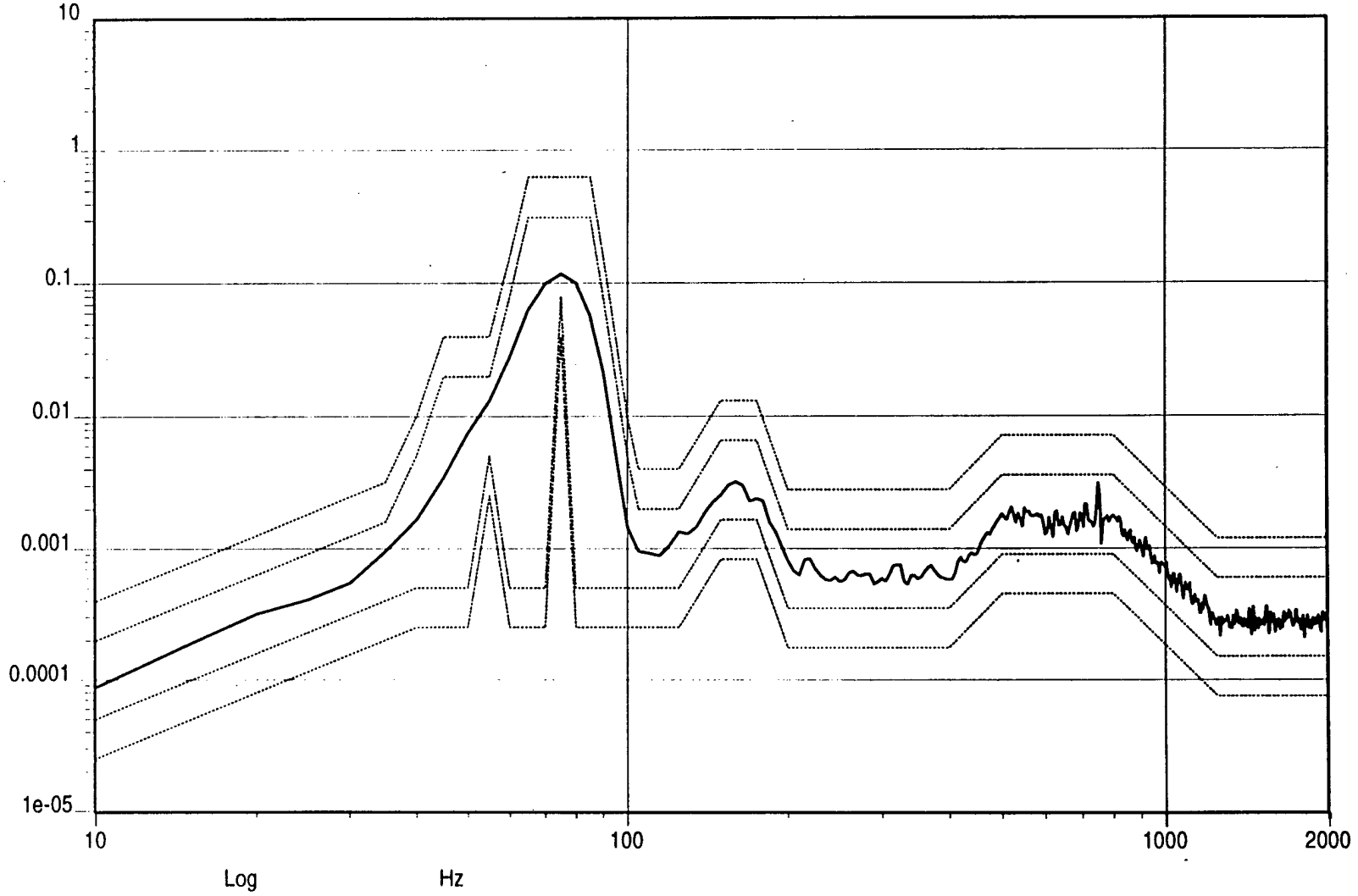
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
2.019

16:14:27
10-Mar-1998

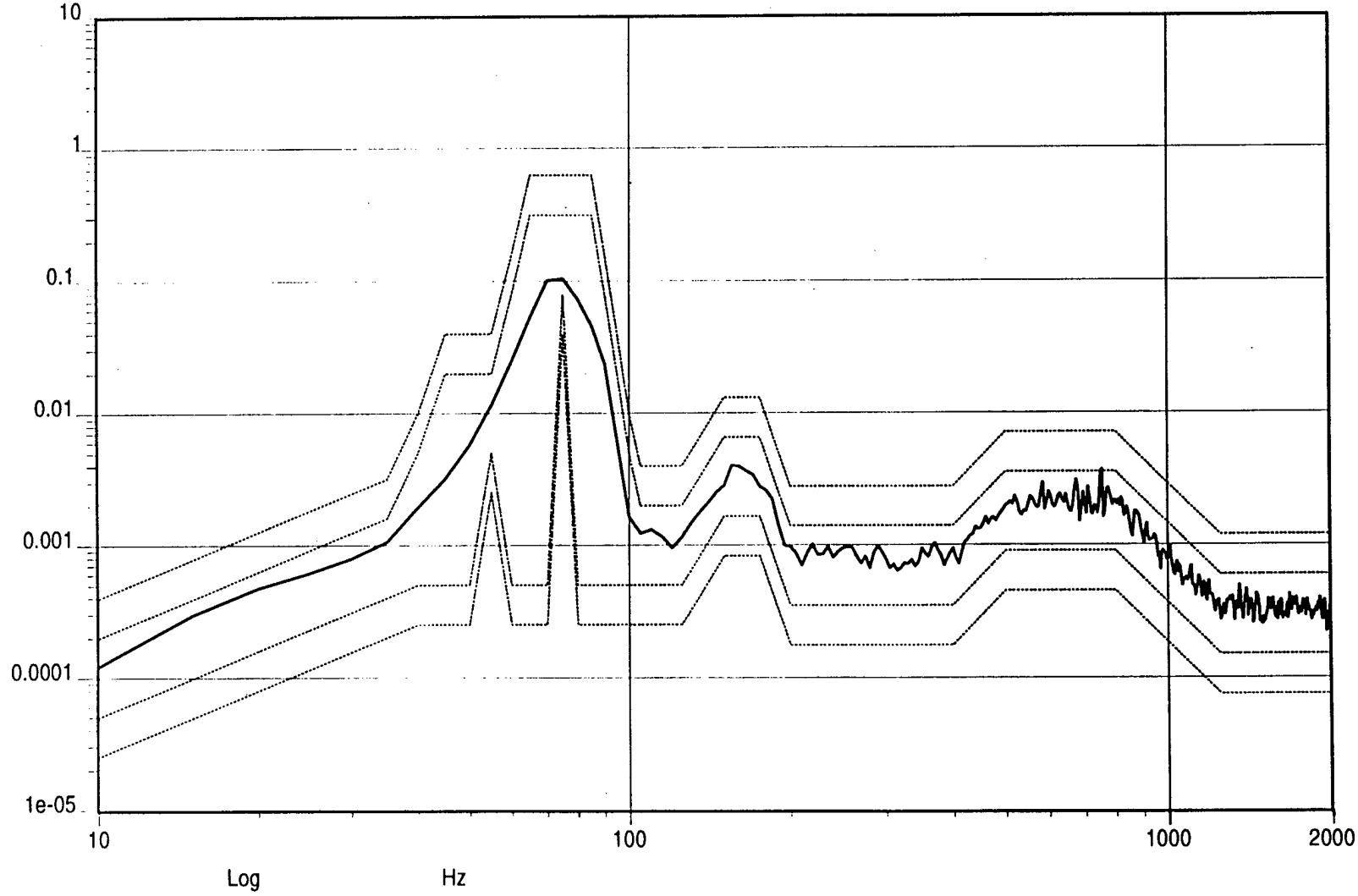
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



17:16:42
10-Mar-1998

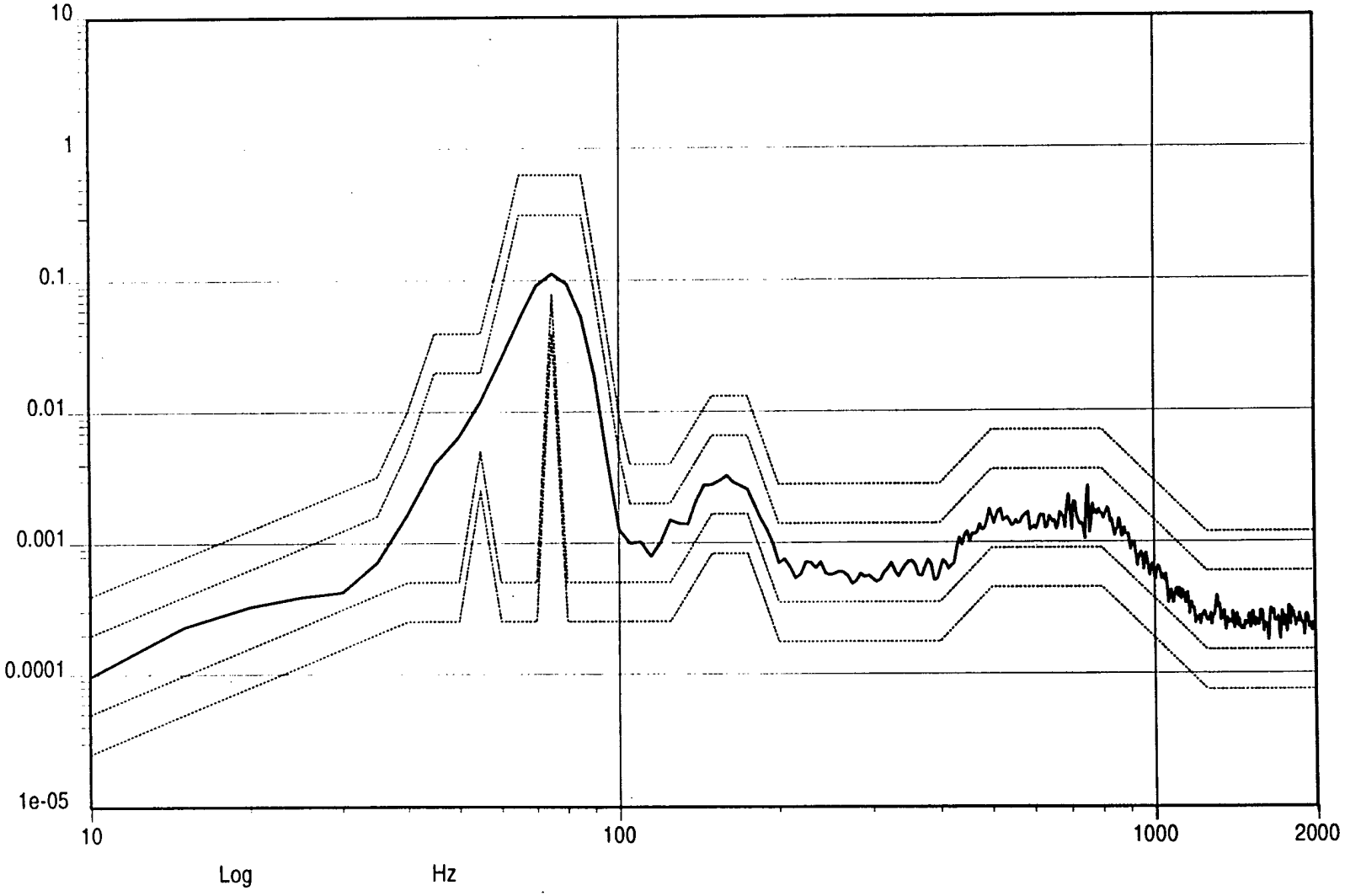
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
1.939

11:47:13
11-Mar-1998

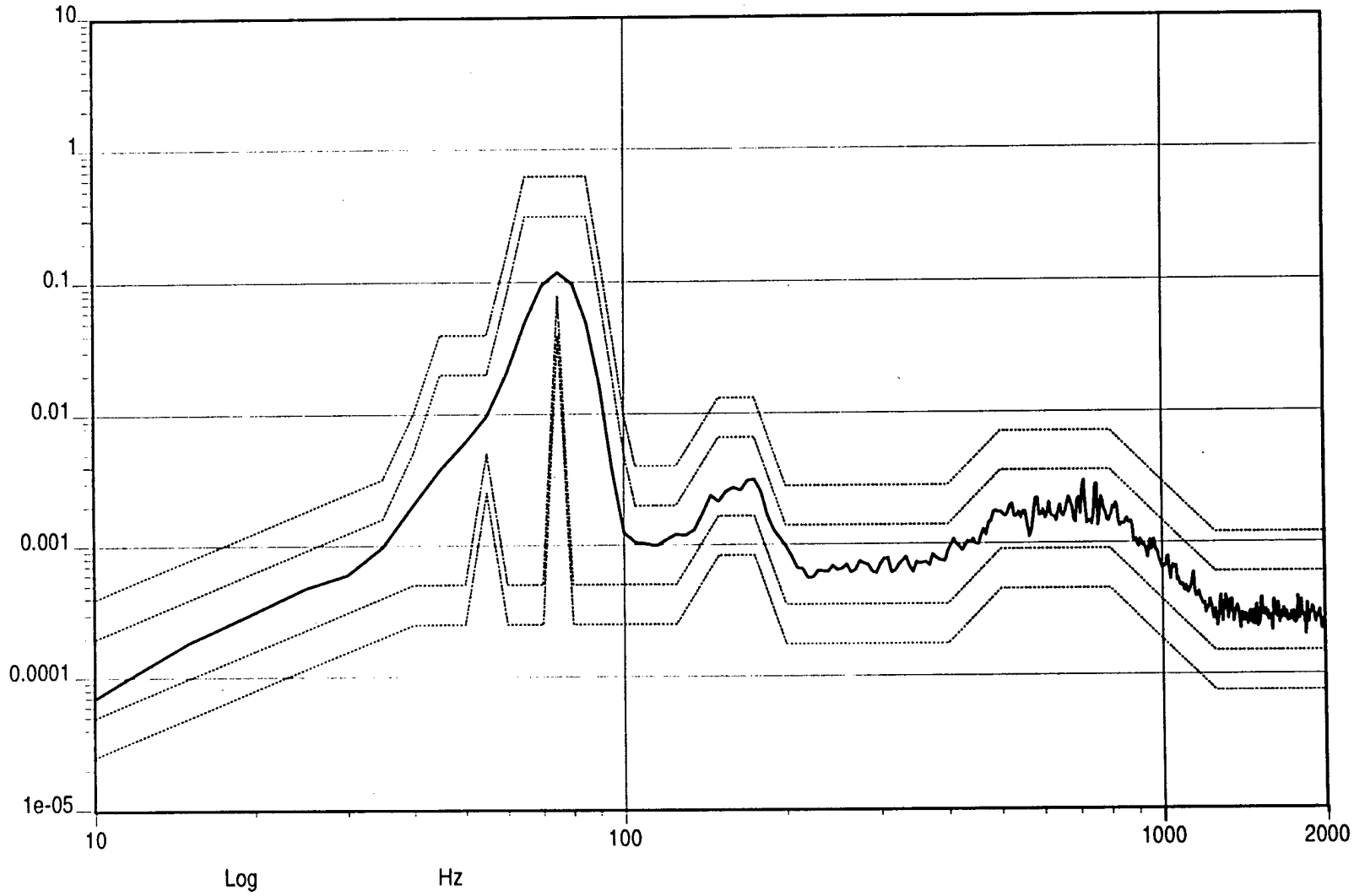
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



13:04:36
11-Mar-1998

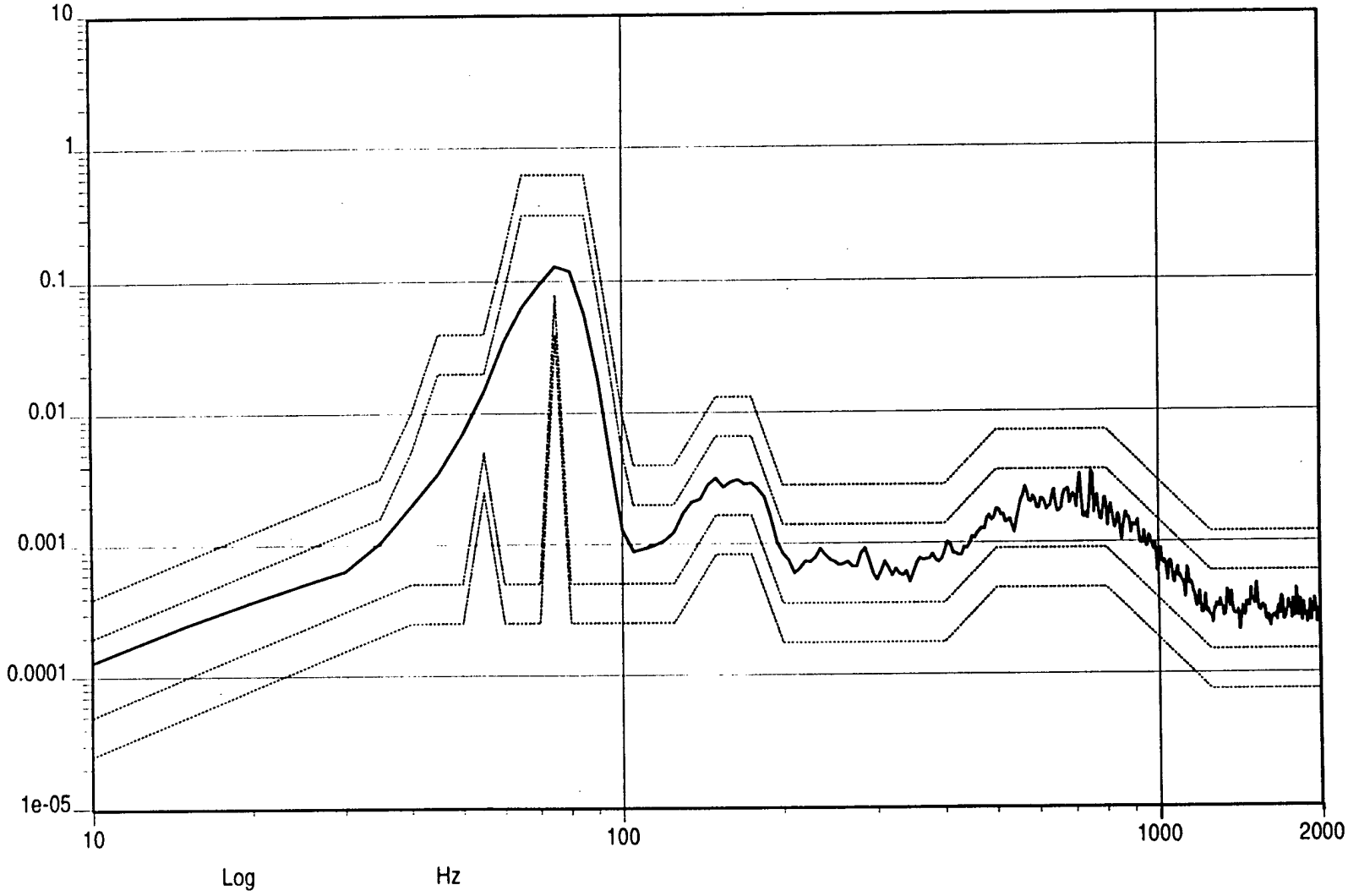
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



14:06:10
11-Mar-1998

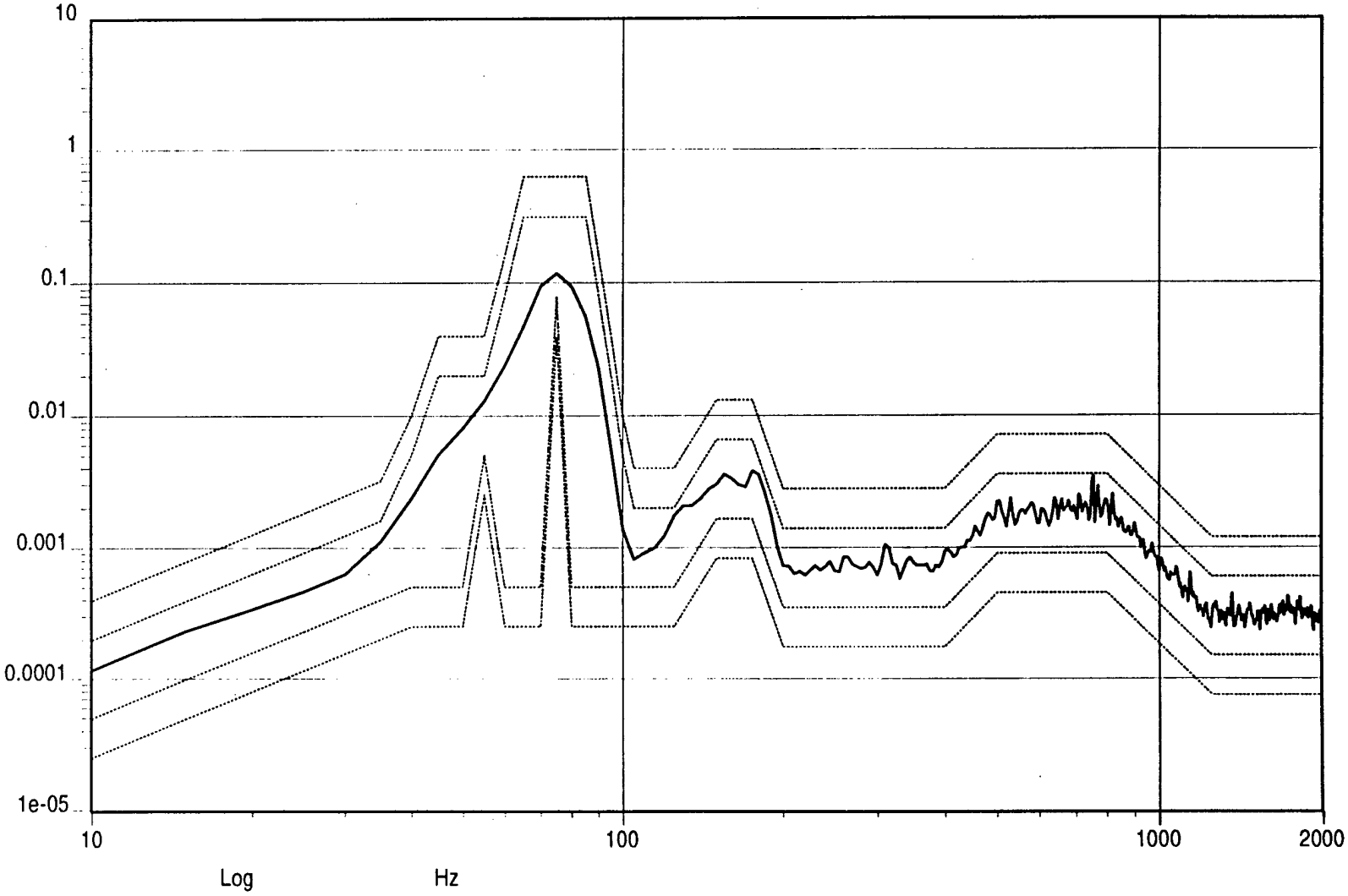
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
2.042

15:07:32
11-Mar-1998

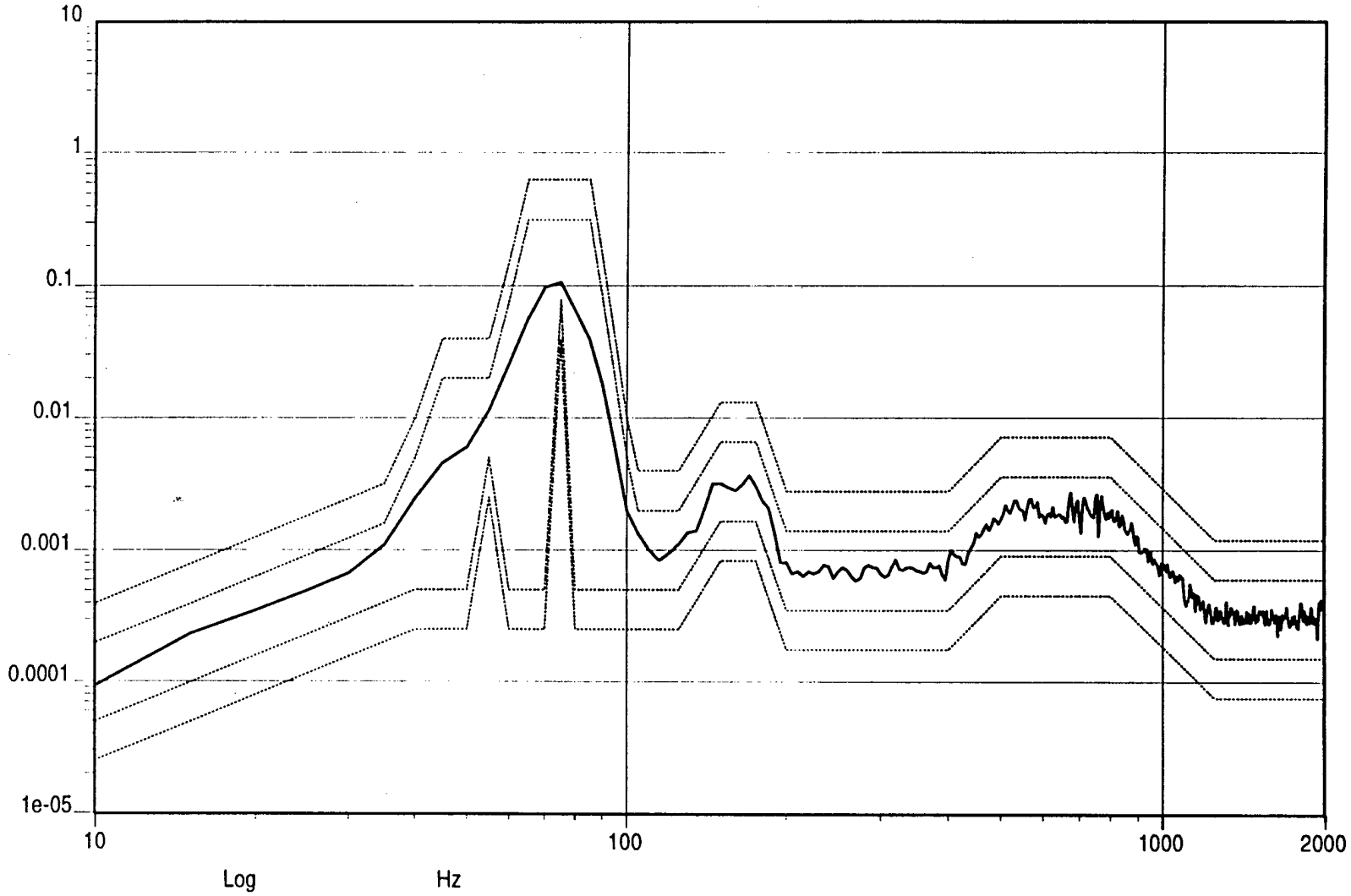
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
1.972

16:09:06
11-Mar-1998

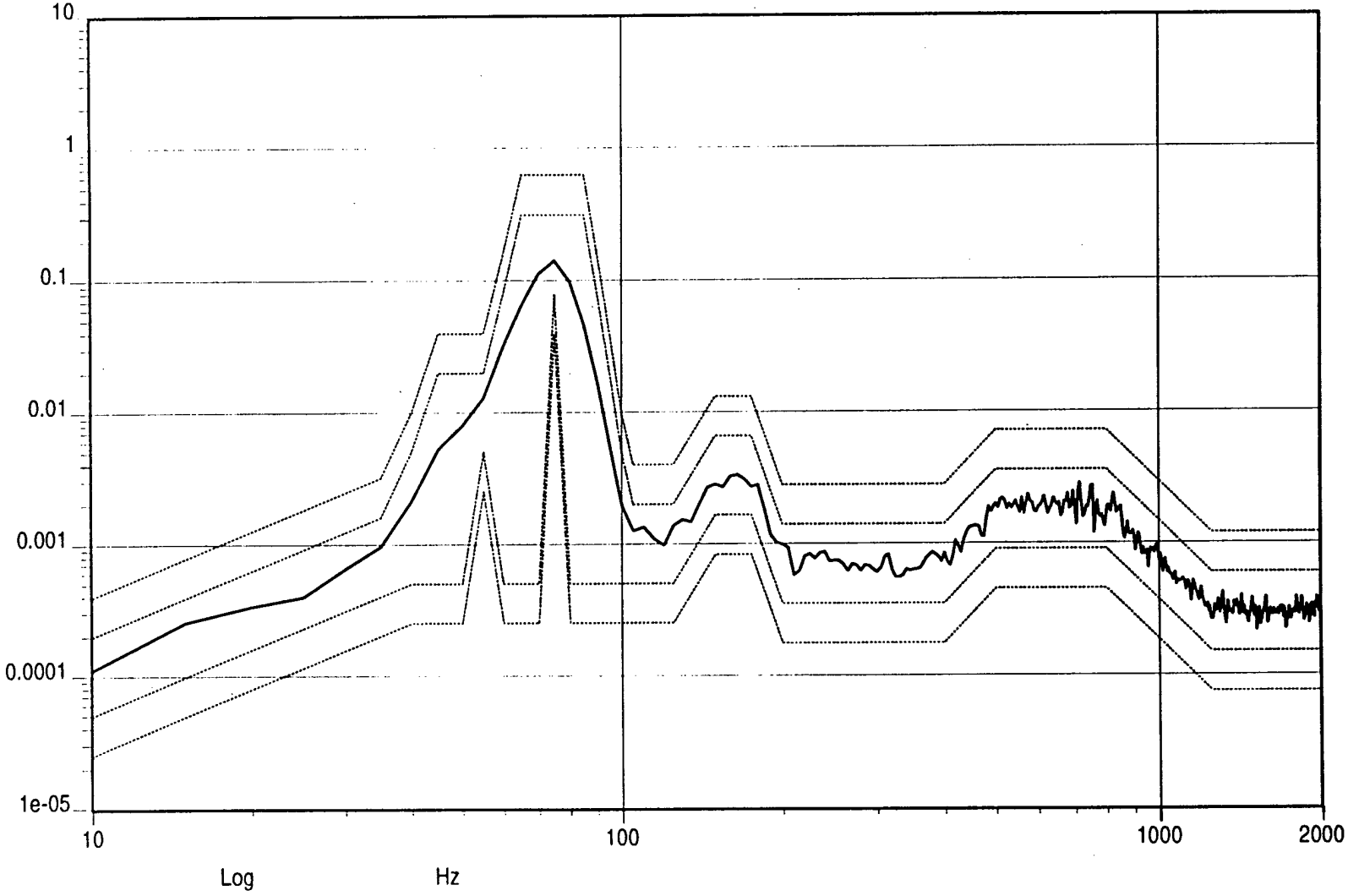
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



17:12:36
11-Mar-1998

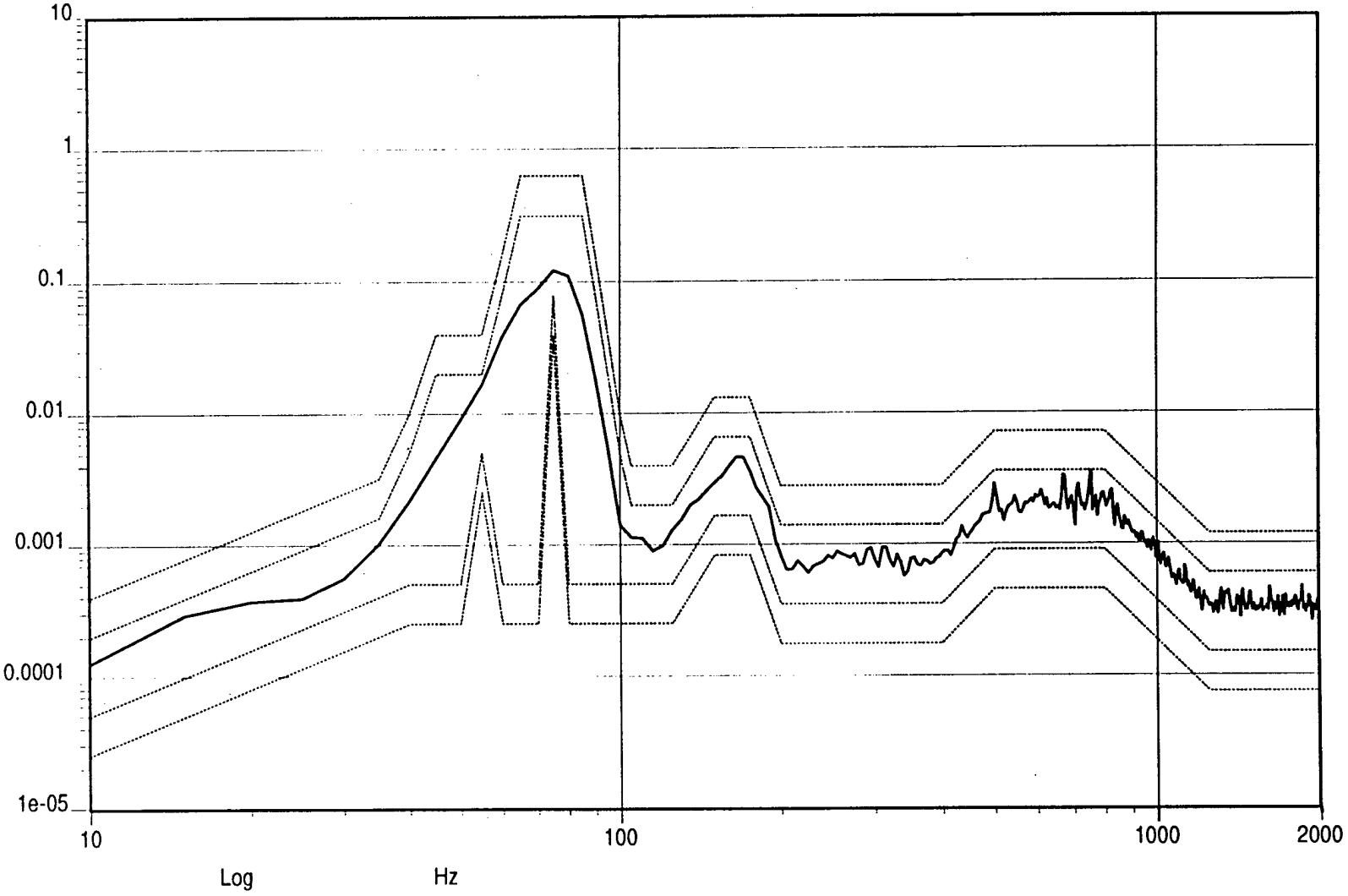
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



18:15:06
11-Mar-1998

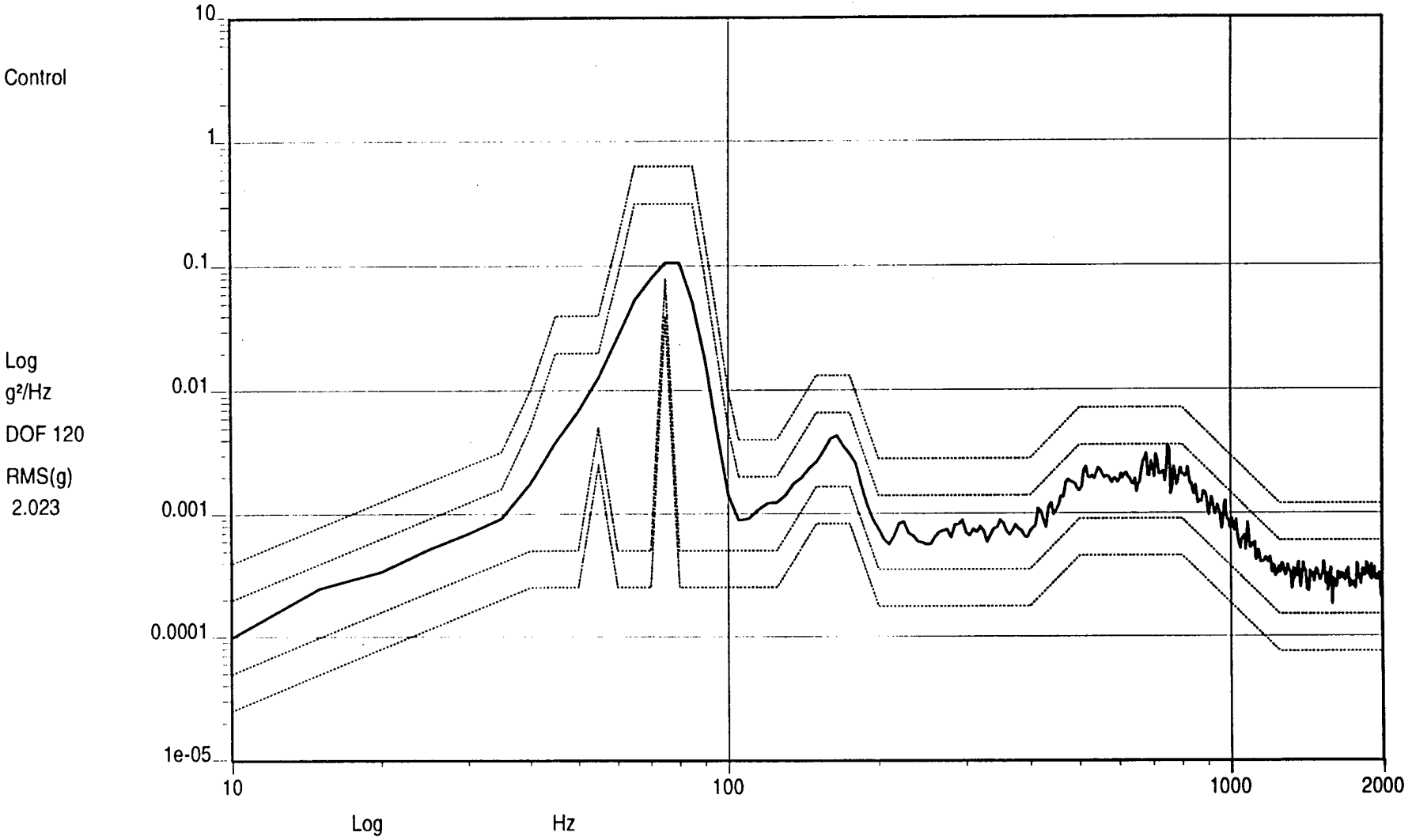
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



08:04:01
12-Mar-1998

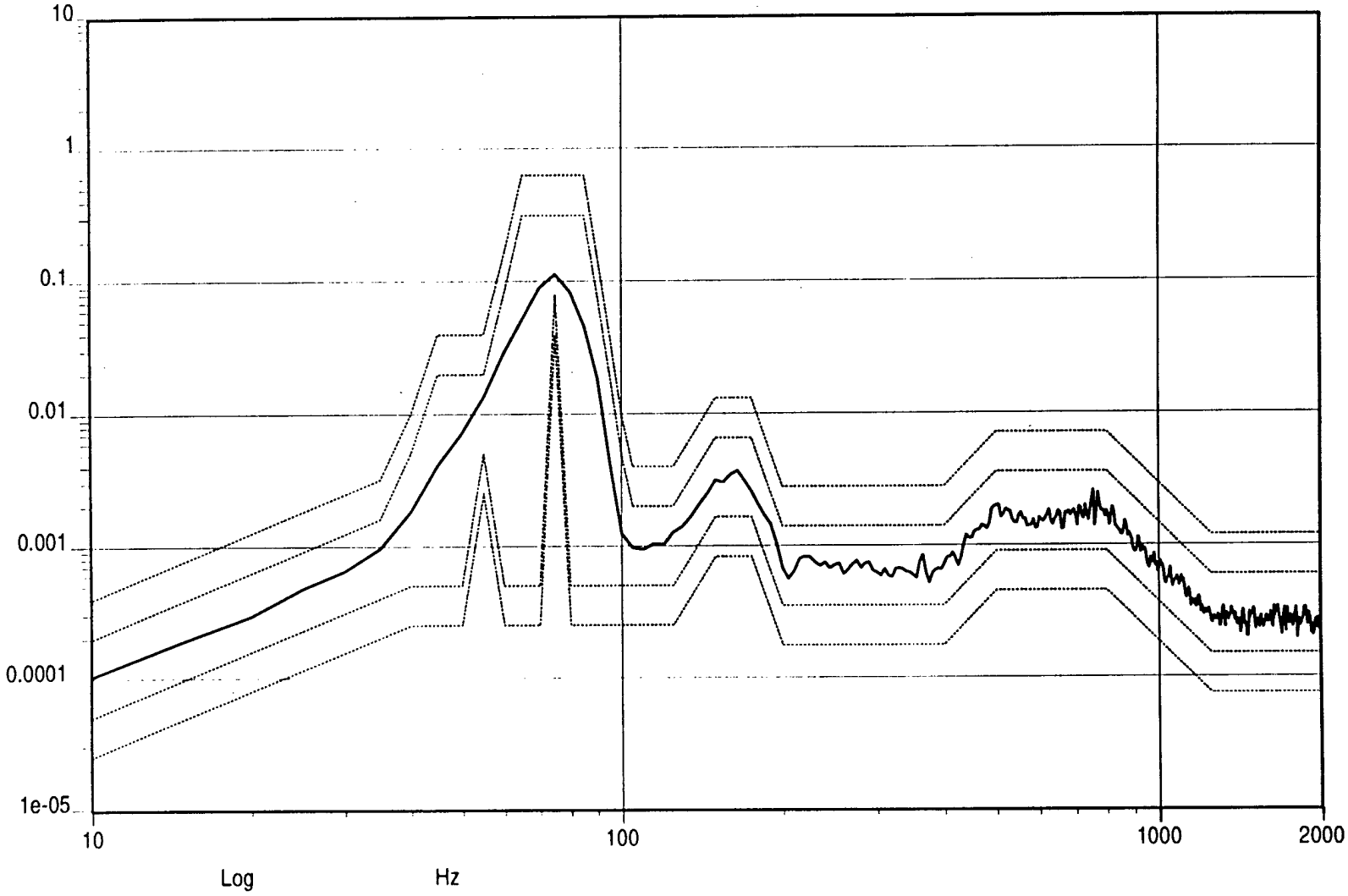
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
1.954

09:05:14
12-Mar-1998

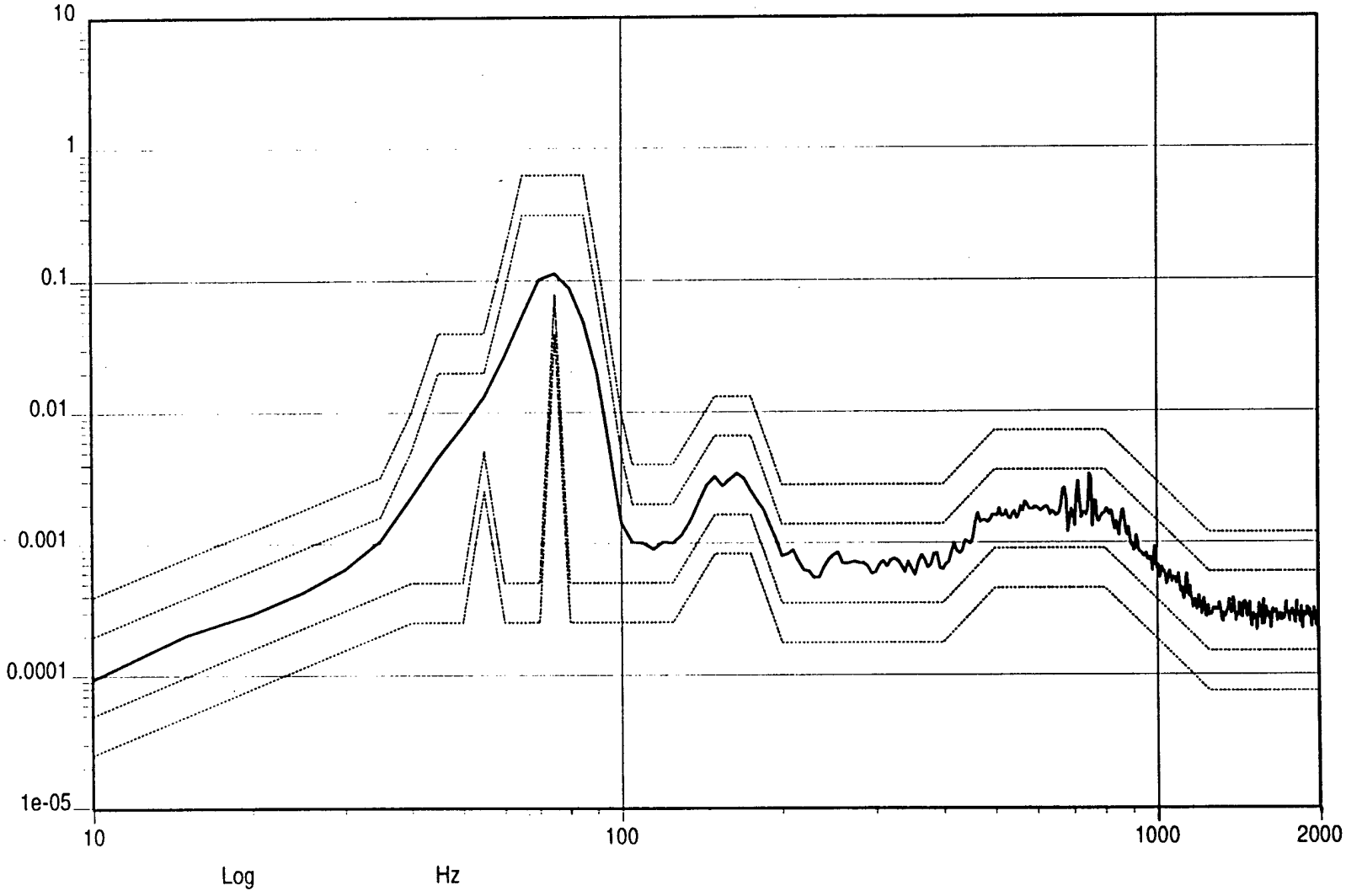
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



10:06:50
12-Mar-1998

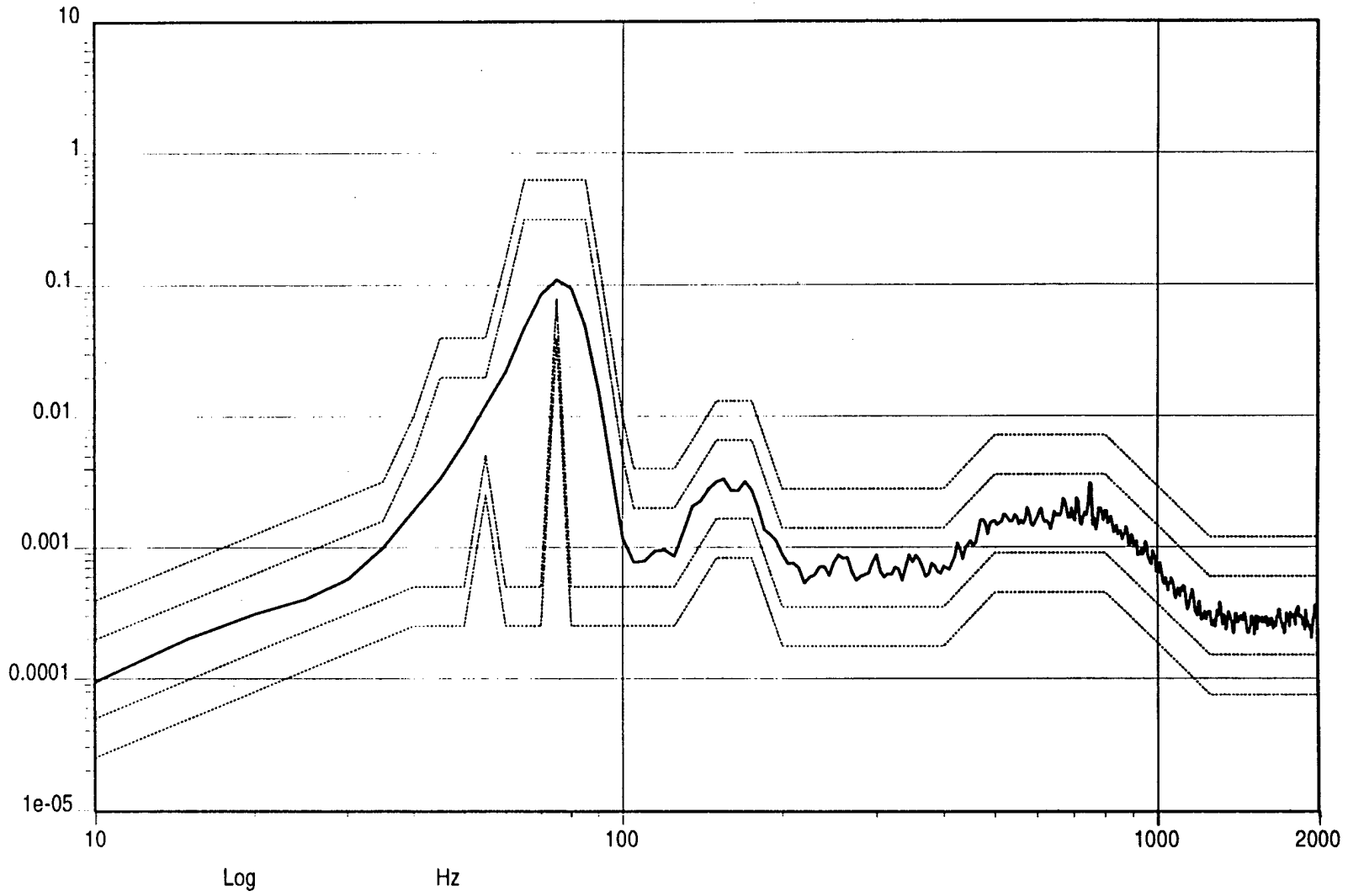
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
1.948

11:08:09
12-Mar-1998

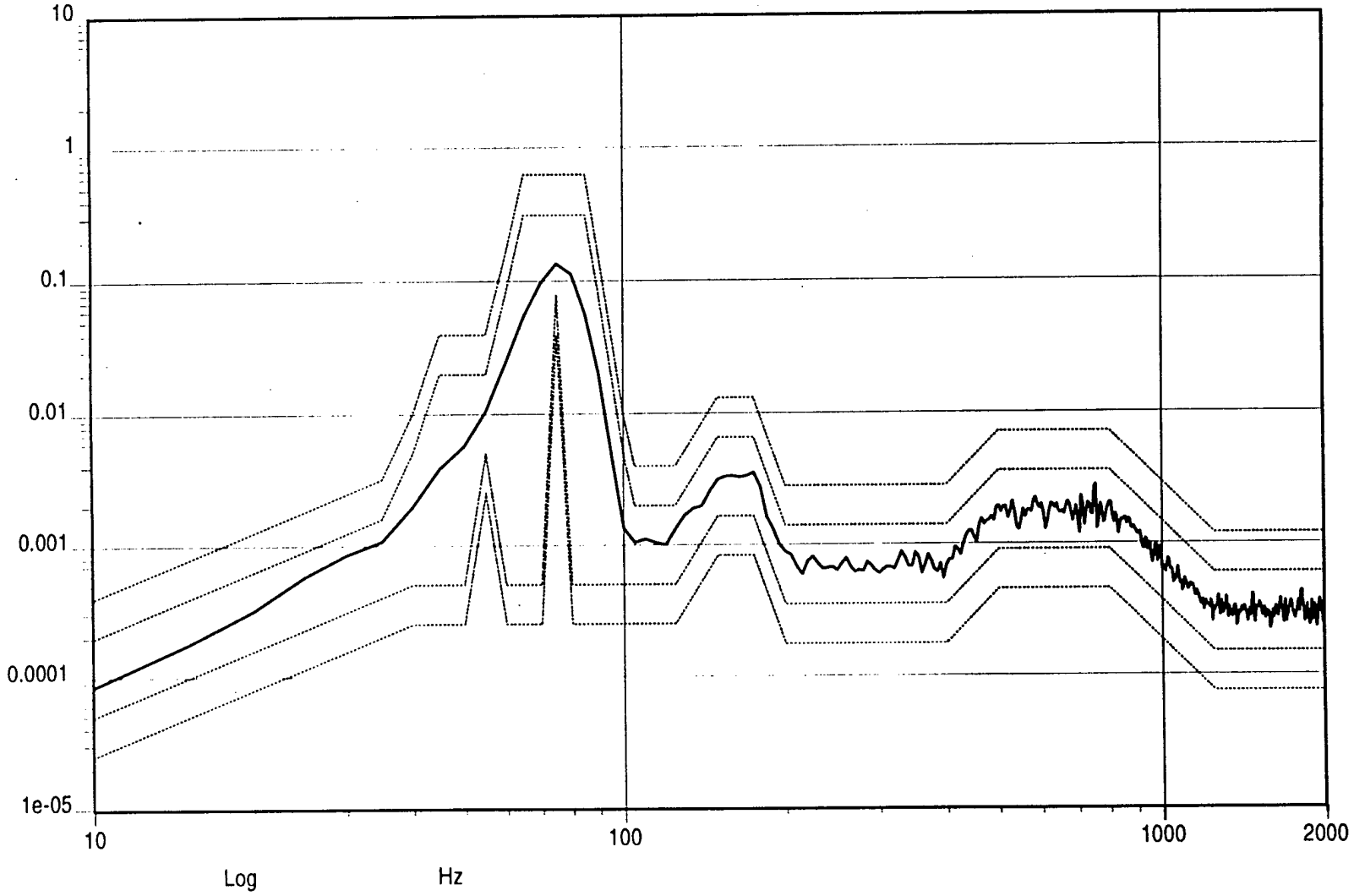
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



12:09:31
12-Mar-1998

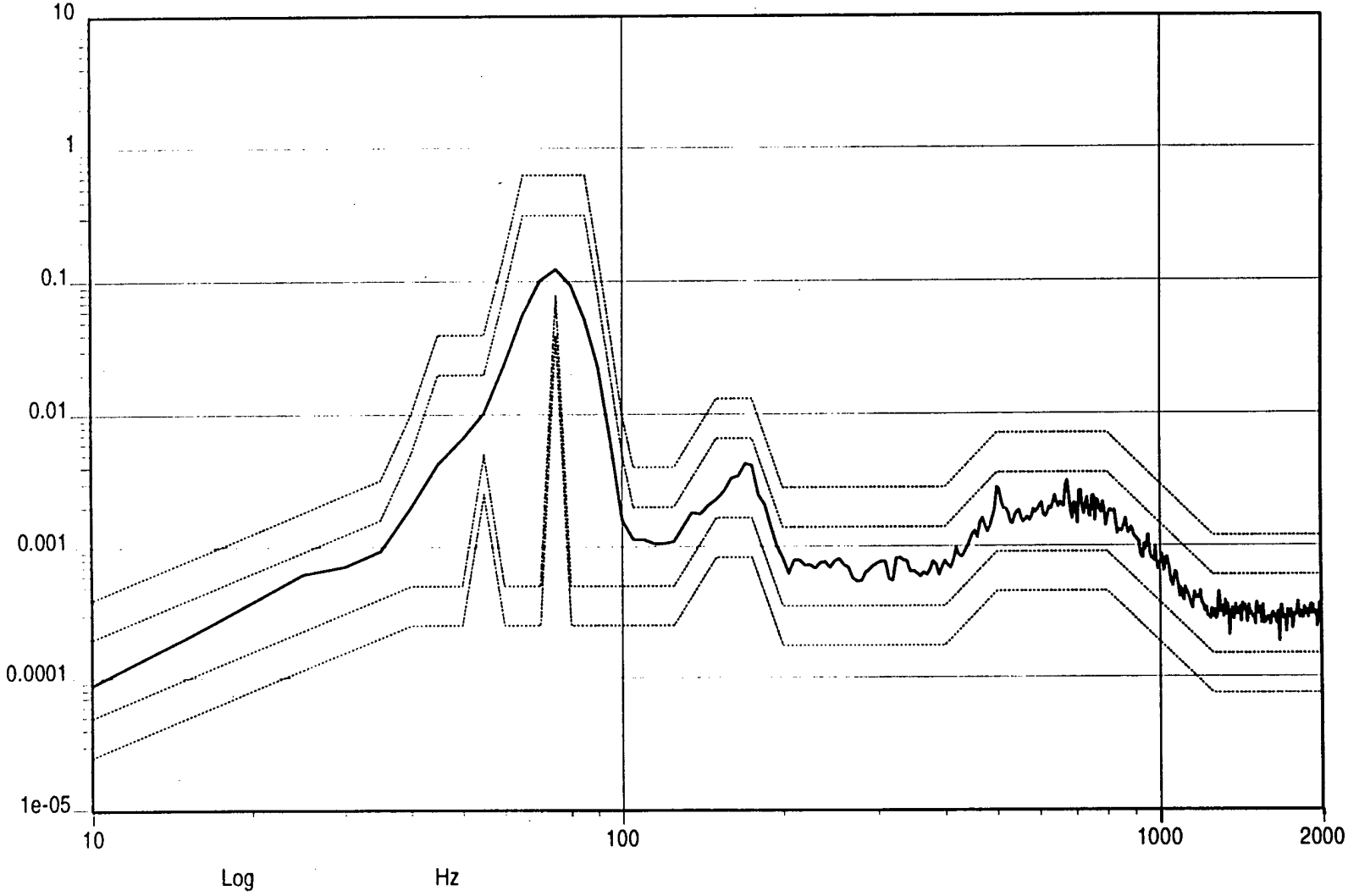
H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Test Level: 0.000 dB
Test Time: 001:00:00

Reference RMS: 1.905
Clipping: Off

Test Range: 10.000, 2000.000 Hz
Resolution: 5.000



Control

Log
g²/Hz

DOF 120

RMS(g)
2.042

13:11:16
12-Mar-1998

H1616-1 AIRCRAFT CRUISE
VERTICAL-AXIS, S/N 13261

Mixed-Mode Test Name: H1616_AC_VERT.tmp

Distribution

1	MS0483	T. D. Hernandez	2165
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1	DOE/AL/WSD	S. M. Nunley	
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Report Number (14) SAND--98-1230

Publ. Date (11) 199806

Sponsor Code (18) DOE/CR , XF

UC Category (19) UC-900 , DOE/ER

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