[redacted]

UNCLASSIFIED

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW	
1st Review Date: 6/9/98	Determination (Circle Numbers):
Authority: DOC ADD	Classification Retained
Name: R B Craner	8 Classification Changed to: UNCL
2nd Review Date: 6-15-98	Contains No DOE Classified Information
Authority: ADD	Coordinate With:
Name: WC Layne	Contains UCAI?
	0 Comments: DECLASSIFY

T-10656 May 27, 1965 File: XW-45, 3-2

SECOND VIBRATION TEST OF W45 TYPE 5A
FOR Q.A. (TERMINER APPLICATION) (U)

CENTRAL TECHNICAL FILE
ACCOUNTABILITY CARD
FILE NO. Mk 45 3-2

PROGRAM 24598
CATEGORY 30213
ORG. 207
DATE 6538

Organization 7300 Environmental Test Report

L. P. Nevada, Org. 7324

RECEIVED
JUN 8 1965
CENTRAL TECH FILE

Approved by: [signature]
Project Leader - 7324

Approved by: [signature]
E. White - 7331

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW DOWNGRADING OR DECLASSIFICATION STAMP	
CLASSIFICATION CHANGED TO: U	AUTHORITY: W.C. Layne
Emelda Selph 6/17/98	
PERSON CHANGING MARKING & DATE	RECORD ID: 98SN2417
WC Layne 6/17/98	
PERSON VERIFYING MARKING & DATE	DATED: 6/15/98

Distribution:
D. S. Breeson, 2142
Attn: L. J. Flesner
J. S. Williams, Jr., 1442
H. T. Othmer, 1541
D. S. Bliss, 2562
M. R. Madsen, 7324
W. D. Zinke, 8147
A. D. Ford, Jr., 8168
Attn: G. H. Funk (2)
E. White, 7331
Central Technical File, 3428-1

1096

[redacted]

UNCLASSIFIED

[redacted]

Table of Contents

		Page
Introduction		3
Summary		3
Procedure and Results		4
Discussion of Results		4-5
Figures 1-3	- Photos of Test Setups	6-8
Figures 4-5	- Photos of Bolt Failures	9-10
Figures 6-9	- Vibration Plots - Longitudinal Axis 1g Survey	11-14
Figures 10-15	- Vibration Plots - Longitudinal Axis 8g Cycling	15-20
Figures 16-23	- Vibration Plots - Vertical Axis 1g Survey	21-28
Figures 24-31	- Vibration Plots - Vertical Axis 8g Cycling - 1st Run	29-36
Figures 32-39	- Vibration Plots - Vertical Axis 8g Cycling - 2nd Run	37-44
Figure 40	- Graph of Output Current vs Frequency	45

[redacted]

UNCLASSIFIED

T-10656

SWEEP VIBRATION TEST OF W45 TYPE 5A
FOR Q.A. (WARHEAD APPLICATION)

Introduction

The object of this test was to subject the W45 to a mechanical vibration test to determine the structural adequacy of the design and to qualify two quality assurance production units. The Type 5A unit had an inert LRL system. Upon satisfactory completion of the Type 5A vibration test, a Type 5 (with HE) unit was to have been subjected to the same vibration test.

During a previous test (T-18301) the W45 skin to adapter ring rivets failed on the Type 5A unit. This same unit was repaired using a new adapter ring and was used in this test.

The following tests were requested for both the longitudinal and vertical axes:

Test 1. A 1 g survey 10-2000 cps using a logarithmic sweep rate of 5-minute duration

Test 2. Two cycles (20 minutes total) from 10-2000-10 cps using a logarithmic sweep rate of 10-minute duration with the following input:

0.25 inch DA	10 to 25 cps
8.0 g	25 to 2000 cps
8.0 g	2000 to 25 cps
0.25 inch DA	25 to 10 cps

This test was requested by Mr. G. Hosking, 2122. Mr. R. A. Mikkelsen, T331, was the Test Project Engineer. The test item was instrumented for testing on November 23, 1964; testing was completed December 14, 1964.

Summary

The W45 Type 5A was subjected to the longitudinal axis vibration test. No deleterious effects were noted.

The unit was then subjected to the vertical axis test. During the downsweep portion of the test, with an input of 8 g, five of the bolts along the bottom of the mounting ring failed. After replacement of the Helicoils, three of the W45 mounting bolts failed during the 8 g downsweep portion of the second vertical test run.

UNCLASSIFIED

[redacted]

Procedure and Results

The W45 was mounted on the shaker as shown in Figure 1 for testing in the longitudinal orientation. Figure 3 shows the internal instrumentation for this test. The 1 g survey and the 8 g cycling tests were conducted using a filtered input in the control circuit. The input control filter was a Spectral Dynamics tracking filter with a 15 cps bandwidth between 10 and 100 cps and a 150 cps bandwidth between 100 and 2000 cps.

There was no visible damage to the unit after longitudinal tests. Figures 6 through 9 are the 1 g test response plots, and 10 through 15 are the 8 g test response plots. Observing Figure 10, the notch at approximately 135 cps was caused by saturation of the tape due to a high level of noise signal at this frequency.

Following the longitudinal test, the W45 was mounted in the vertical fixture using a 120 in-lb torque on the 1/4 inch NS mounting bolts. Eleven bolts were used as one of the Helicoils apparently was bad. It is pointed out on Figure 4. The 1 g input test was conducted and the responses plotted in Figures 16 through 23. A fundamental mode of the cantilevered unit was apparent at 90 cps with an output acceleration of approximately 19 g measured at the forward end.

The 8 g input run was swept up to 2000 cps. A fundamental mode of the cantilevered unit with this input occurred at approximately 70 cps with an output acceleration of 90 g measured at the forward end. The output accelerations experienced during this half cycle are shown in Figures 24 through 30. During the downsweep (2000 cps to 10 cps), five mounting bolts failed as the frequency approached 70 cps. Figure 31 is an output plot from the accelerometer mounted on the forward end during the downsweep. The bolt failure is shown in Figure 4. Testing was interrupted while the Helicoils were replaced.

After the rework of the Helicoils, the unit was again tested in the vertical axis with an 8 g input. The mounting bolts were tightened to 120 in-lb. The responses for the sweep are shown in Figures 32 through 38. Observing Figure 33, it is evident the shaker input could not be controlled at approximately 70 cps, a mode of resonance of the cantilevered unit. The shaker amplifier servo system could not furnish the force fast enough to maintain the 8 g input at this frequency. During the downsweep, bolts again failed at approximately 70 cps; this time the three lower bolts fractured, as shown in Figure 5. The plot of the response of the accelerometer on the forward end of the W45 during the downsweep is shown in Figure 39.

Discussion of Results

During this test, the armature current to the shaker was monitored and is plotted in Figure 40. At approximately 15 cps, the current required

[redacted]

to drive the combined weight of the shaker armature, fixture and test unit (a total of 650 pounds) to an acceleration level of 3 g was approximately 7.5 amperes. If the armature current is proportional to the total generated force, which is a reasonably good assumption at low frequencies, then the current required to drive the 150 lb warhead at 3 g (450 lbs force input) is proportional to the ratio of the test item weight to the total moving weight, or approximately 1.7 amperes. At 70 cps, with an input of approximately 8 g (actually it dropped to approximately 1g, see Figure 33), the driver coil current was approximately 110 amperes. Assuming the test fixture and armature assembly as being rigid at this frequency, approximately 95 amps were required to drive the 150 lb W45. Assuming the same force per ampere of current at 70 cps as was generated at 15 cps (263 $\frac{\text{pounds-force}}{\text{amp}}$), the 95 ampere current represents a 25,000 lb force input to the W45.

At 15 cps approximately 1200 pounds of force must be supplied to the W45 to maintain an input of 8 g; whereas at the frequency of the bolt failure the force supplied to the W45, maintaining the same input, is approximately 25,000 pounds. Radical force variation such as this would appear to cast doubt on the validity of the test specification.

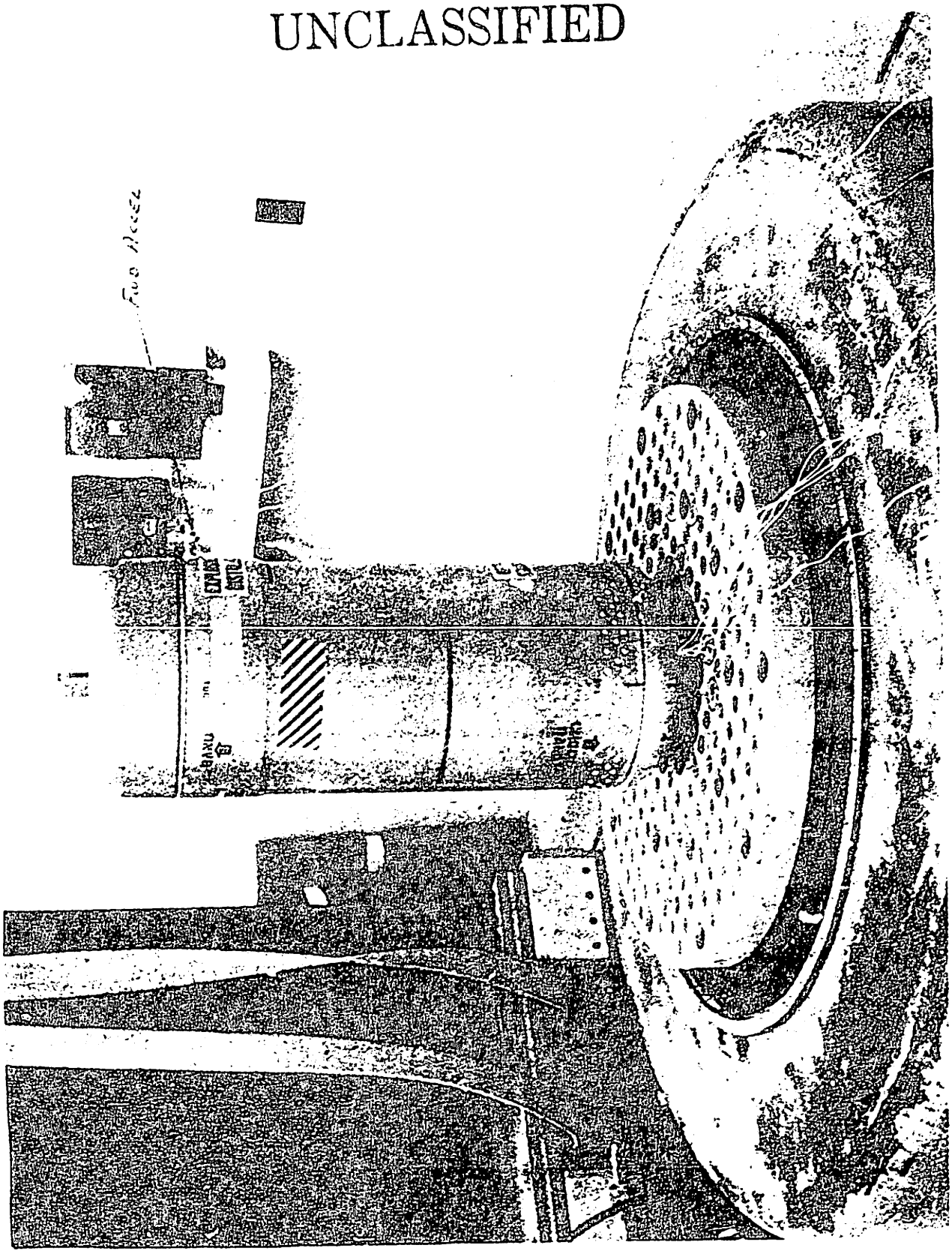
It is believed further testing of the W45 at this 8 g input test specification will result in failures of the same types experienced during this test (T-10656) and the previous test (T-18301). It is suggested modification of the test specification be considered.

IEH:dc

[redacted]

[redacted]

UNCLASSIFIED

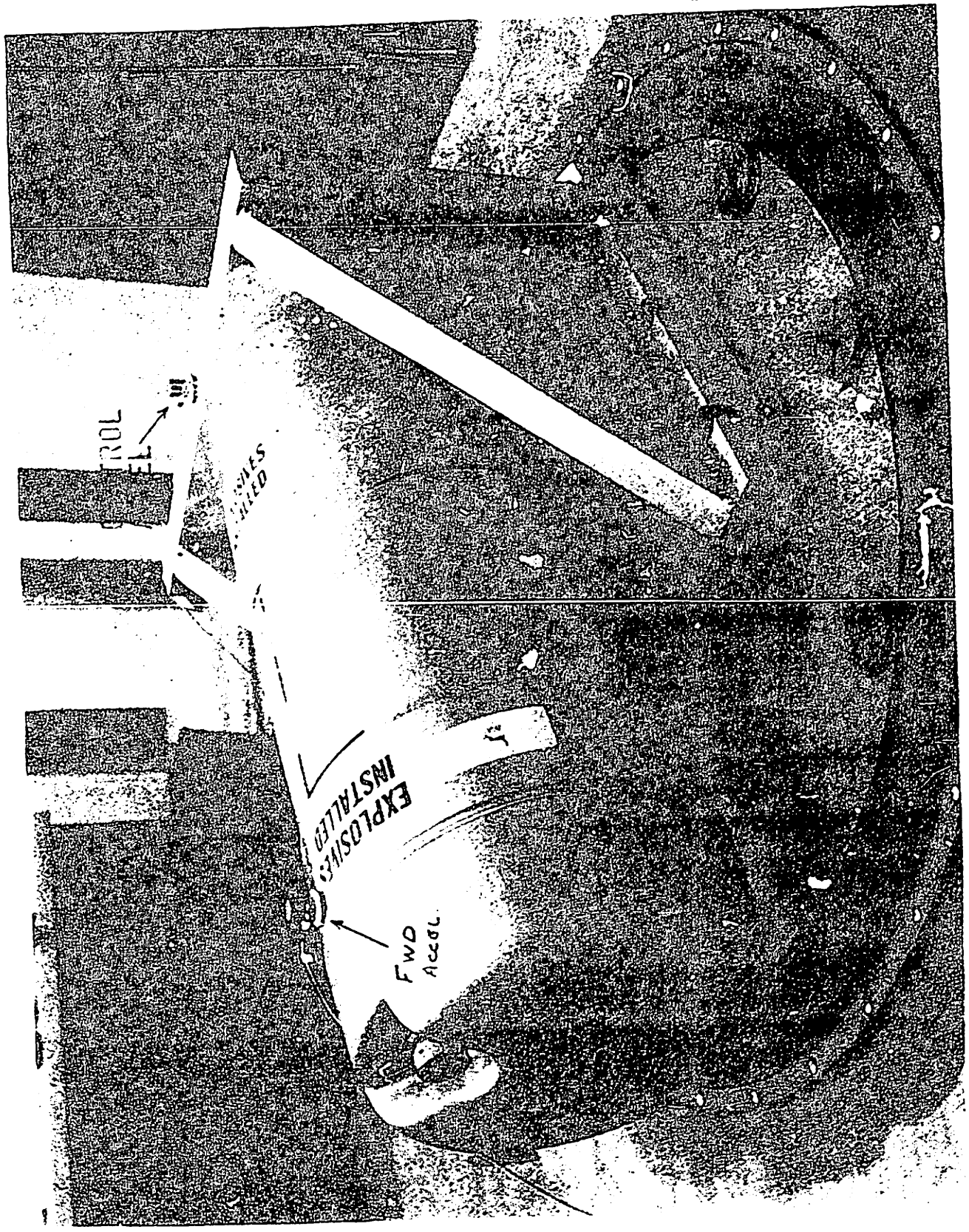


[redacted]

UNCLASSIFIED

[redacted]

UNCLASSIFIED



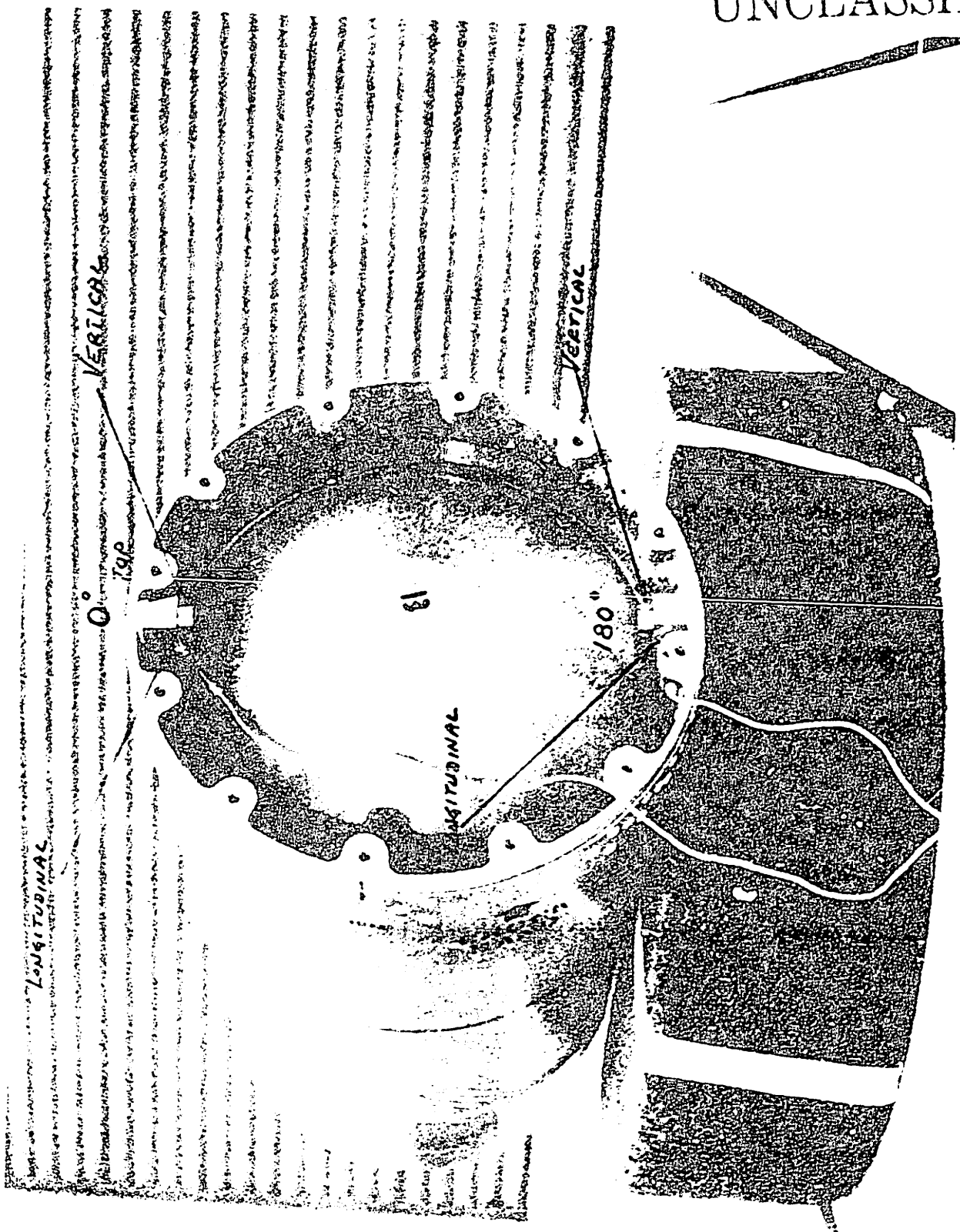
[redacted]

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED

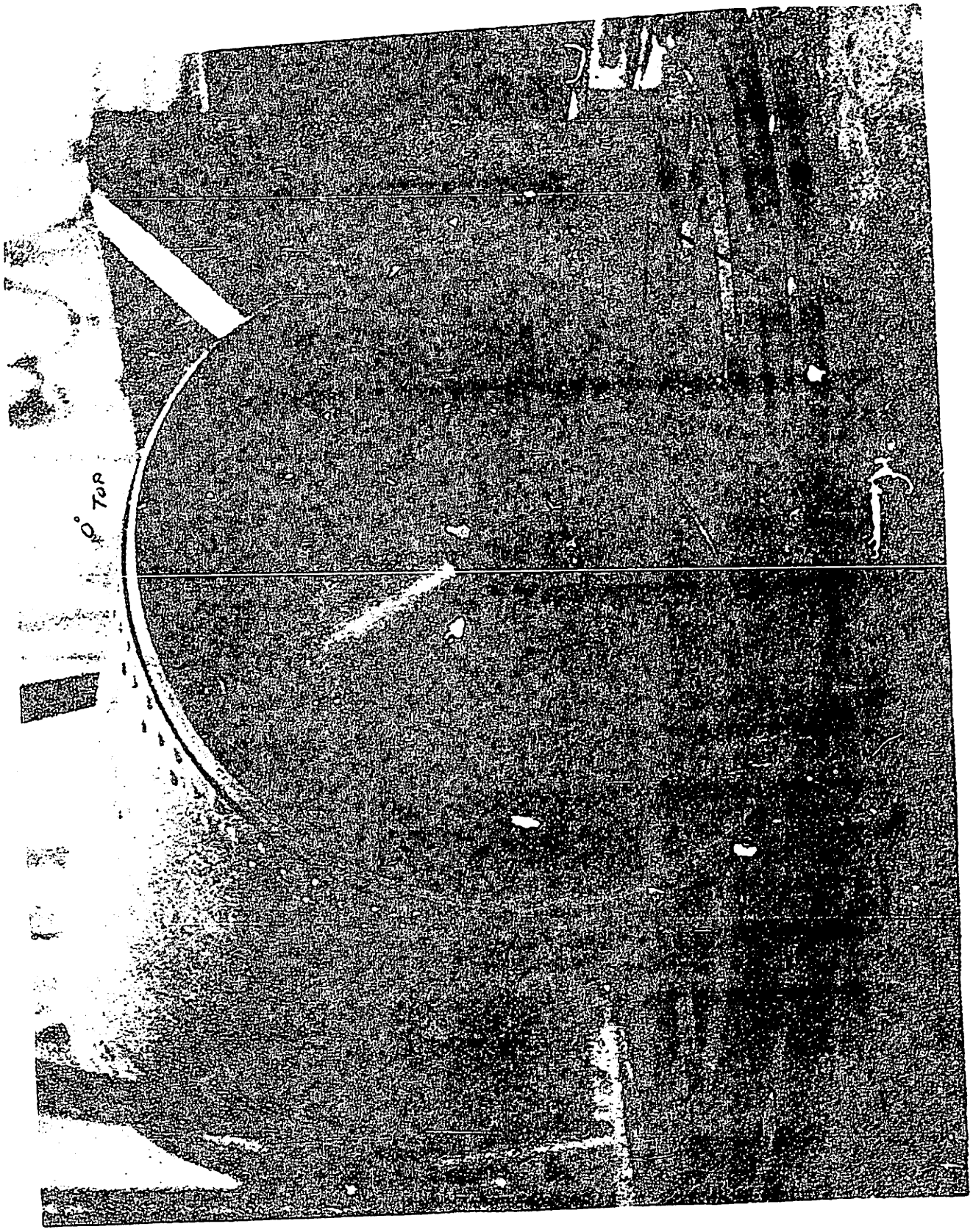


[redacted]

UNCLASSIFIED

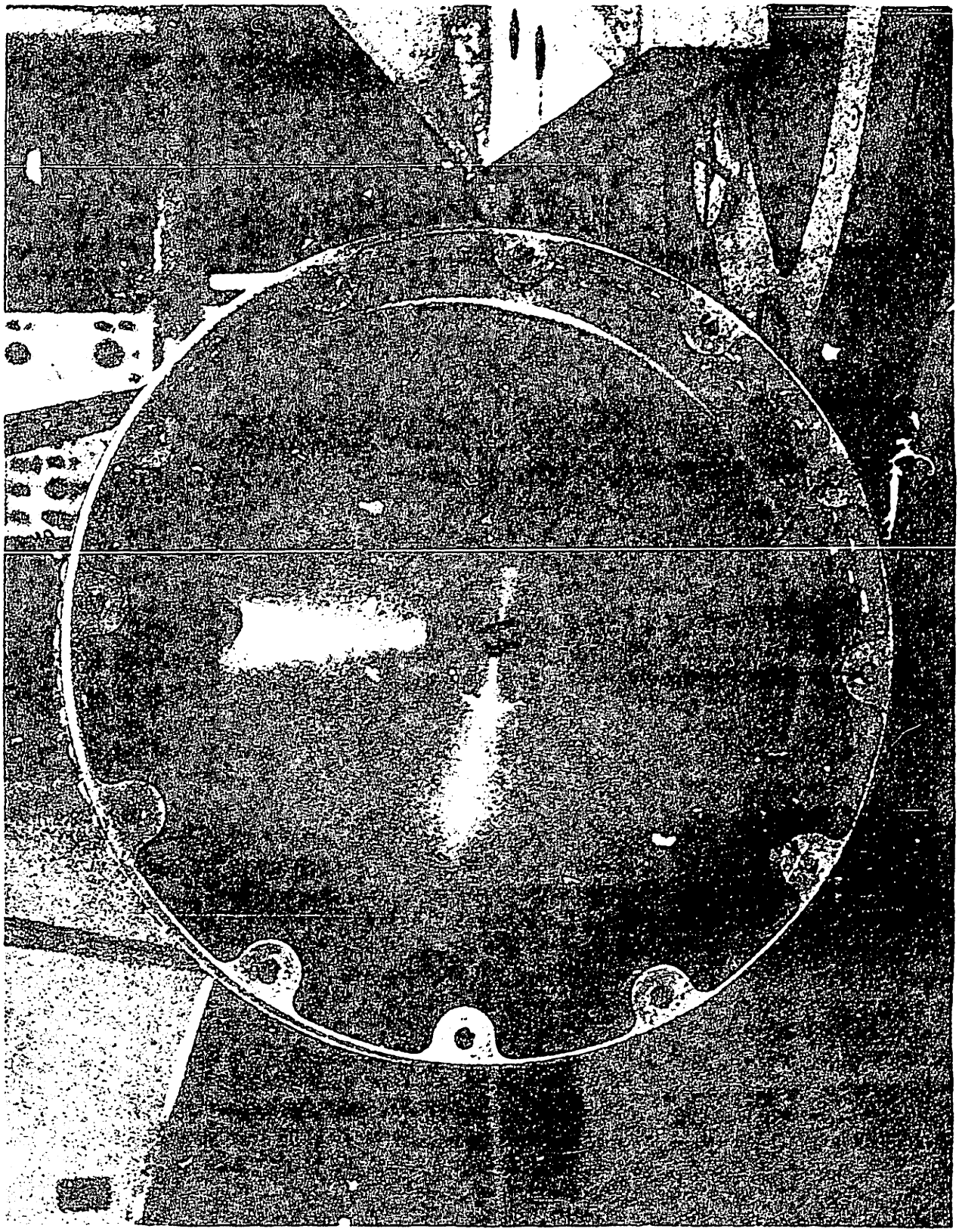
[redacted]

UNCLASSIFIED



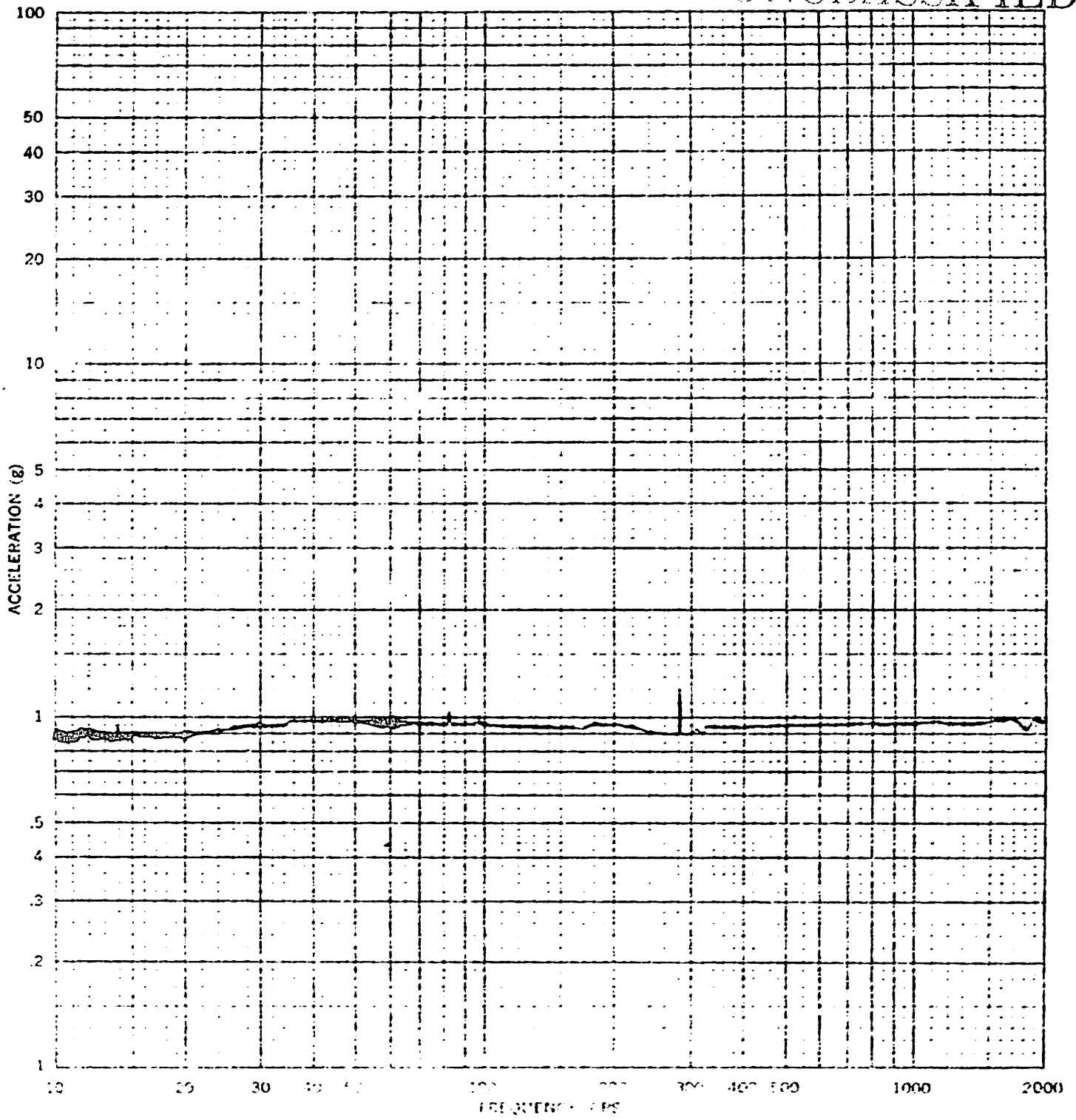
UNCLASSIFIED

[redacted]



[redacted]

UNCLASSIFIED



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS, AT [illegible] F T. [illegible]

ACCEL. LOCATION [illegible] REF SYM. [illegible]

FIGURE REFERENCE [illegible] TEST DATE [illegible]

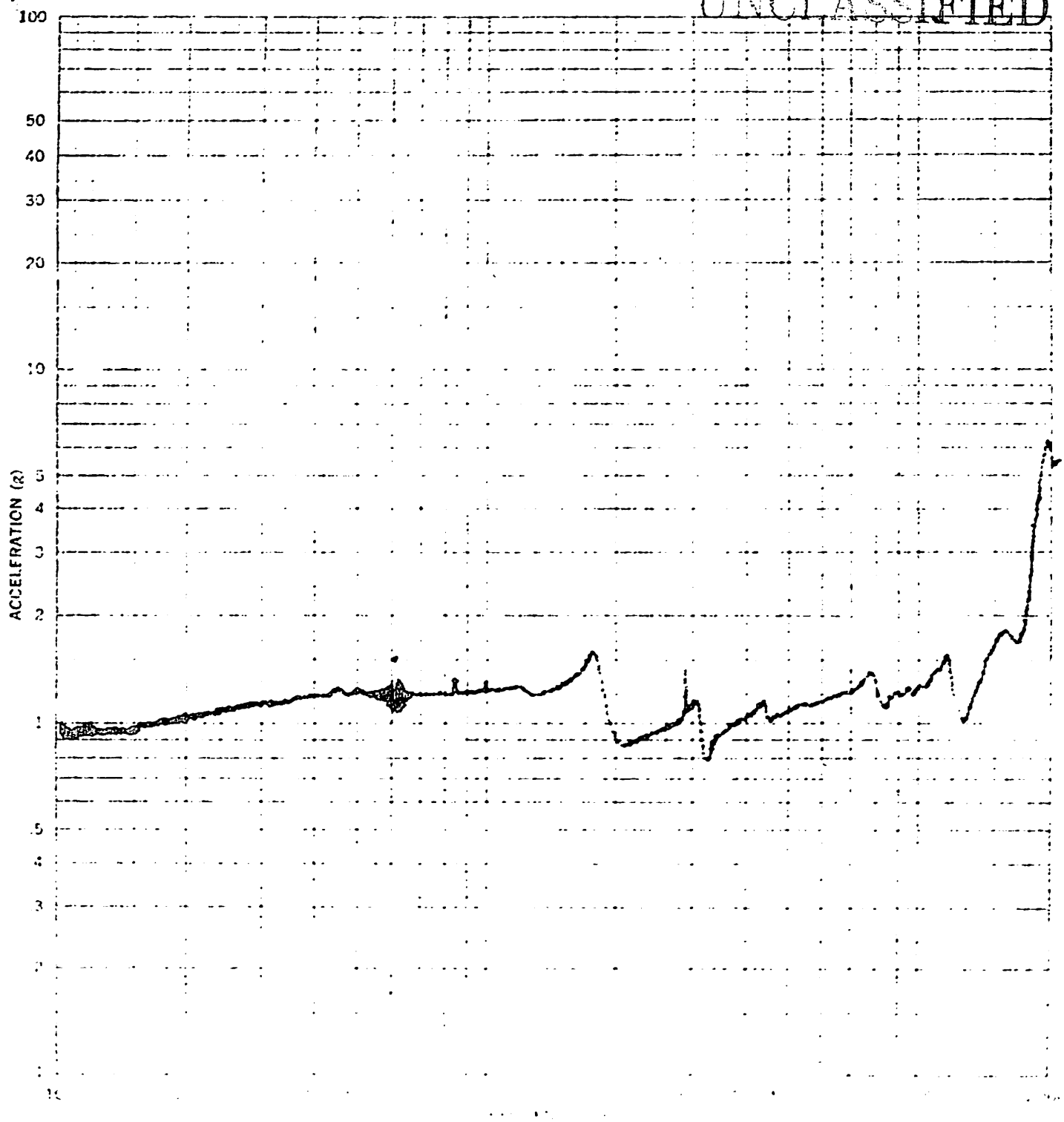
AXIS [illegible] FIGURE [illegible]

FILTER BANDWIDTH [illegible] CPS PAGE [illegible]

UNCLASSIFIED [redacted]

[redacted]

UNCLASSIFIED



VIBRATION [illegible]

WITH [illegible]

ACCELERATION

FIGURE NUMBER

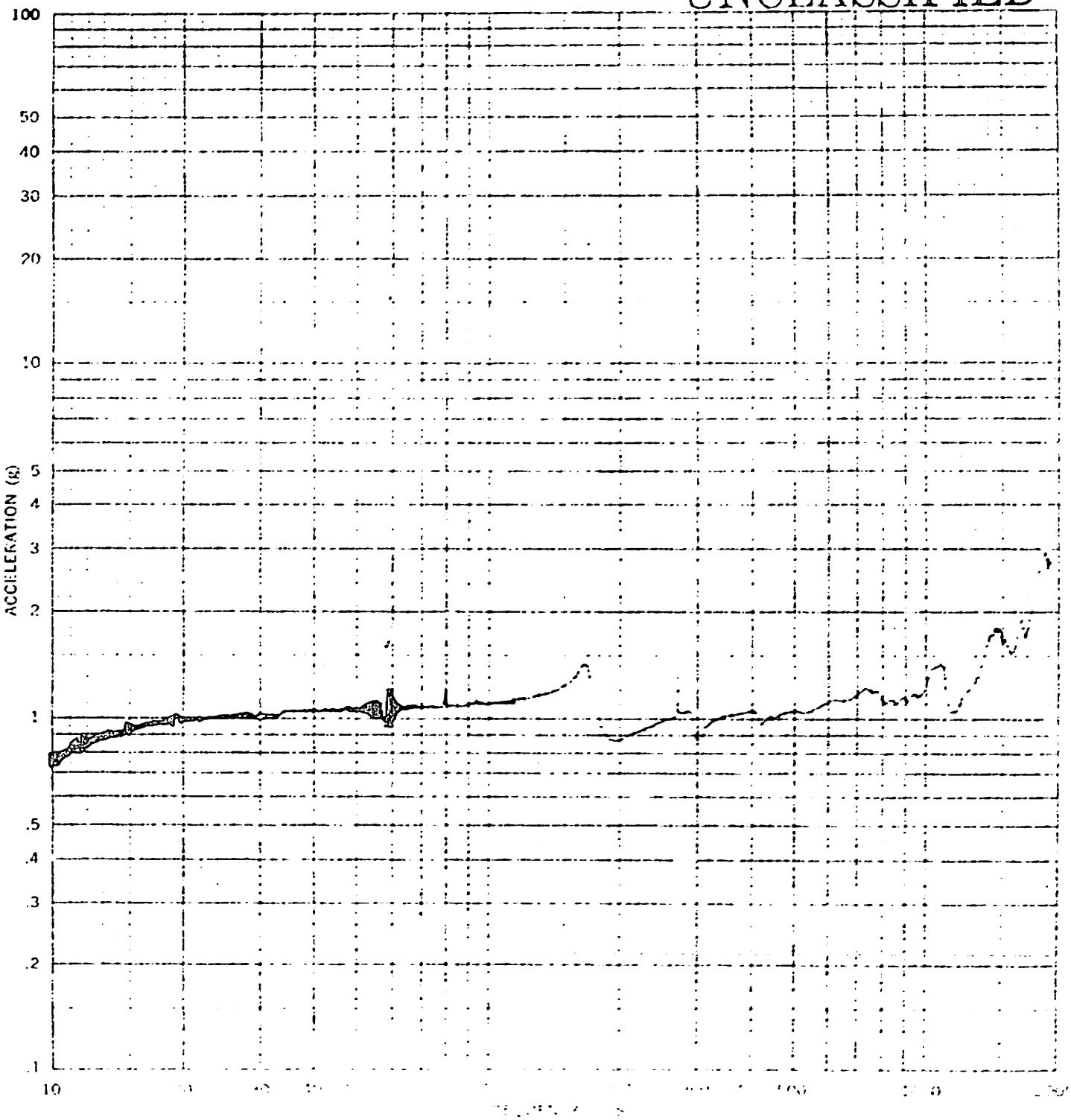
AXIS

FILTER BANDWIDTH

PAGE

UNCLASSIFIED [redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS AT

ACCEL LOCATION REF SYM

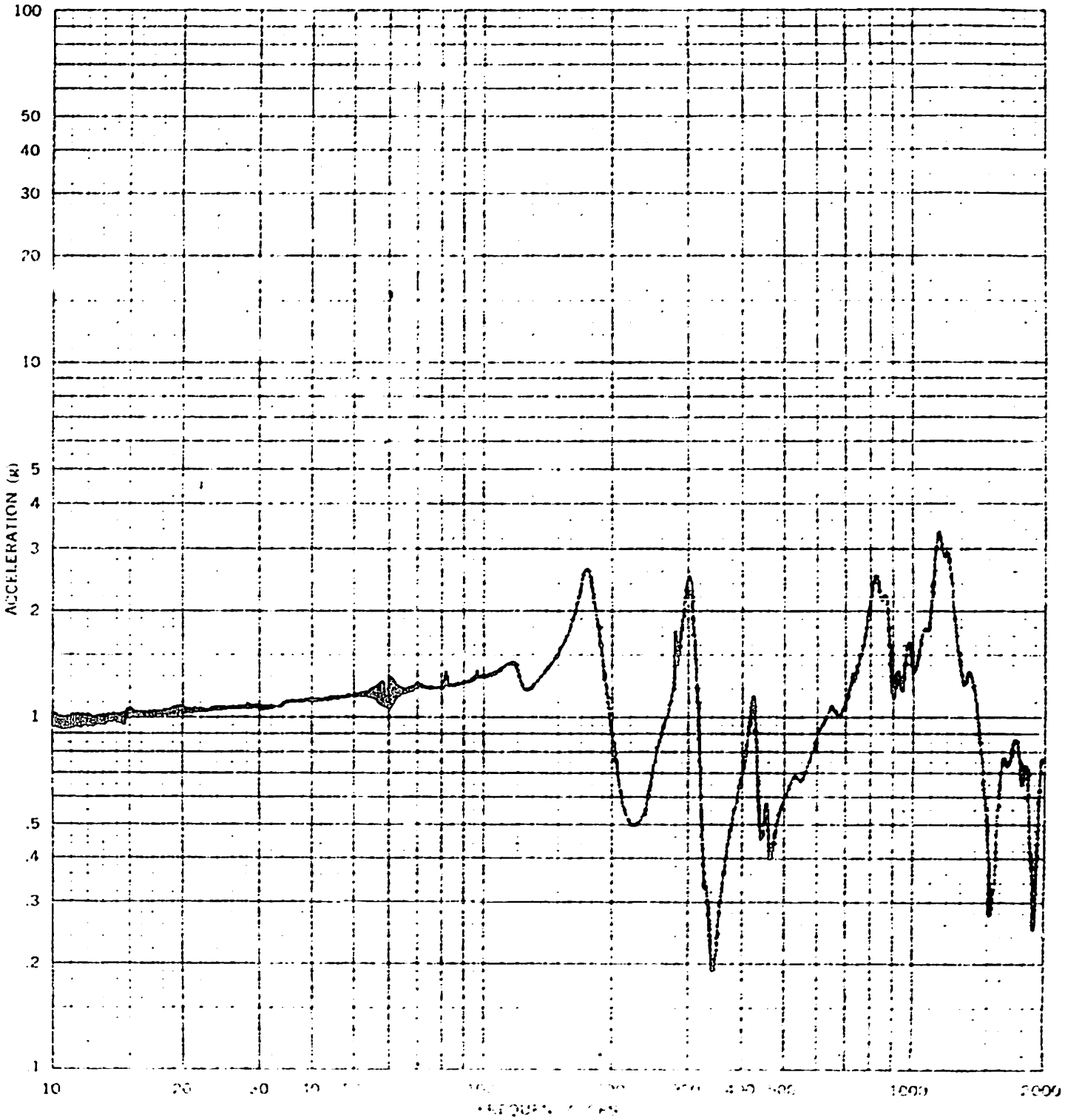
FIGURE REFERENCE TEST DATE

AXIS FIGURE

FILTER BANDWIDTH CPS PAGE

UNCLASSIFIED [redacted] 1108

[redacted] UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS AT F T

ACCEL. LOCATION REF. SYM.

FIGURE REFERENCE TEST DATE

AXIS FIGURE

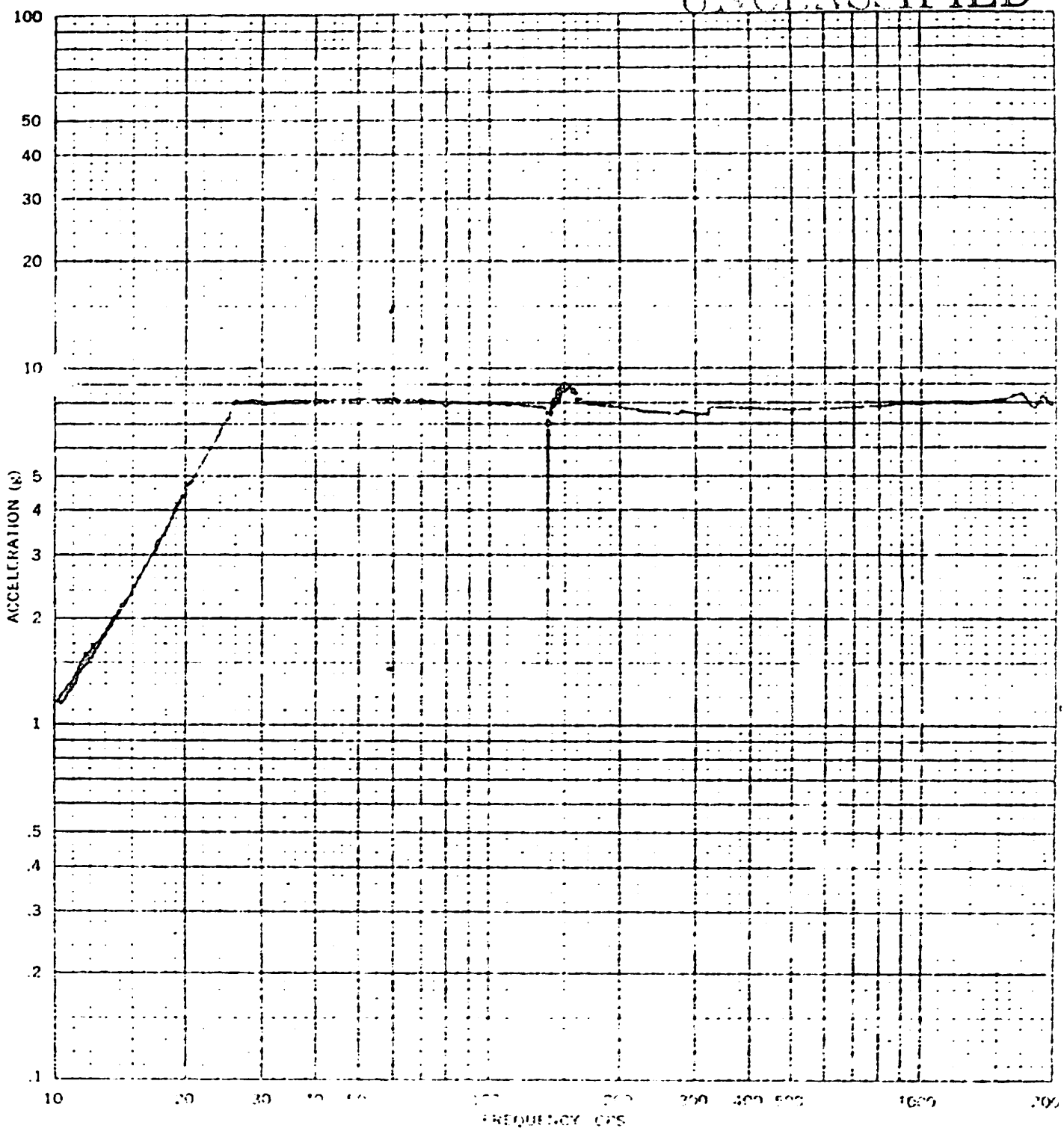
FILTER BANDWIDTH CPS PAGE

UNCLASSIFIED [redacted] 1109

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS, AT F T.

ACCEL. LOCATION REF. SYM.

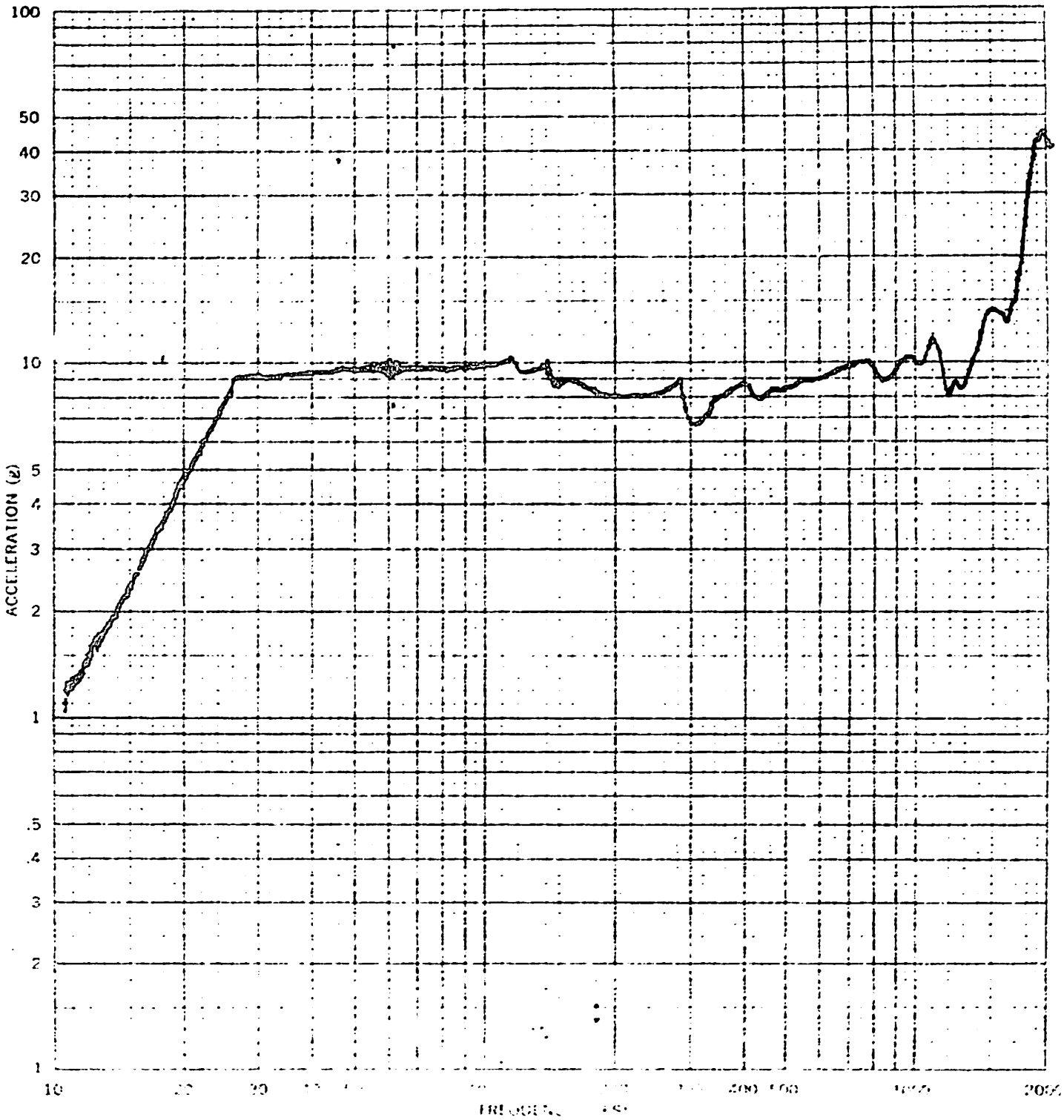
FIGURE REFERENCE TEST DATE

AXIS FIGURE

FILTER BANDWIDTH CPS UNCLASSIFIED PAGE

[redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS AT

ACCEL. LOCATION REF. SYM.

FIGURE REFERENCE TEST DATE

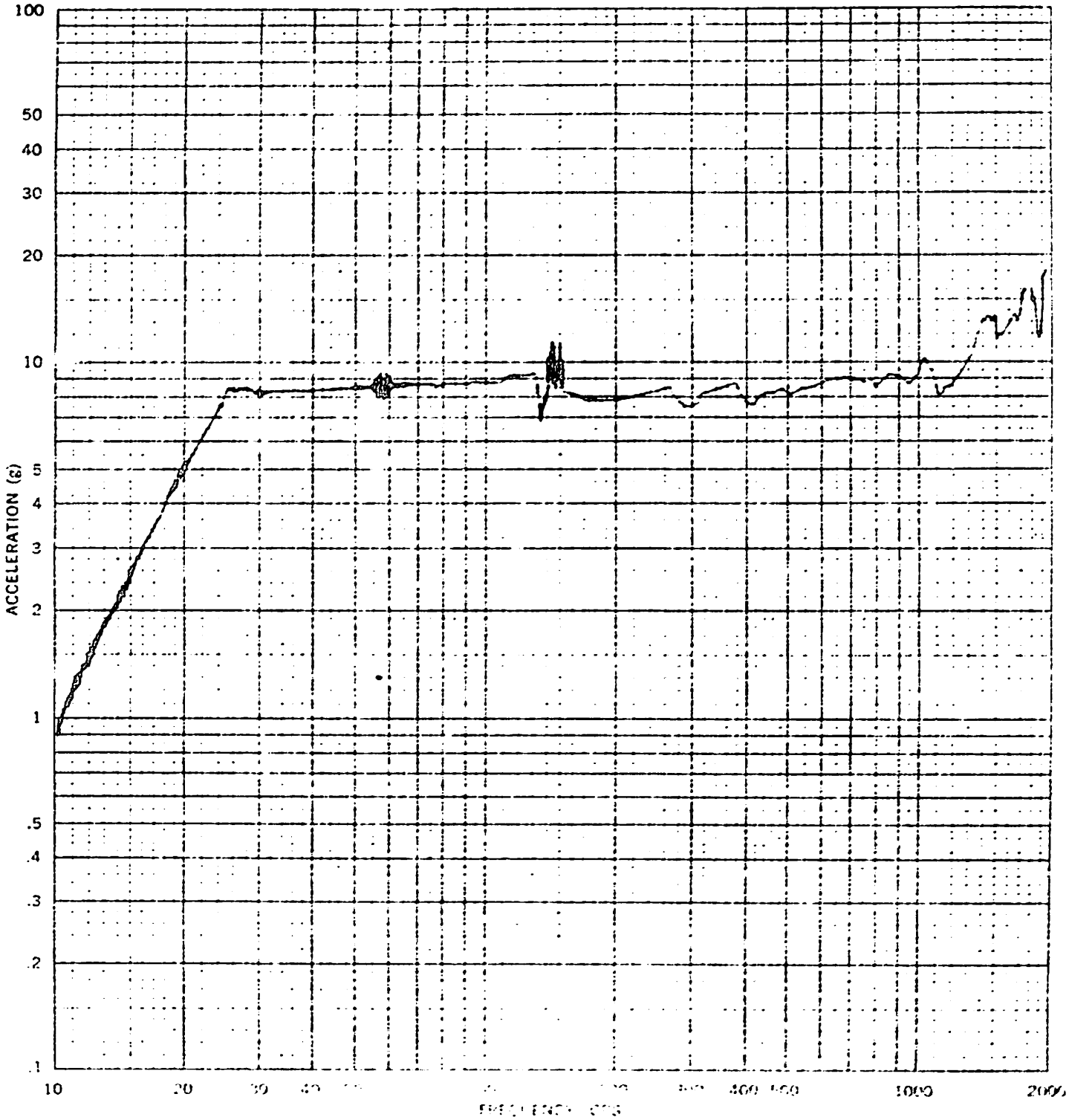
AXIS FIGURE

FILTER BANDWIDTH CPS UNCLASSIFIED PAGE

[redacted]

1111

[redacted] UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS. AT F T

ACCEL. LOCATION REF. SYM.

FIGURE REFERENCE TEST DATE

AXIS FIGURE

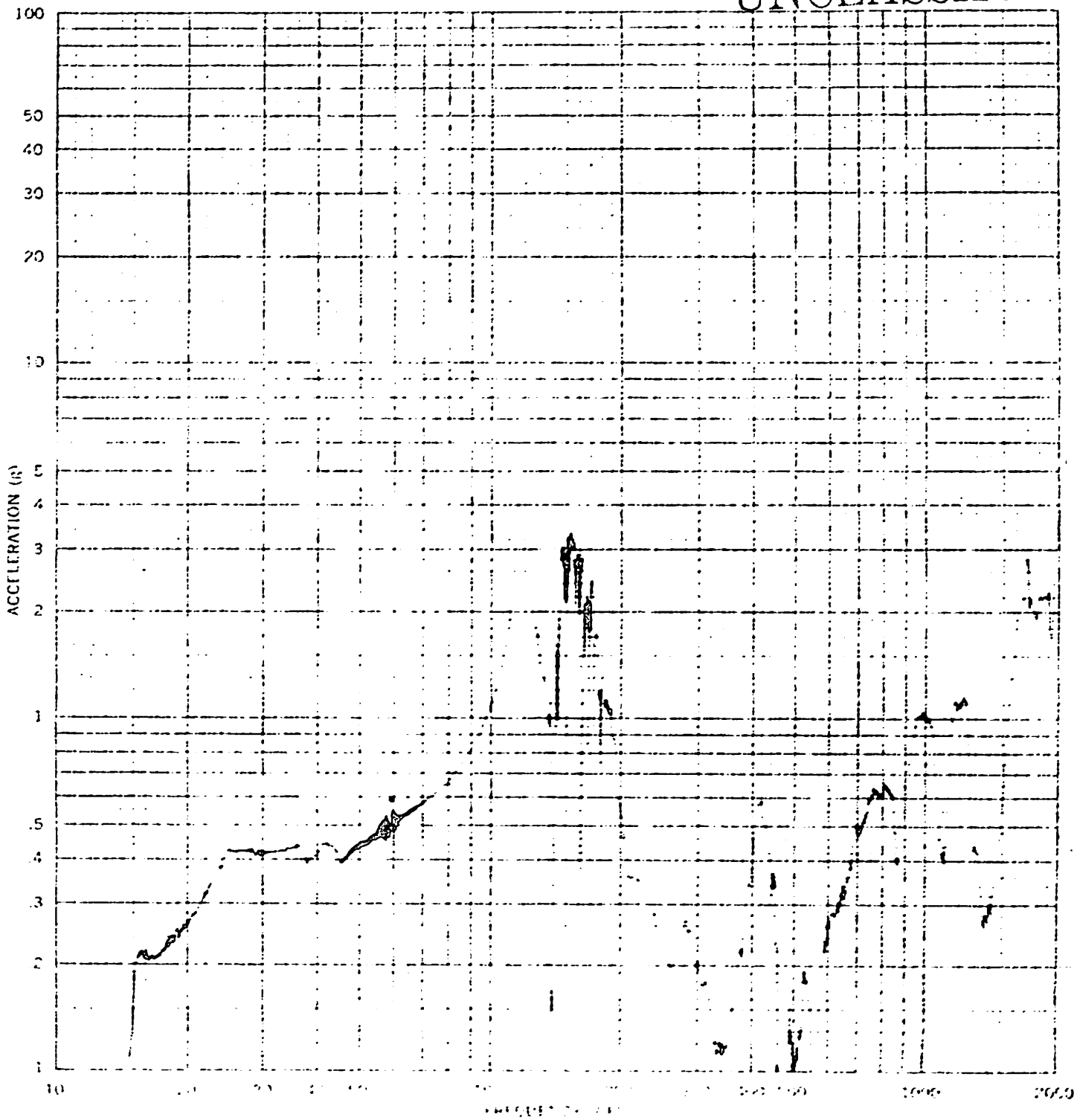
FILTER BANDWIDTH CPS UNCLASSIFIED PAGE

[redacted]

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS AT

ACCEL. LOCATION REF. SYM.

FIGURE REFERENCE TEST DATE

AXIS FIGURE

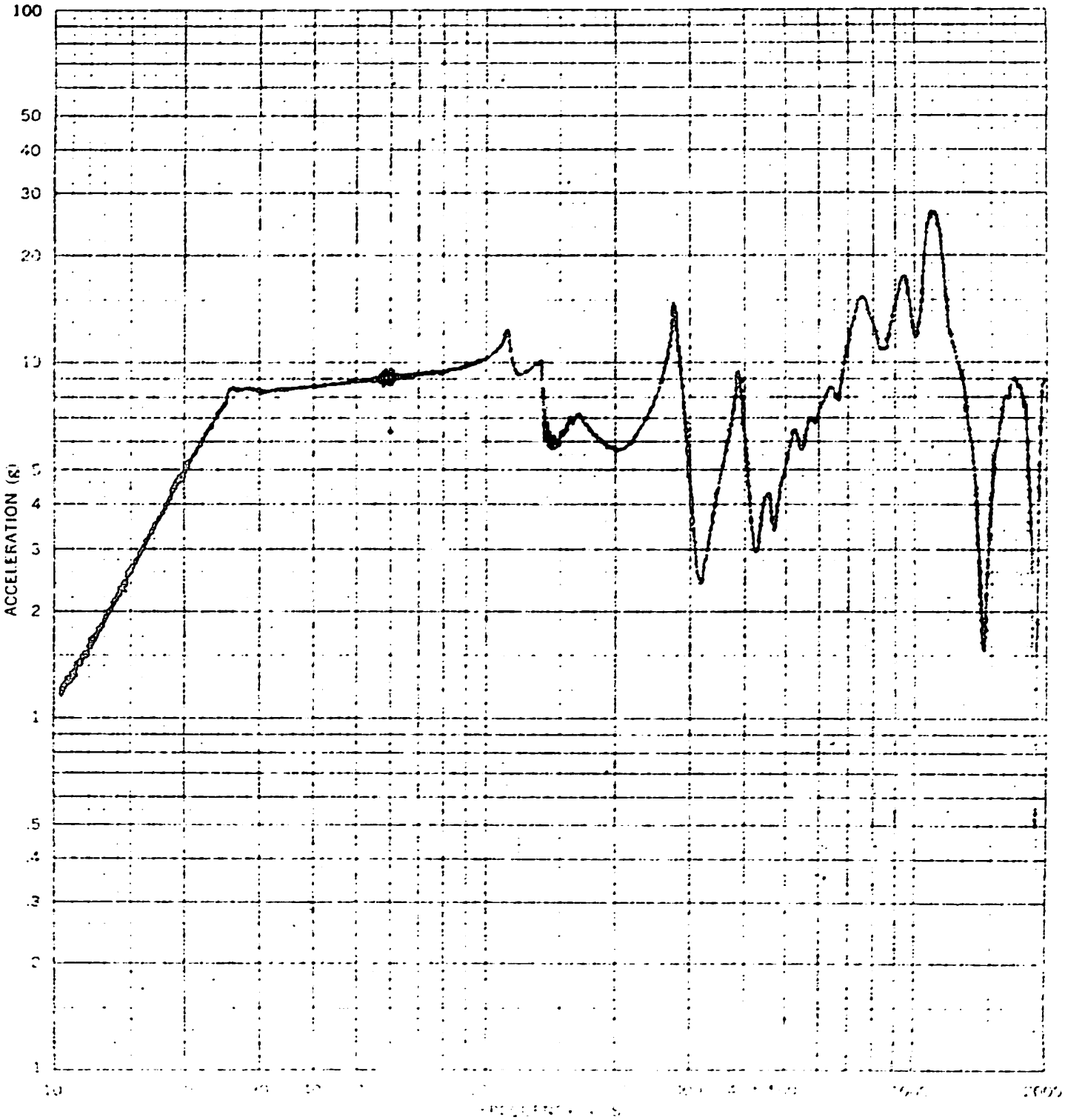
FILTER BANDWIDTH CPS PAGE

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS, AT

ACCEL. LOCATION REF. SYM

FIGURE REFERENCE TEST DATE

AXIS FIGURE

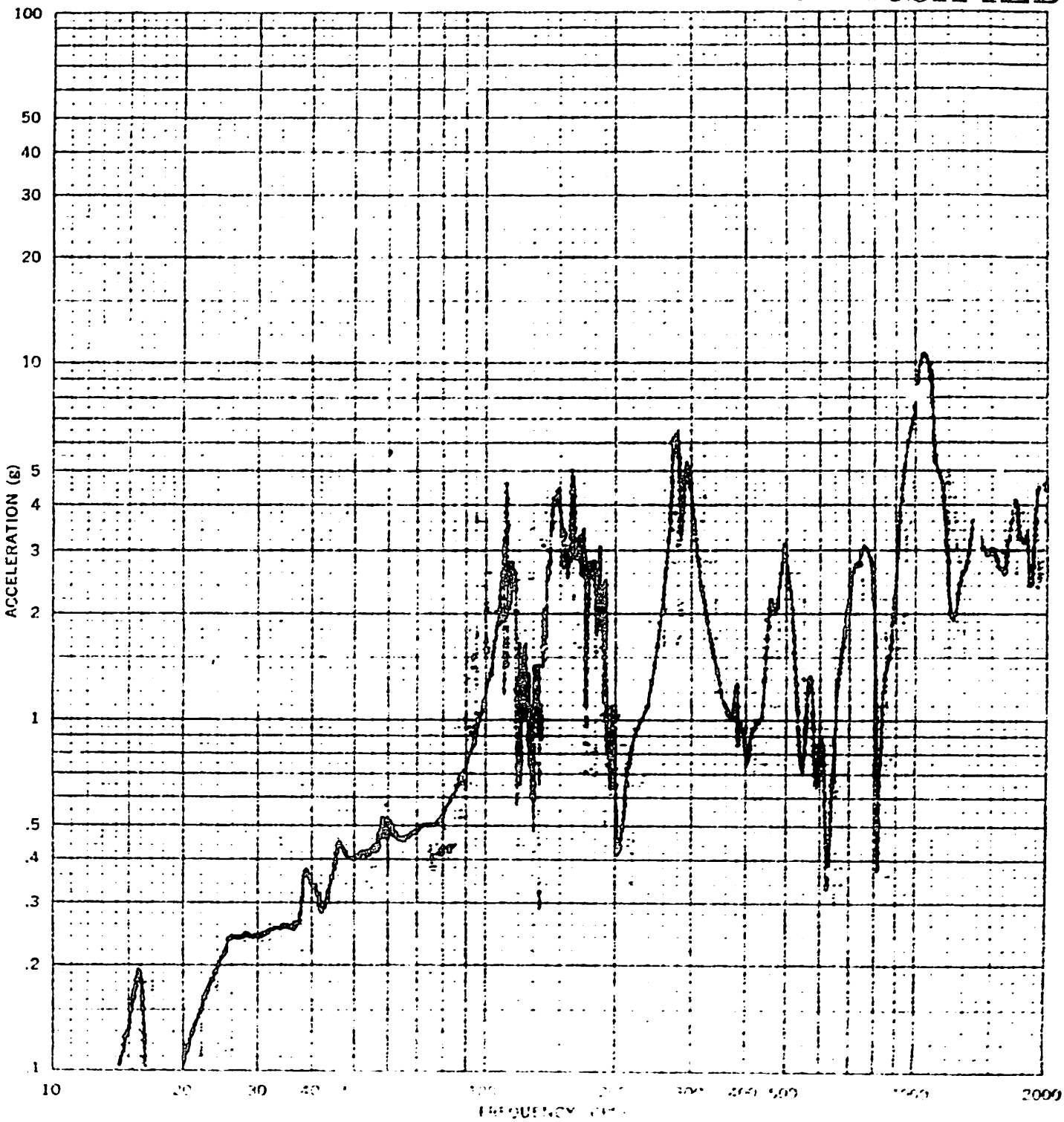
FILTER BANDWIDTH CPS PAGE

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS. AT F T.

ACCEL. LOCATION REF SYM.

FIGURE REFERENCE TEST DATE

AXIS FIGURE

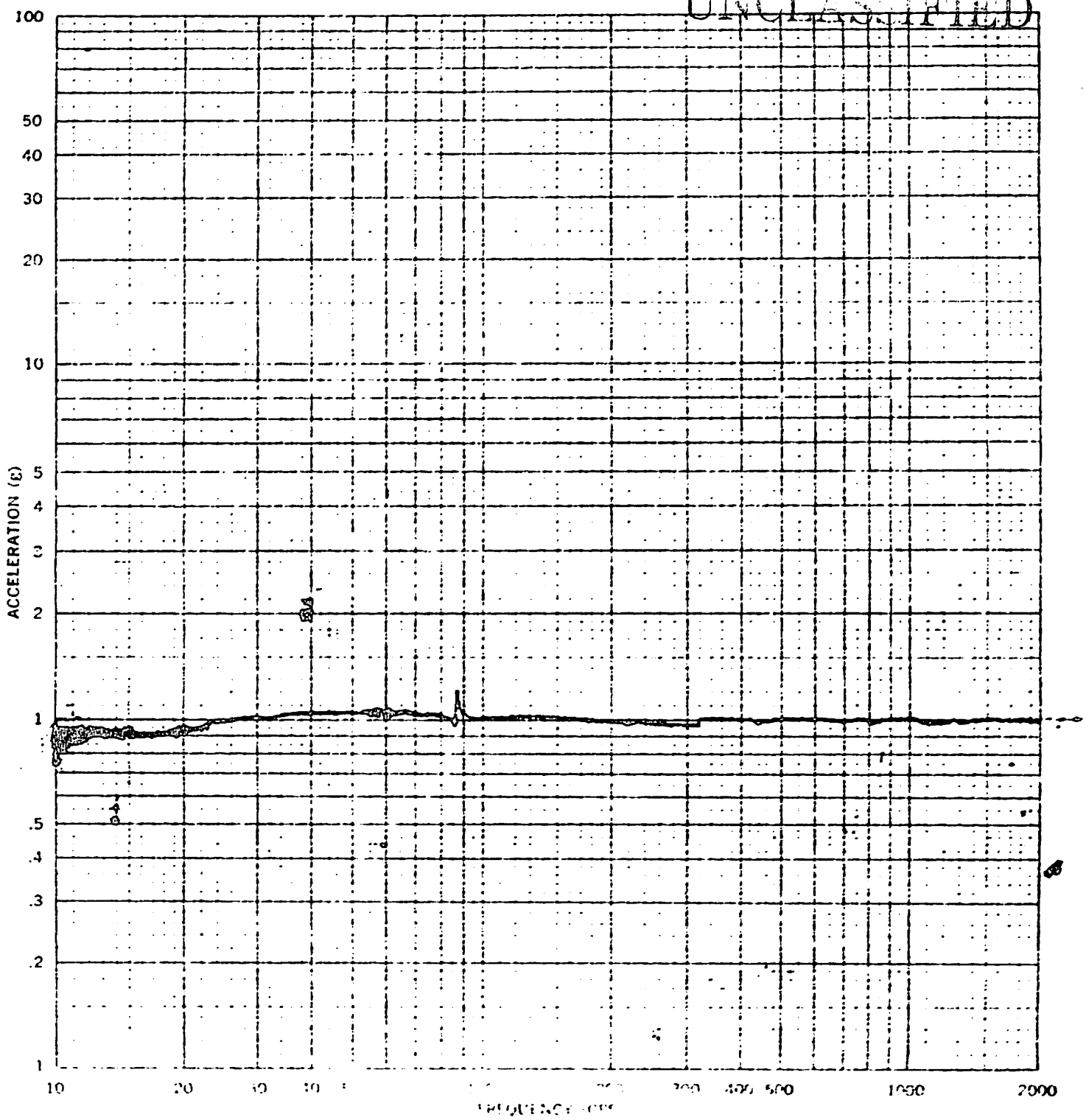
FILTER BANDWIDTH CPS PAGE

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS, AT F T

ACCEL. LOCATION REF. SYM.

FIGURE REFERENCE TEST DATE

AXIS FIGURE

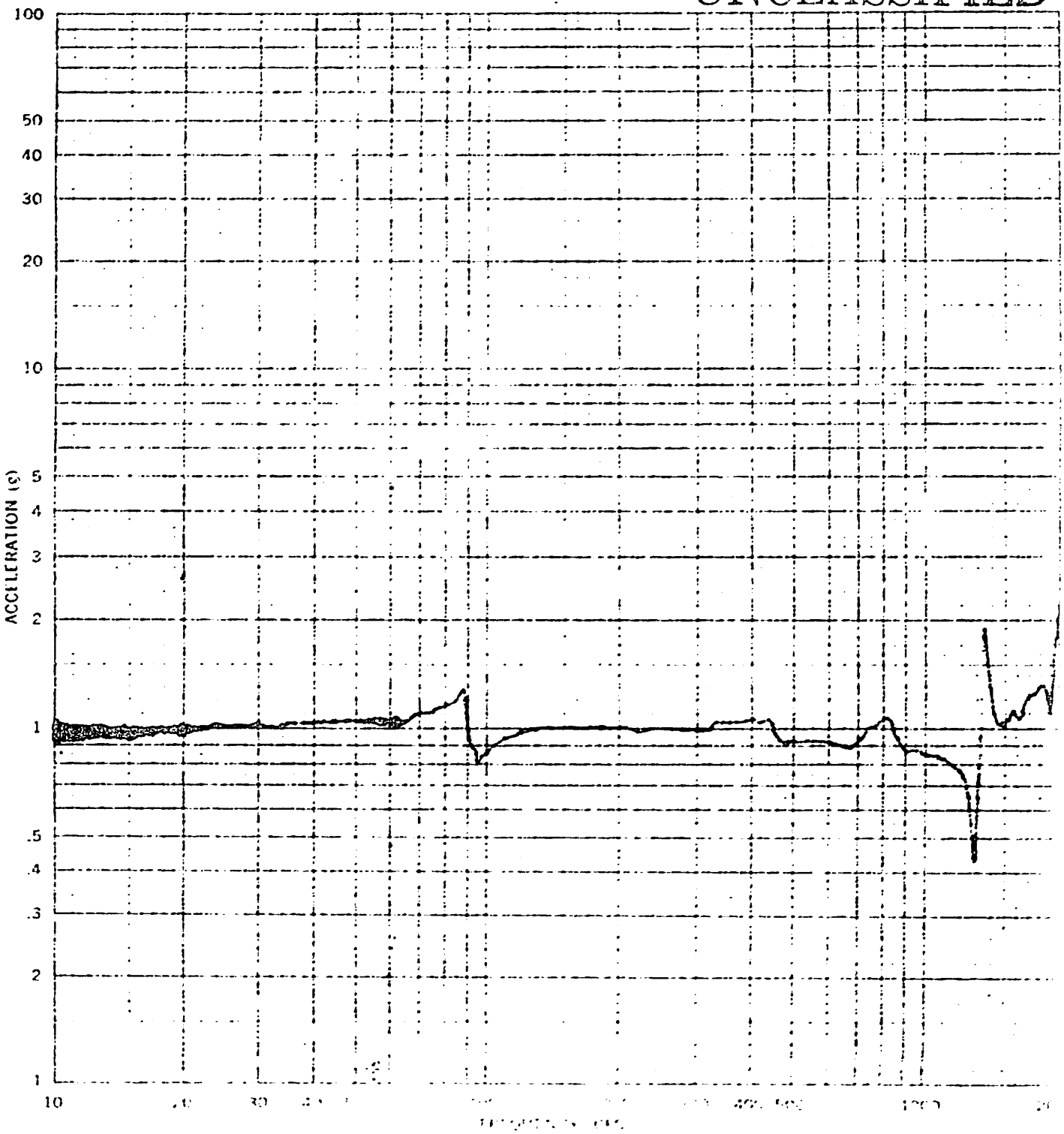
FILTER BANDWIDTH CPS PAGE

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS AT

ACCEL. LOCATION REF. SYM

FIGURE REFERENCE TEST DATE

AXIS FIGURE

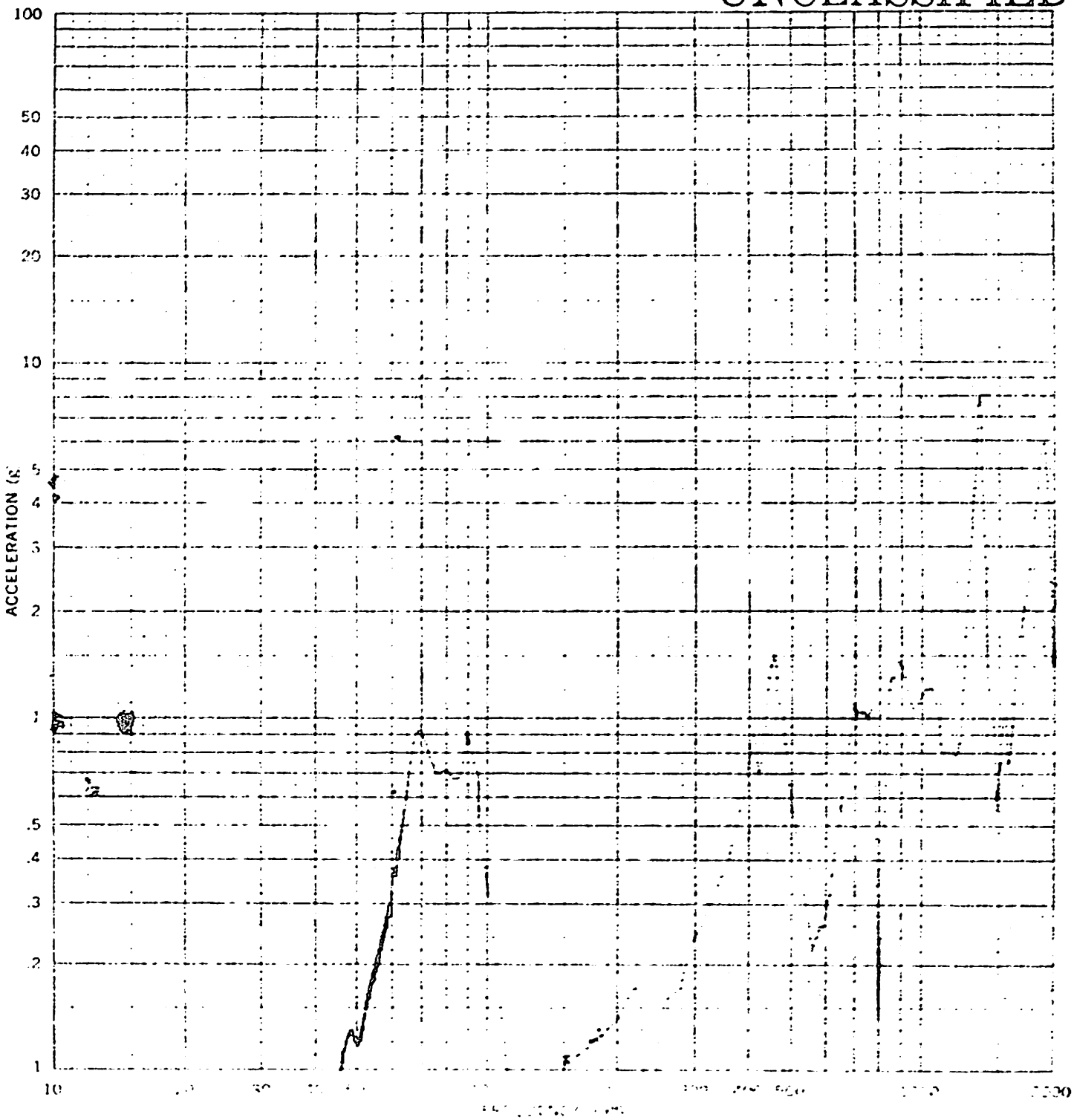
FILTER BANDWIDTH CPS PAGE

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS AT

ACCEL. LOCATION

REF. SPEC.

FIGURE REFERENCE

TEST DATE

AXIS

FIGURE

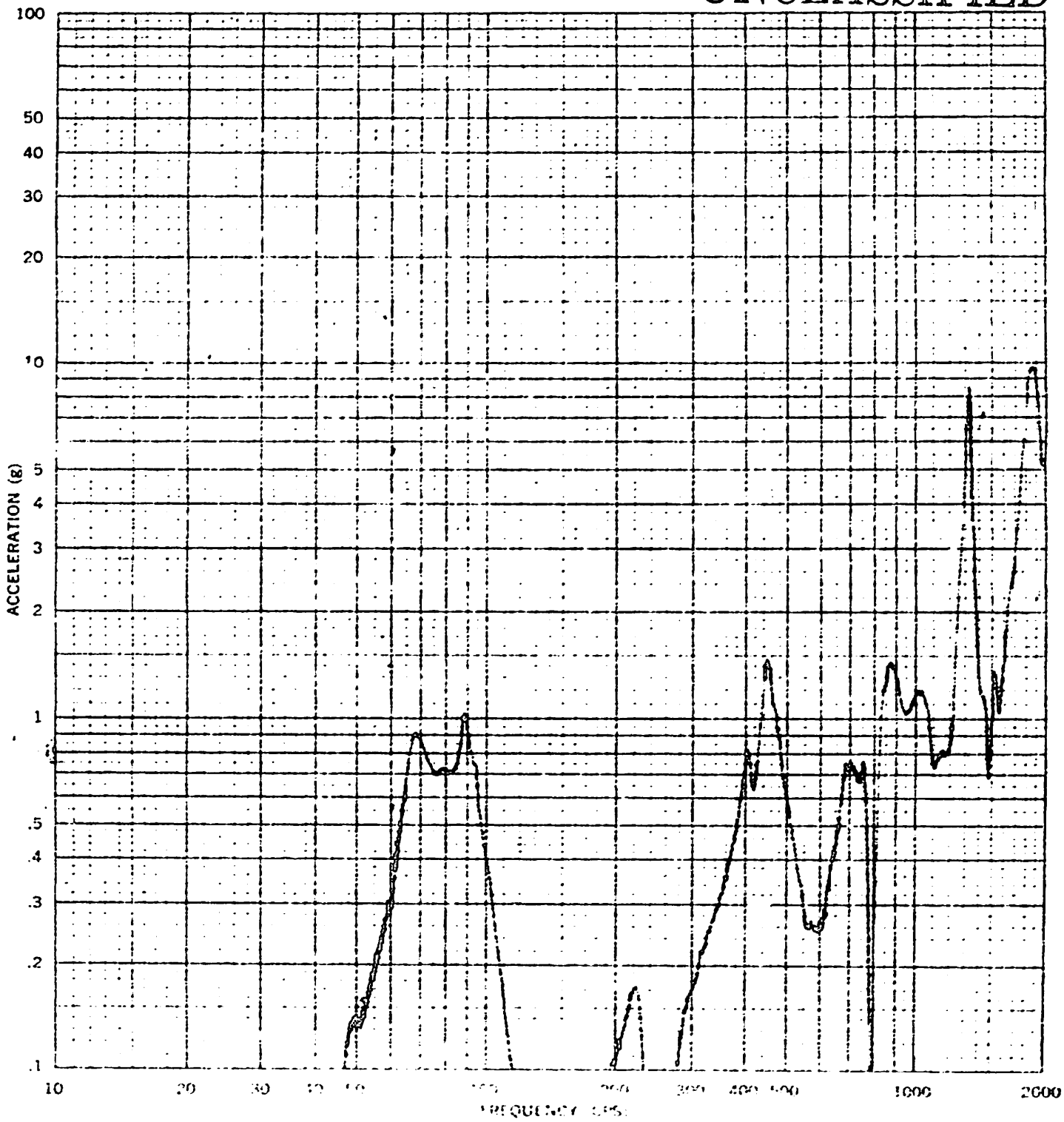
FILTER BANDWIDTH CPS

PAGE

UNCLASSIFIED

[redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS. AT [illegible] F [illegible] T- [illegible]

ACCEL. LOCATION [illegible] 5 REF SYM.

FIGURE REFERENCE [illegible] TEST DATE [illegible]

AXIS [illegible] FIGURE [illegible]

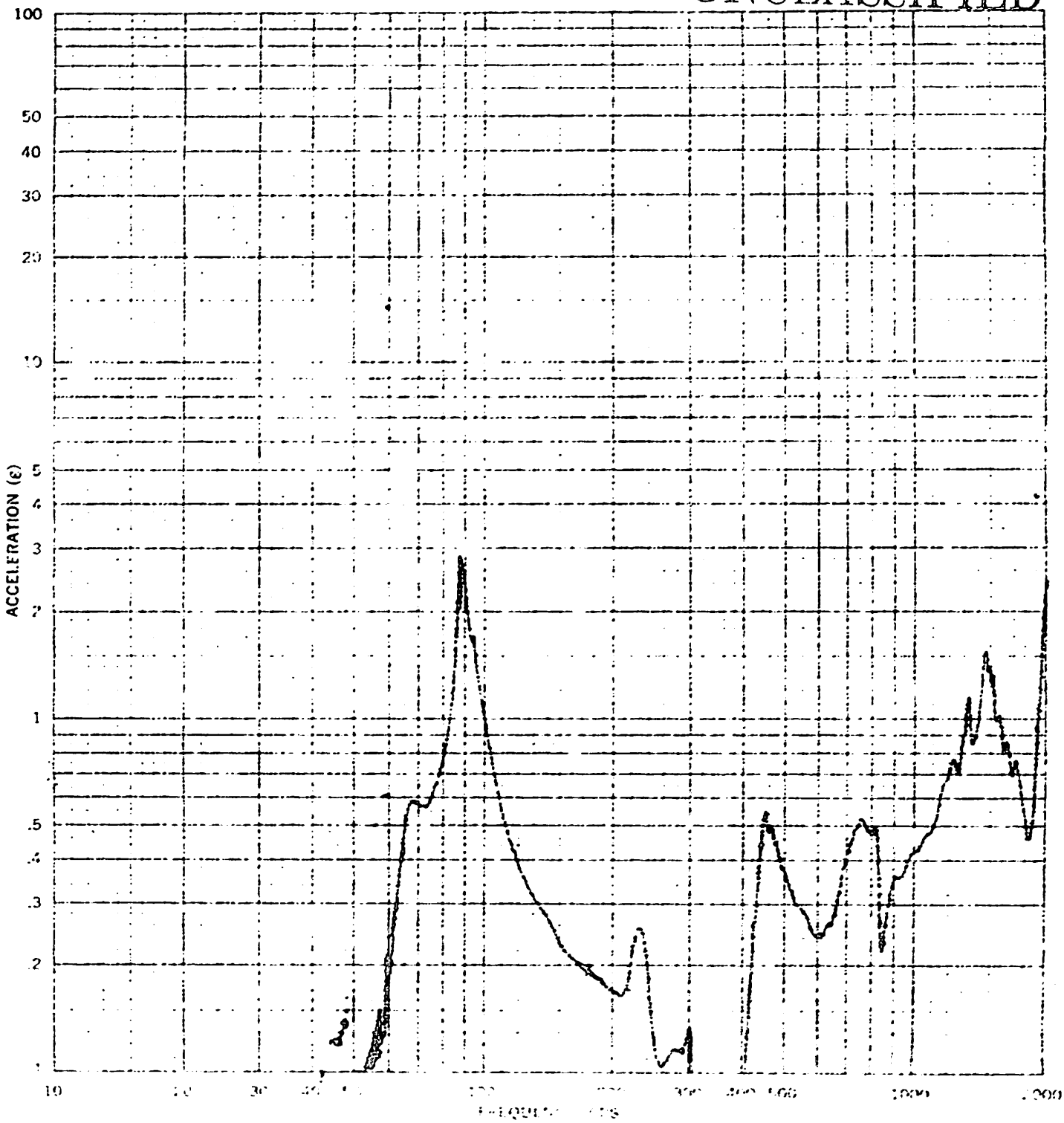
FILTER BANDWIDTH [illegible] CPS UNCLASSIFIED PAGE [illegible]

[redacted]

1119

[redacted]

UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS, AT

ACCEL. LOCATION

REF. SYM.

FIGURE REFERENCE

TEST DATE

AXIS

FIGURE

FILTER BANDWIDTH CPS

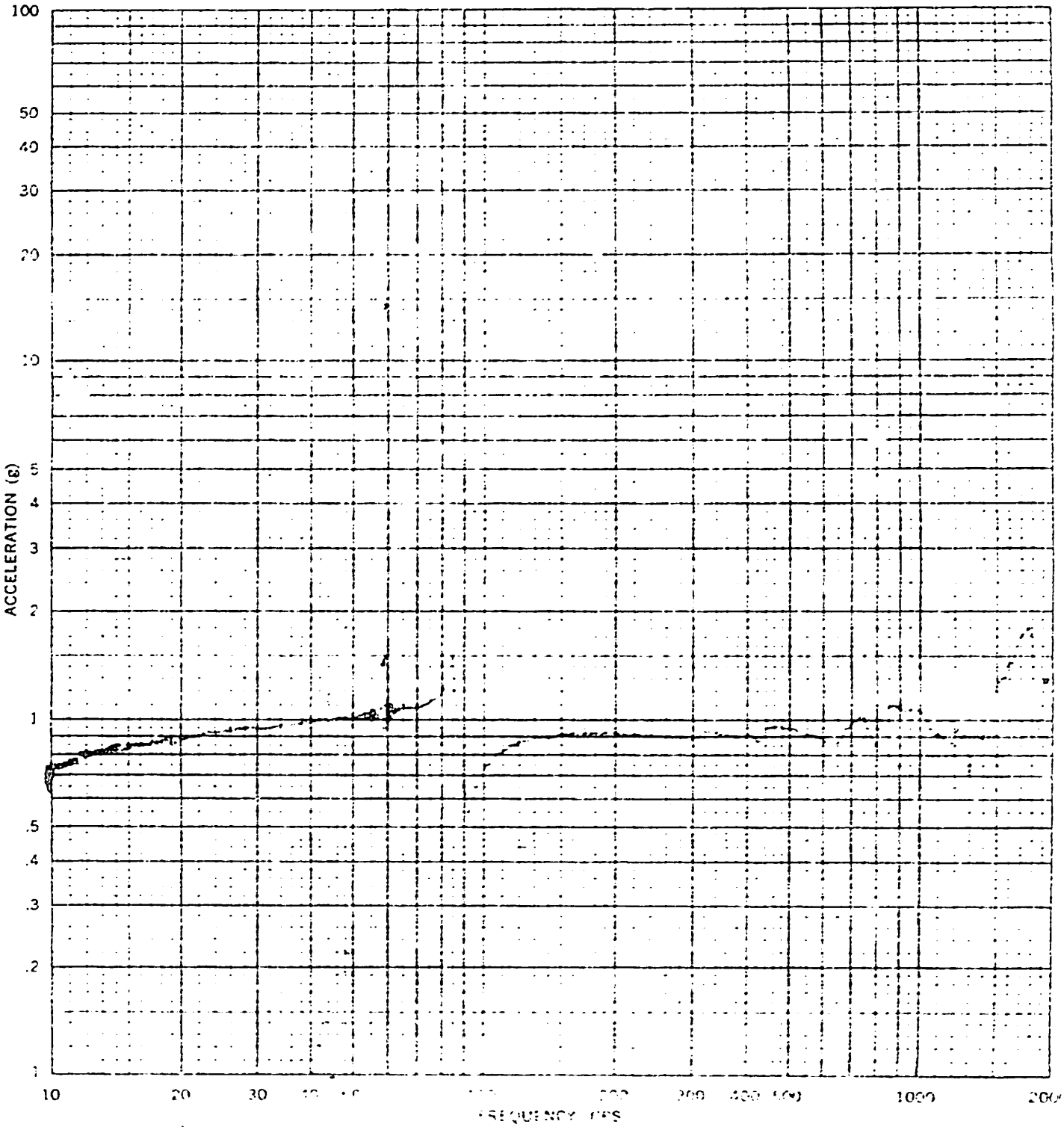
PAGE

UNCLASSIFIED

[redacted]

[redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS, AT °F T

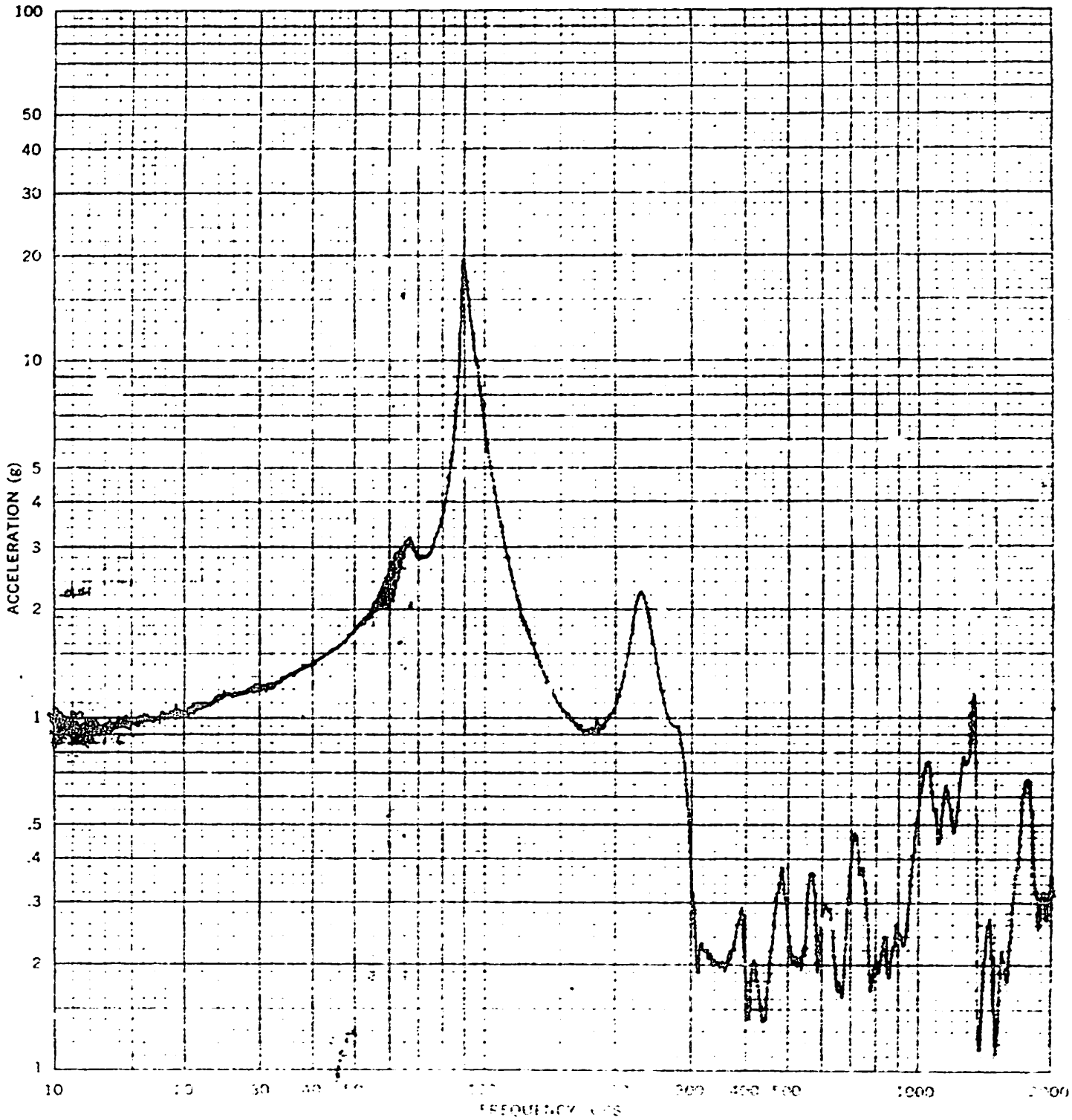
ACCEL. LOCATION REF. SYM.

FIGURE REFERENCE TEST DATE

AXIS FIGURE 21

FILTER BANDWIDTH CPS UNCLASSIFIED PAGE 21

[redacted]



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS AT [illegible] F T [illegible]

ACCEL. LOCATION [illegible] REF. SYM. [illegible]

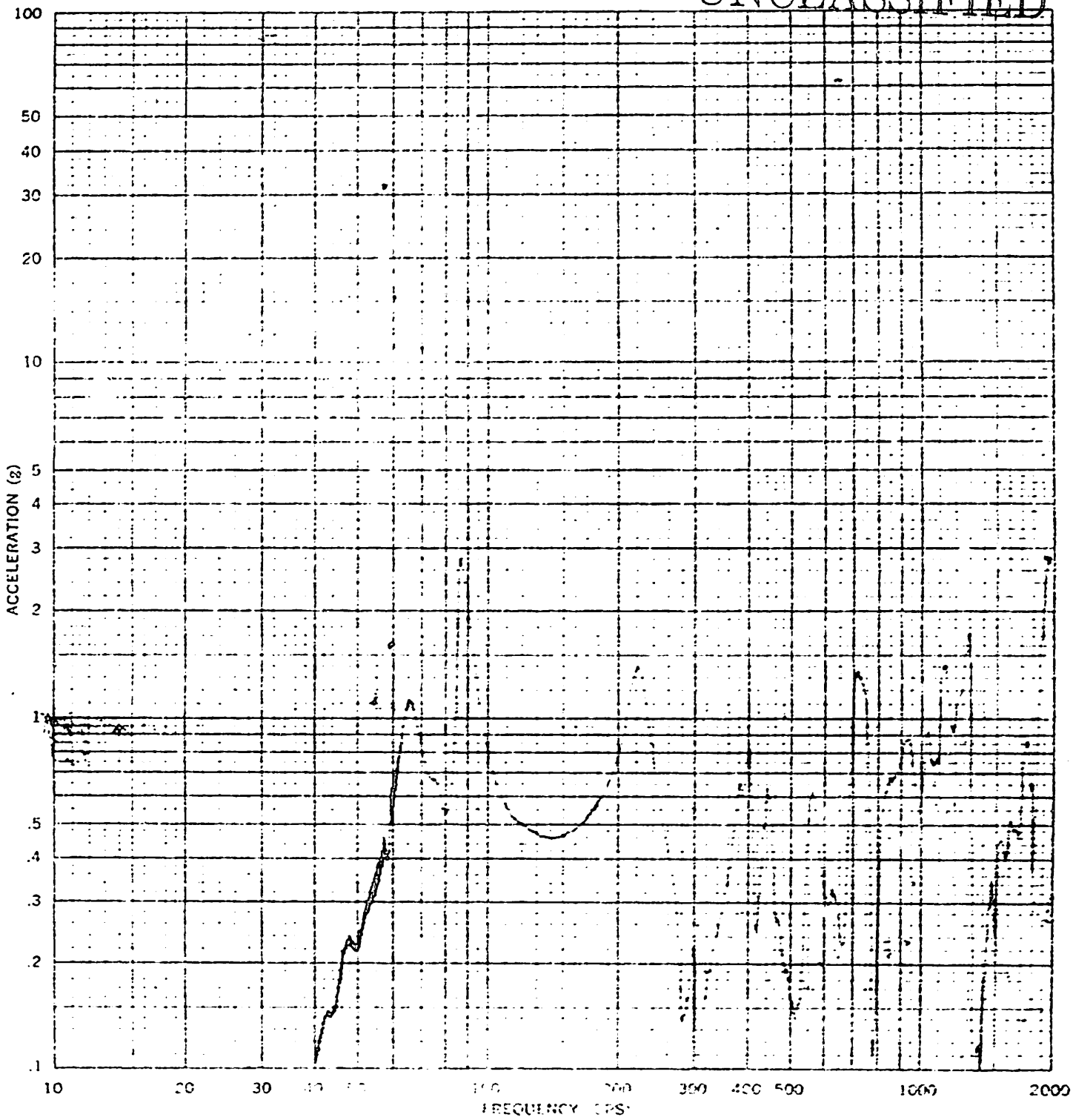
FIGURE REFERENCE [illegible] TEST DATE [illegible]

AXIS [illegible] FIGURE [illegible]

FILTER BANDWIDTH [illegible] CPS PAGE [illegible]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS, AT [illegible] F T [illegible]

ACCEL. LOCATION [illegible] REF. SYM. [illegible]

FIGURE REFERENCE [illegible] TEST DATE [illegible]

AXIS [illegible] FIGURE 23

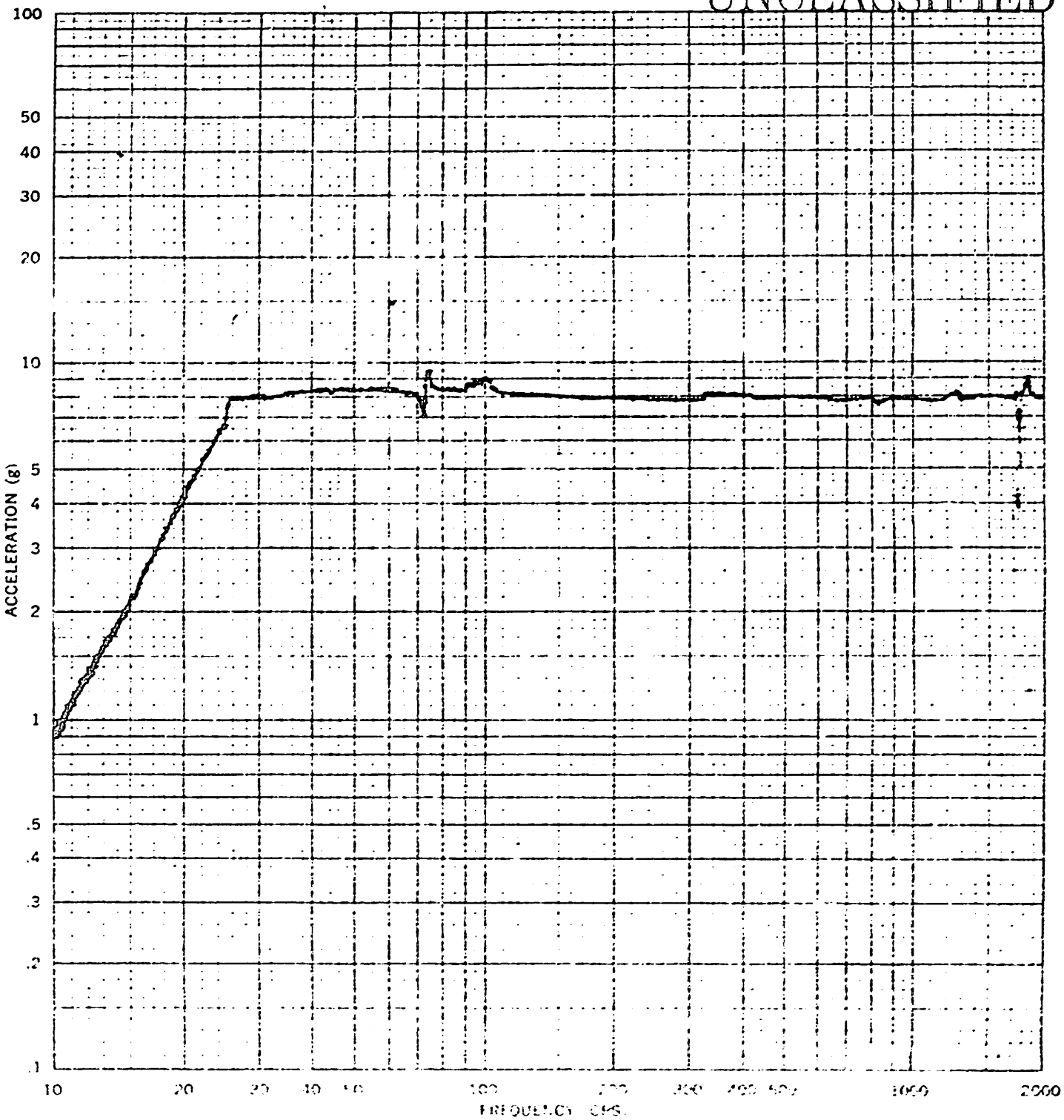
FILTER BANDWIDTH [illegible] CPS PAGE 28

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF

WITH INPUT ALONG THE AXIS, AT F T-

ACCEL. LOCATION REF. SYM.

FIGURE REFERENCE TEST DATE

AXIS FIGURE 24

FILTER BANDWIDTH CPS PAGE 29

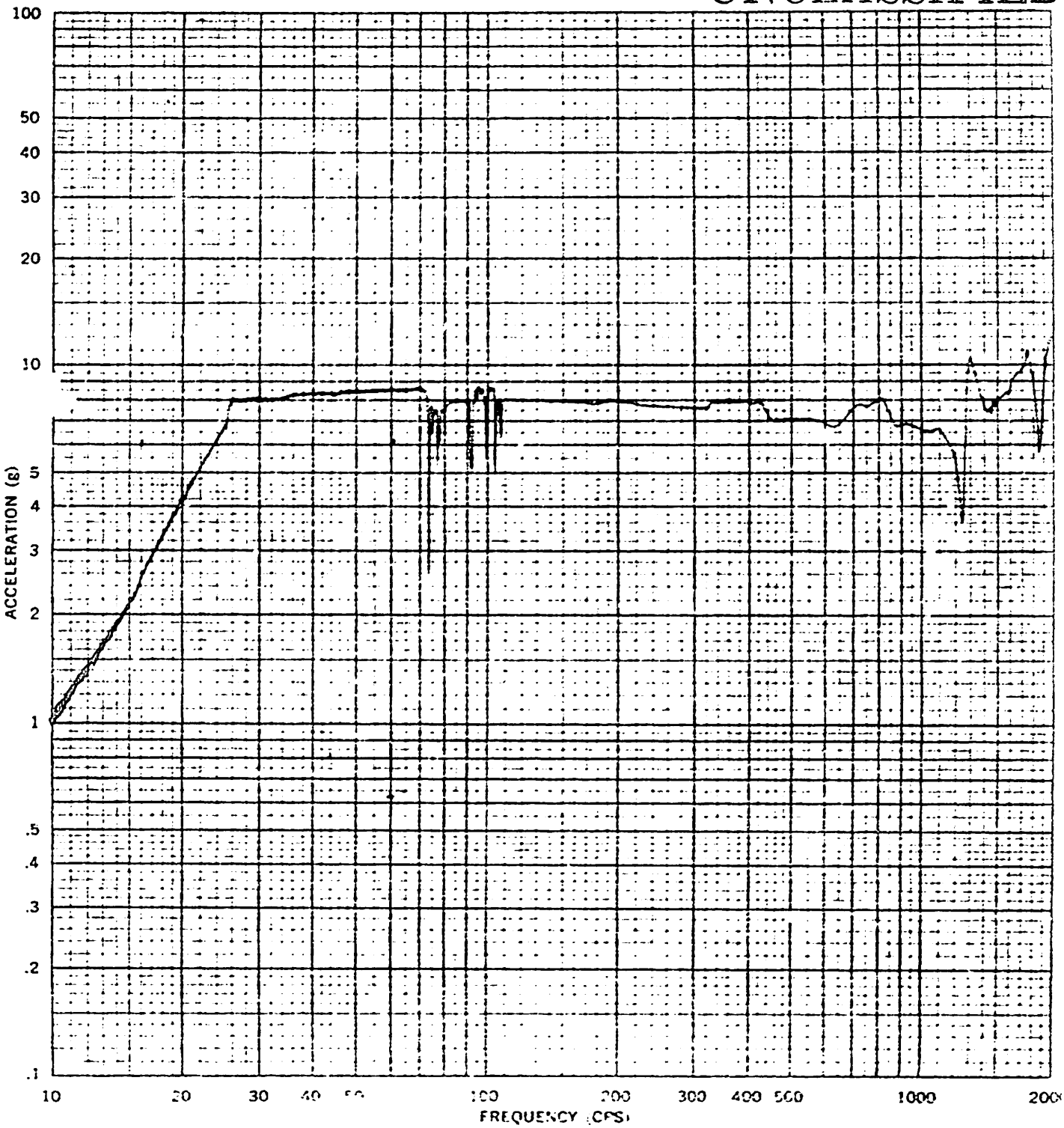
UNCLASSIFIED

[redacted]

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF W45 Type 5A 9c Cycling - 1st Run

WITH INPUT ALONG THE Vertical AXIS, AT Room Temp. °F T- 10[illegible]

ACCEL. LOCATION Flange Bottom REF. SYM.

FIGURE REFERENCE 1 TEST DATE 11/27/[illegible]

AXIS Vertical FIGURE 25

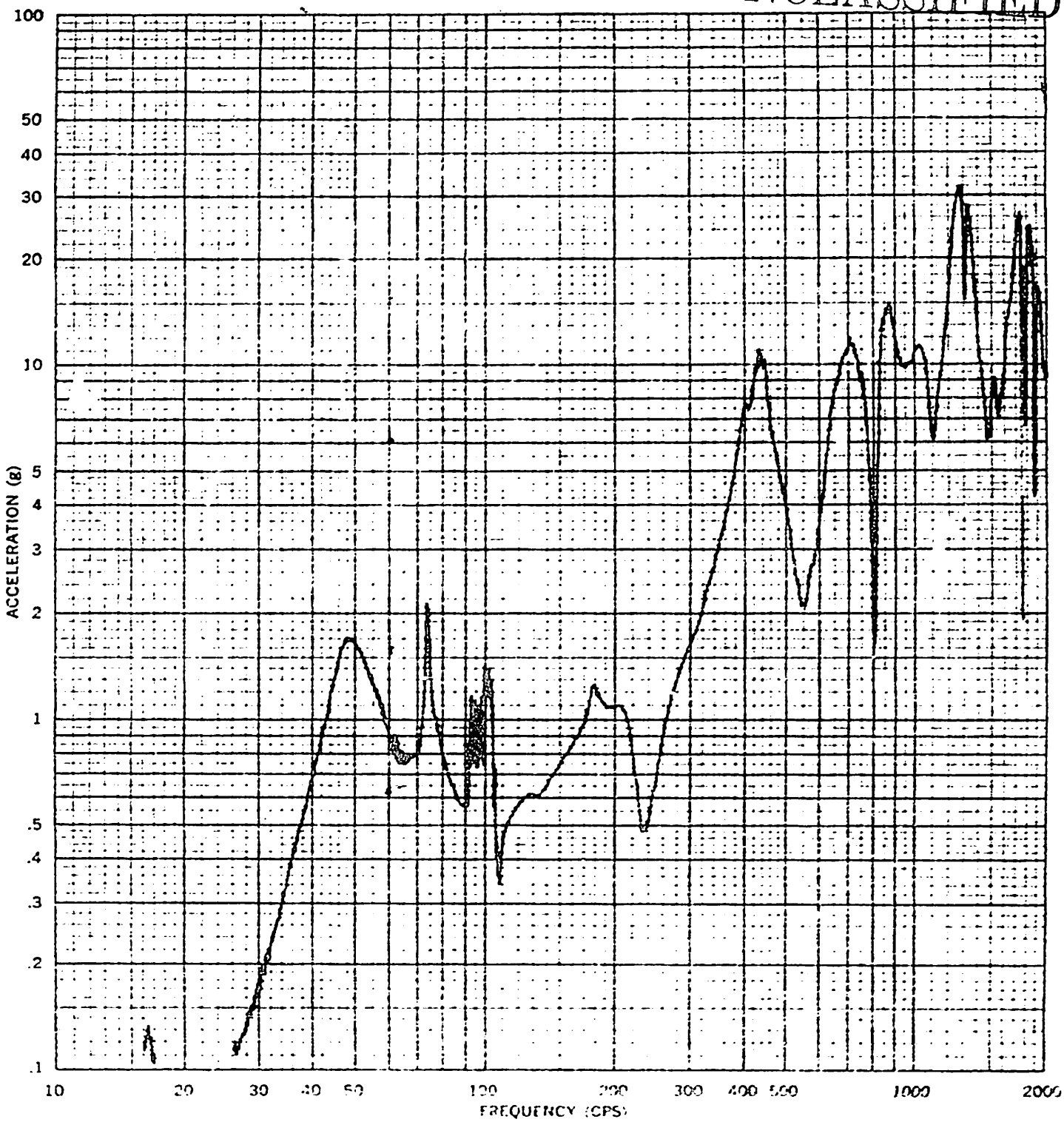
FILTER BANDWIDTH 10 CPS PAGE 30

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF W45 Type 5A Pg Cycling - 1st Run

WITH INPUT ALONG THE Vertical AXIS. AT [illegible] °F T- 10[illegible]

ACCEL. LOCATION Fixture [illegible] REF. SYM.

FIGURE REFERENCE [illegible] TEST DATE 11/27/64

AXIS Longitudinal FIGURE 26

FILTER BANDWIDTH [illegible] CPS PAGE 31

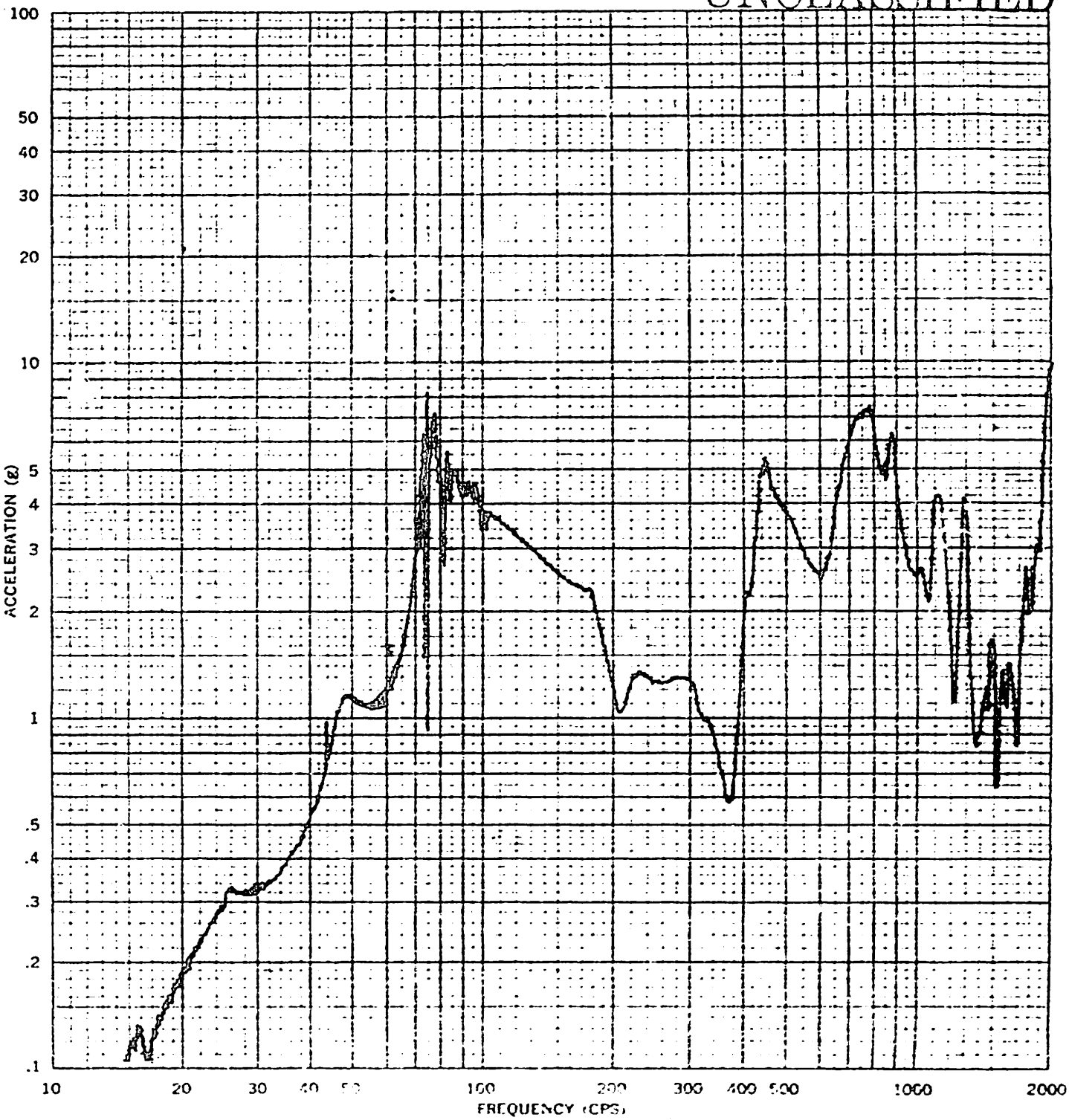
UNCLASSIFIED

[redacted]

1126

[redacted]

UNCLASSIFIED



VIBRATION TEST OF W45 Type 5A Rg Cycling - 1st Run

WITH INPUT ALONG THE Vertical AXIS. AT [illegible] °F T- [illegible]

ACCEL. LOCATION Base of Pitot [illegible] REF. SYM. [illegible]

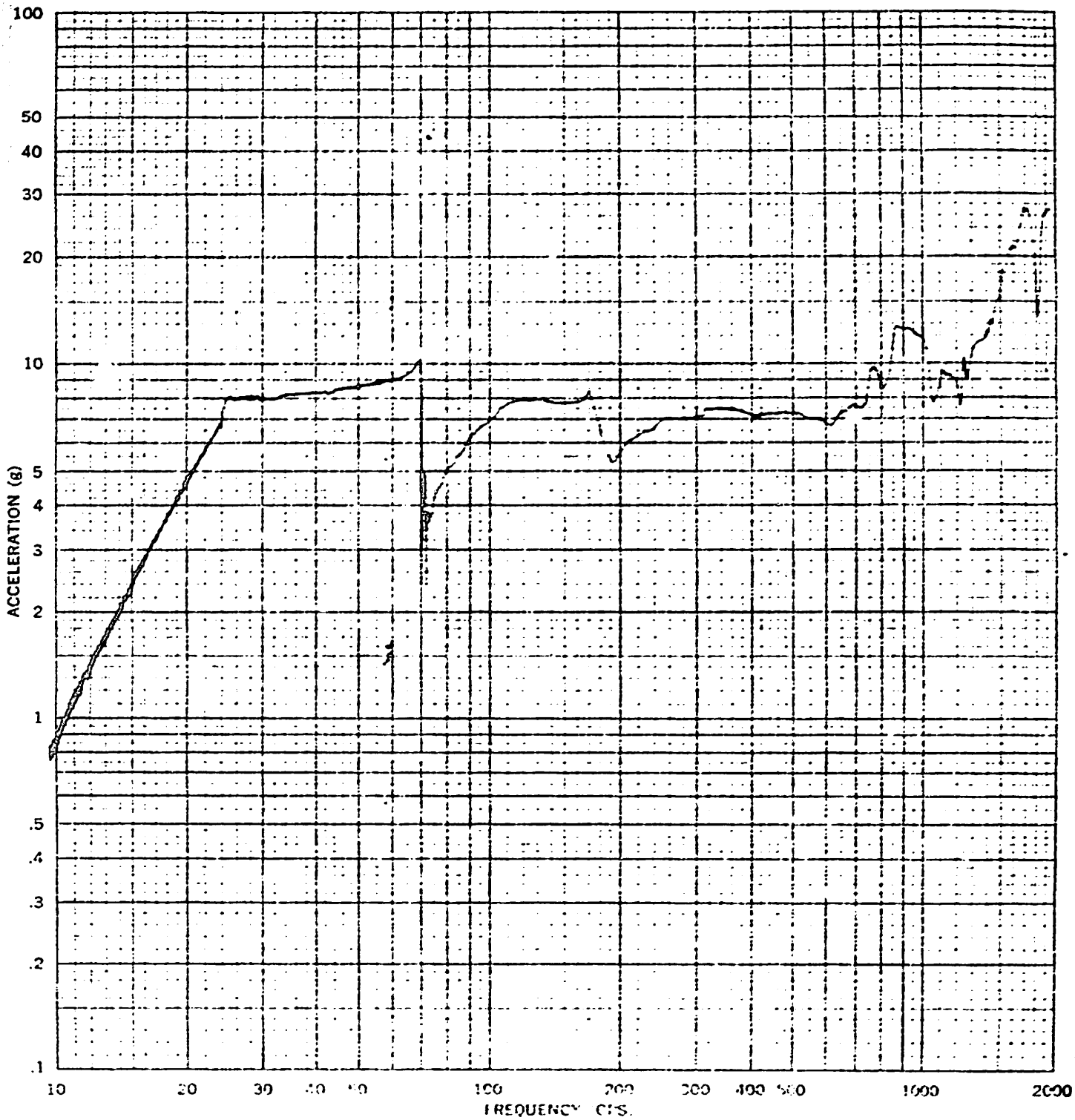
FIGURE REFERENCE [illegible] TEST DATE [illegible]

AXIS Longitudinal FIGURE 27

FILTER BANDWIDTH [illegible] CPS UNCLASSIFIED PAGE 32

[redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS. AT [illegible] F T- [illegible]

ACCEL. LOCATION [illegible] REF. SYM. [illegible]

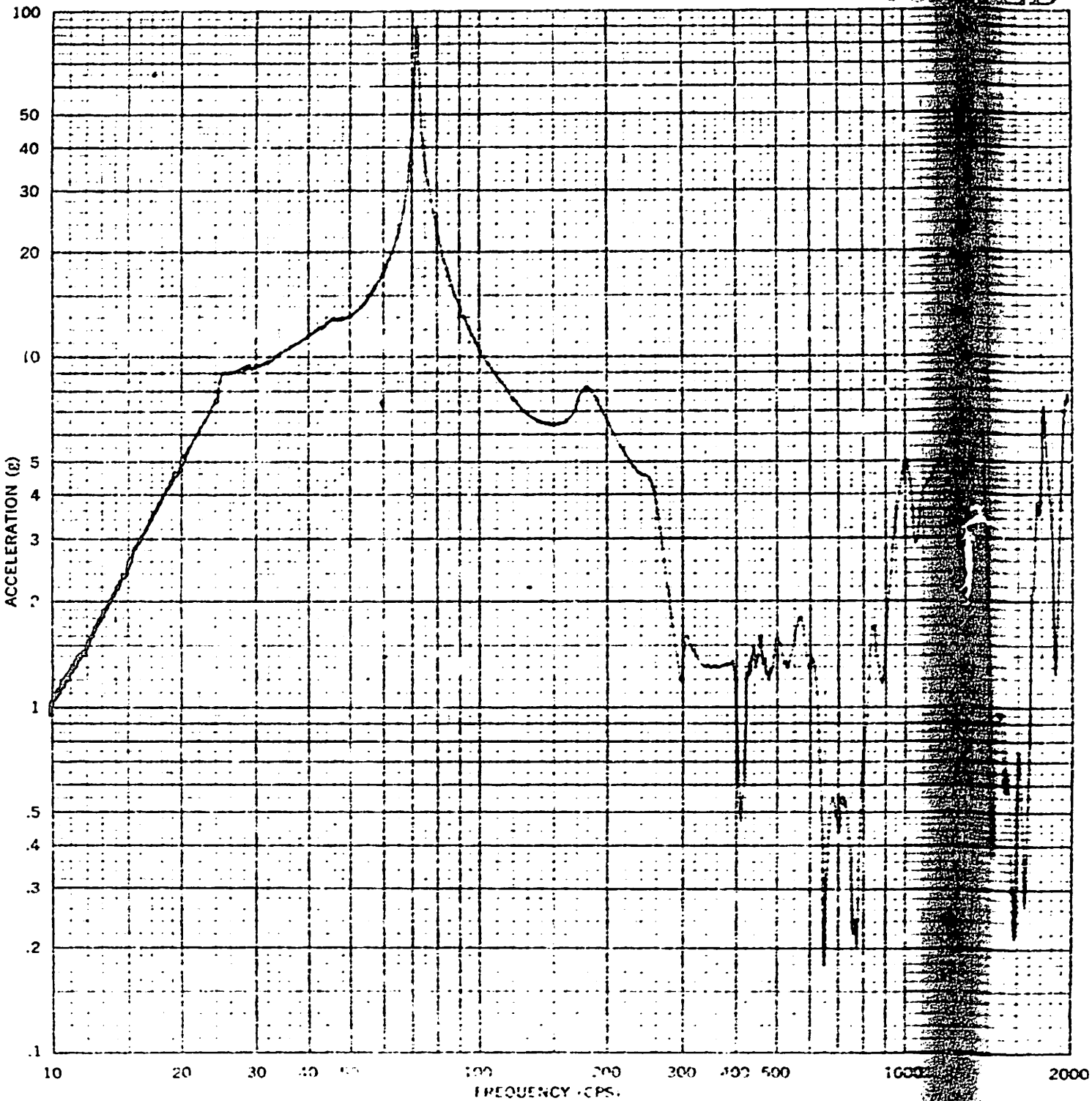
FIGURE REFERENCE [illegible] TEST DATE [illegible]

AXIS [illegible] FIGURE 28

FILTER BANDWIDTH [illegible] CPS UNCLASSIFIED PAGE [illegible]

[redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS, AT [illegible] °F T- [illegible]

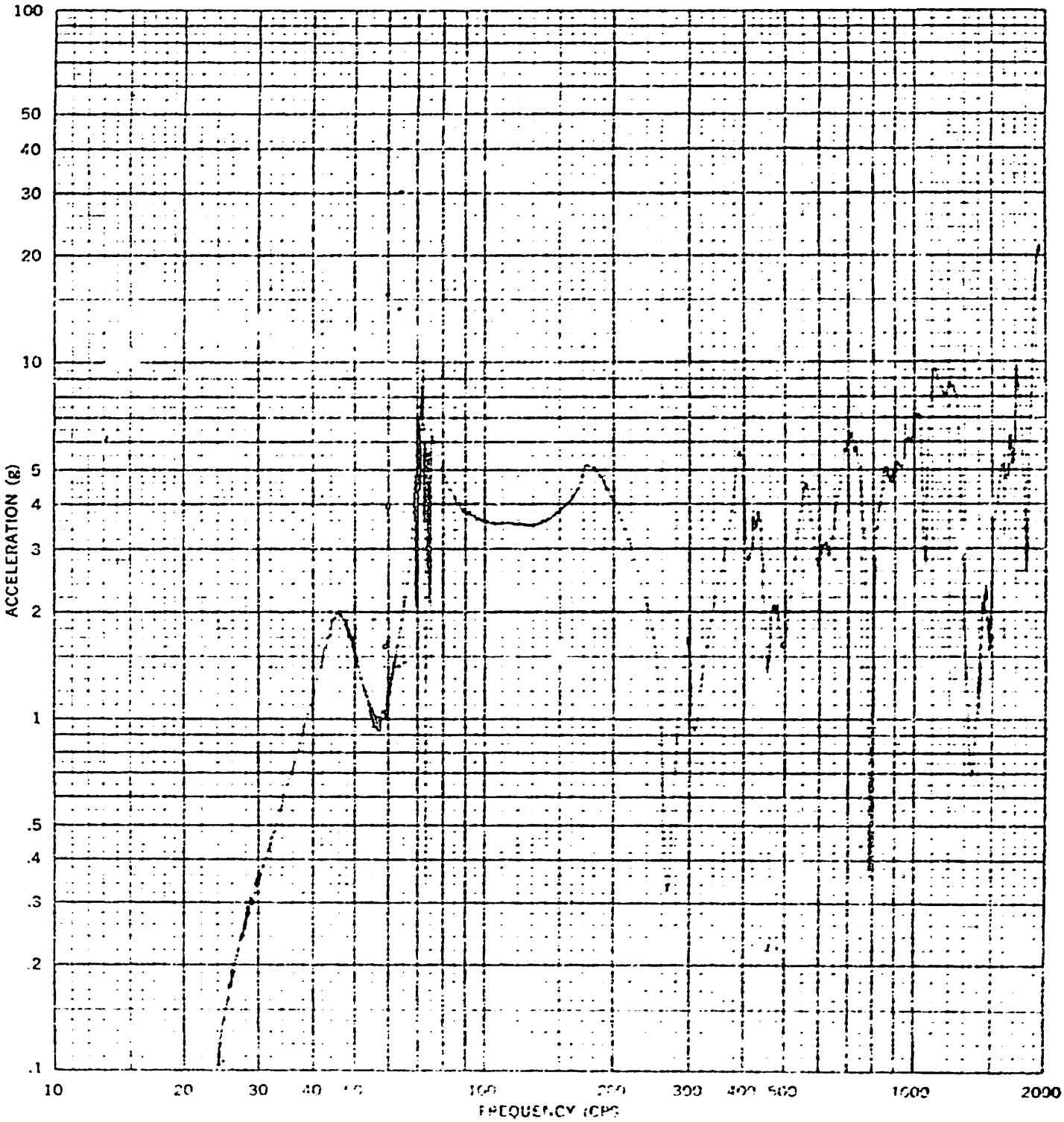
ACCEL. LOCATION [illegible] REF. SYM. [illegible]

FIGURE REFERENCE [illegible] TEST DATE [illegible]

AXIS Vertical FIGURE [illegible]

FILTER BANDWIDTH [illegible] CPS UNCLASSIFIED PAGE [illegible]

[redacted]



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS, AT [illegible] F T- [illegible]

ACCEL. LOCATION [illegible] REF. SYM. [illegible]

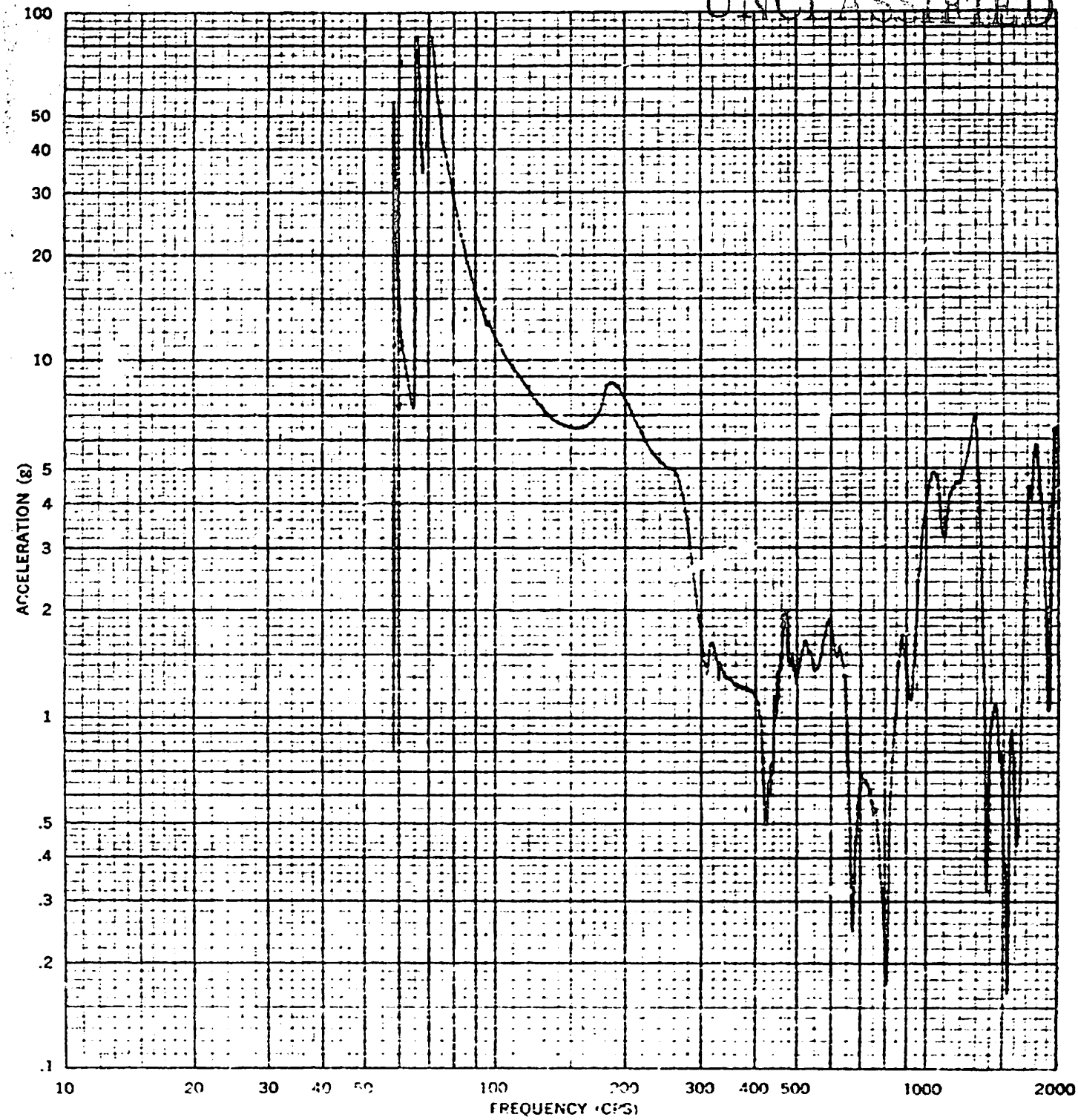
FIGURE REFERENCE [illegible] TEST DATE [illegible]

AXIS [illegible] FIGURE [illegible]

FILTER BANDWIDTH [illegible] CPS UNCLASSIFIED PAGE 35

[redacted]

UNCLASSIFIED



VIBRATION TEST OF W45 Type 5A 8g Cycling - 1st Run

WITH INPUT ALONG THE Vertical AXIS, AT Room Temp. °F T- 10656

ACCEL. LOCATION At Lvd. Broadbo REF. SYM.

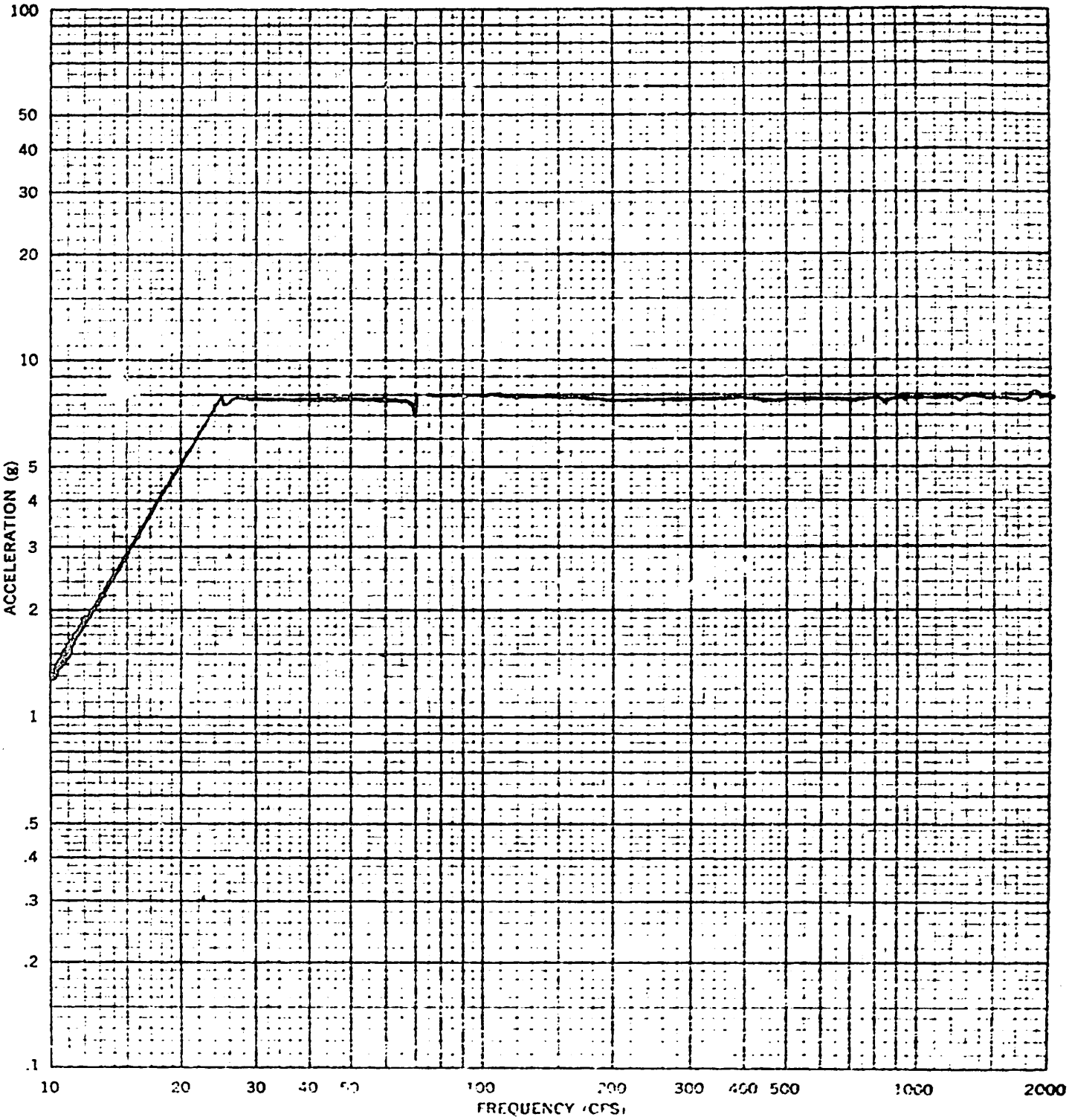
FIGURE REFERENCE 1 TEST DATE 11/27/64

AXIS Vertical FIGURE 31

FILTER BANDWIDTH 10 CPS UNCLASSIFIED PAGE 36

[redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF W45 Type 5A Sz Cycling - 2nd Run

WITH INPUT ALONG THE Vertical AXIS, AT Room Temp. °F T- 10656

ACCEL. LOCATION Sh Fixture REF. SYM.

FIGURE REFERENCE 1 TEST DATE 12/14/64

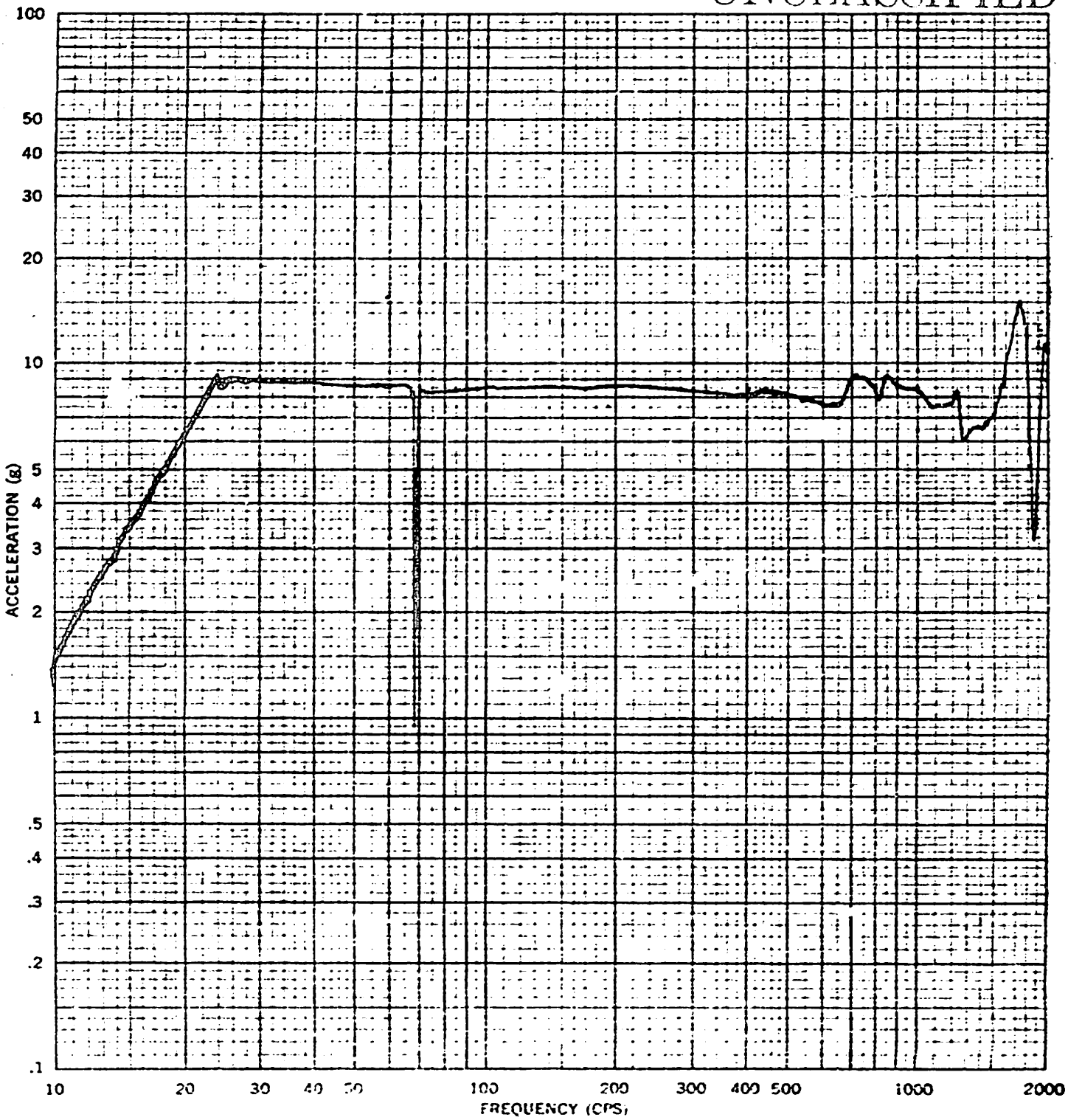
AXIS Input Control FIGURE 32

FILTER BANDWIDTH 10 CPS UNCLASSIFIED PAGE 37

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF W45 Type 5A 9g Cycling - 2nd Run

WITH INPUT ALONG THE Vertical AXIS, AT Room Temp. °F T- 10:56

ACCEL. LOCATION In Fixture REF. SYM.

FIGURE REFERENCE 1 TEST DATE 12/11/64

AXIS Vertical FIGURE 33

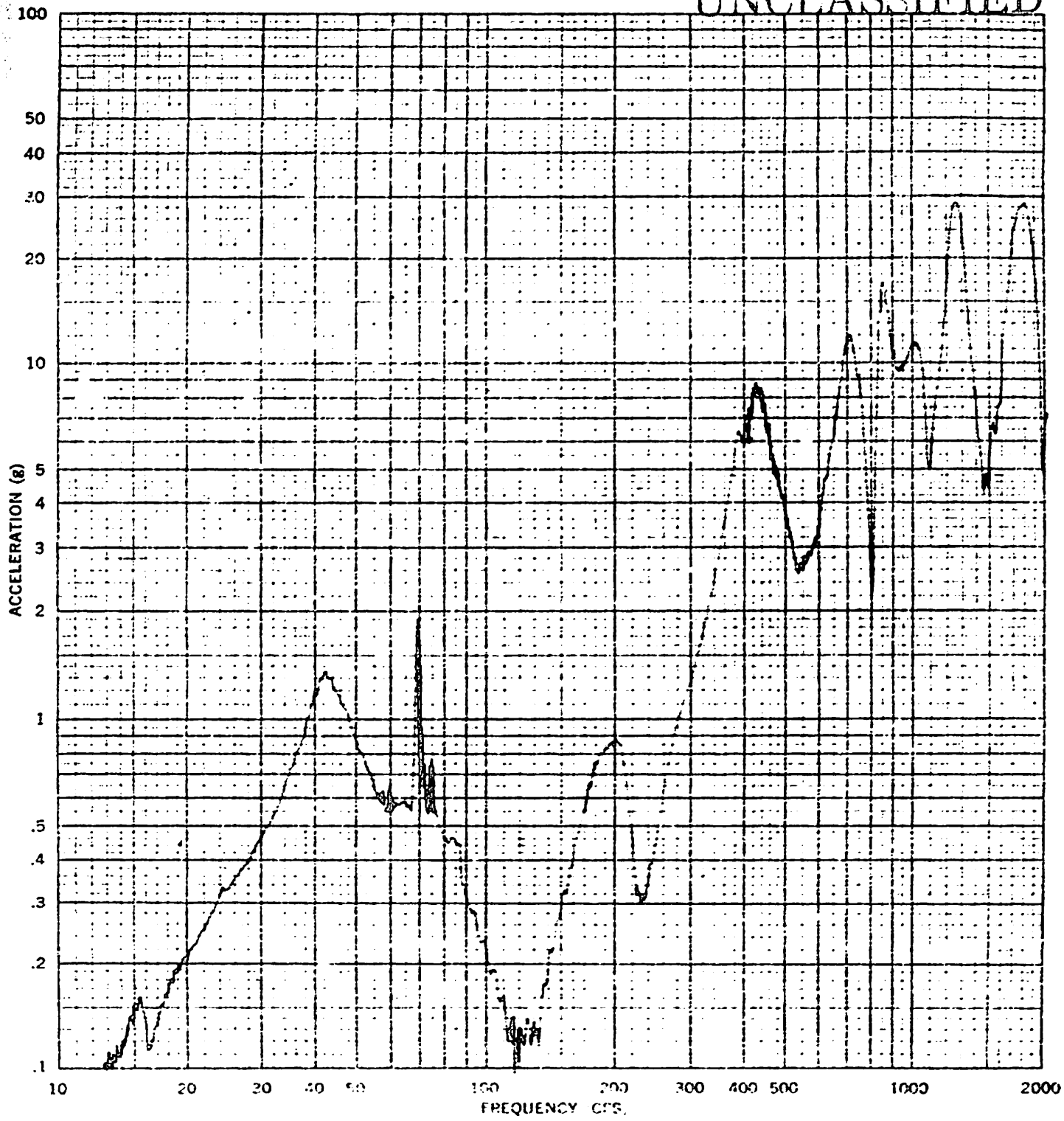
FILTER BANDWIDTH 10 CPS PAGE 38

UNCLASSIFIED

[redacted]

[redacted]

UNCLASSIFIED



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS, AT [illegible] °F T- [illegible]

ACCEL. LOCATION [illegible] REF. SYM. [illegible]

FIGURE REFERENCE [illegible] TEST DATE [illegible]

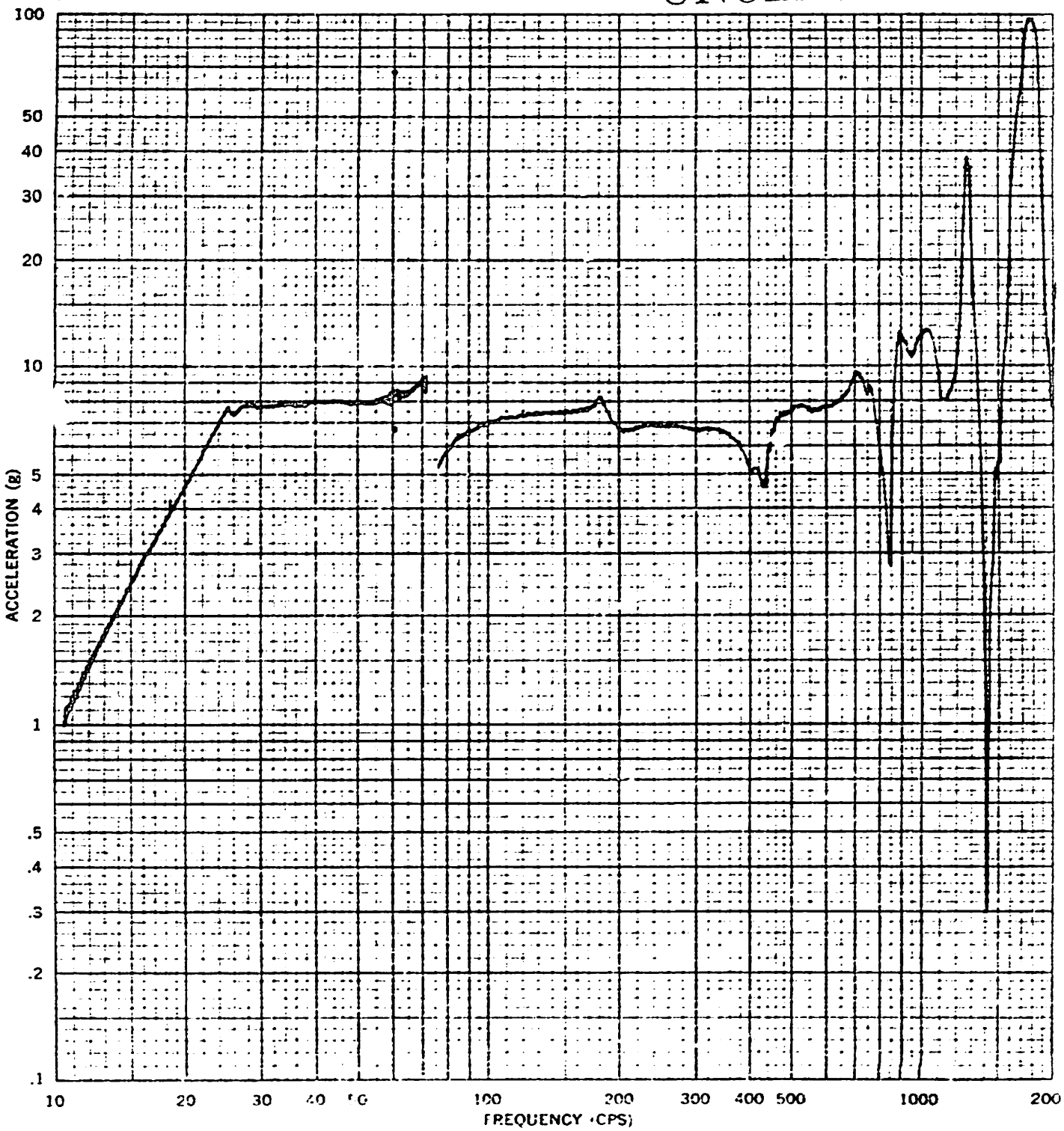
AXIS [illegible] FIGURE [illegible]

FILTER BANDWIDTH [illegible] CPS PAGE [illegible]

UNCLASSIFIED

[redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF W45 Type 5A Sg Cycling - 2nd Run

WITH INPUT ALONG THE Vertical AXIS, AT Room Temp. °F T- 10656

ACCEL. LOCATION At Base of [illegible] REF. SYM.

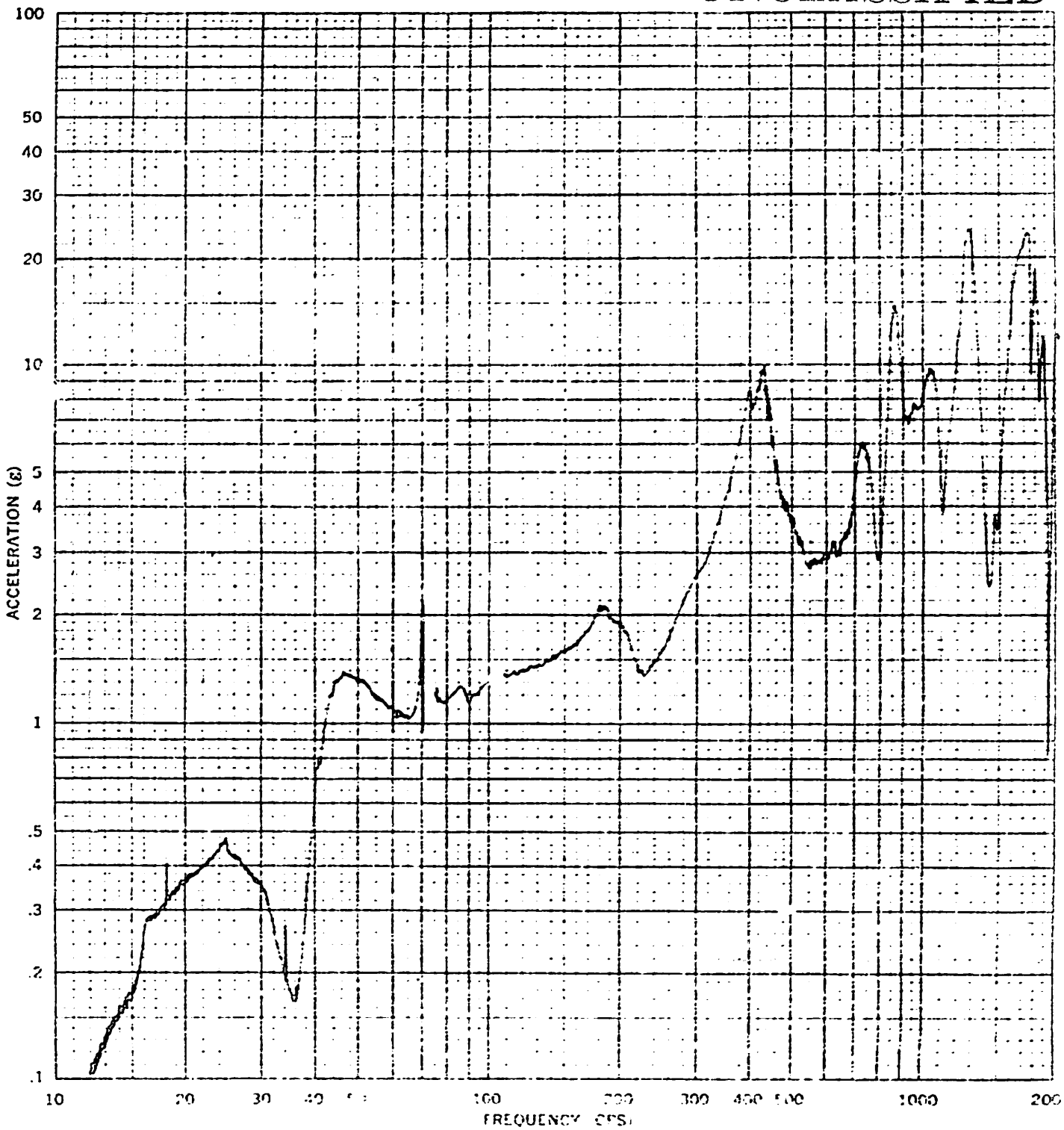
FIGURE REFERENCE [illegible] TEST DATE 12/14/64

AXIS Vertical FIGURE 35

FILTER BANDWIDTH 10 CPS UNCLASSIFIED PAGE 42

[redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS, AT [illegible] F T- [illegible]

ACCEL. LOCATION [illegible] REF. SYM. [illegible]

FIGURE REFERENCE [illegible] TEST DATE [illegible]

AXIS [illegible] FIGURE [illegible]

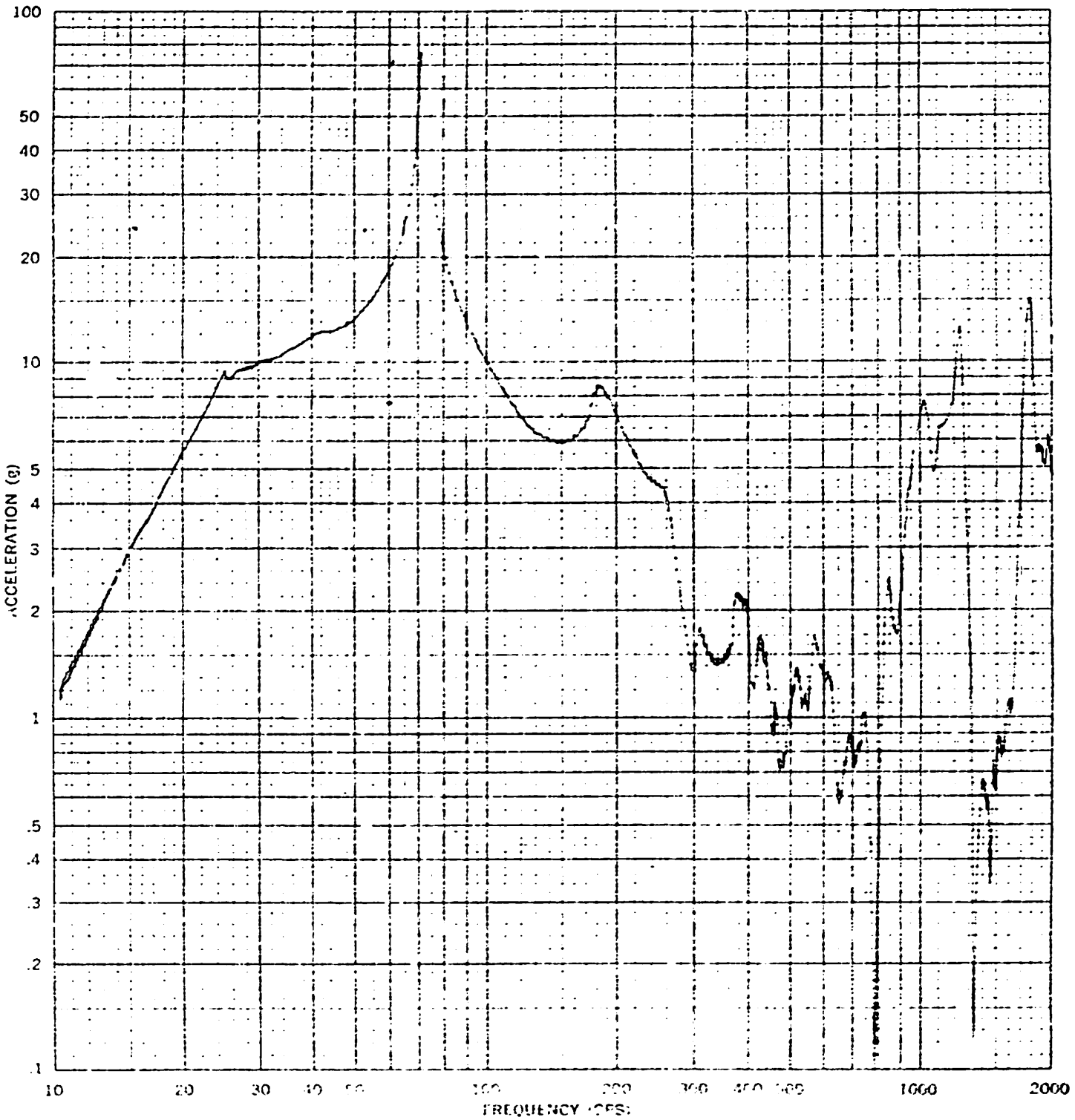
FILTER BANDWIDTH [illegible] CPS UNCLASSIFIED PAGE [illegible]

1136

[redacted]

UNCLASSIFIED

[redacted]



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS, AT [illegible] F [illegible] T [illegible]

ACCEL. LOCATION [illegible] REF. SYM. [illegible]

FIGURE REFERENCE [illegible] TEST DATE [illegible]

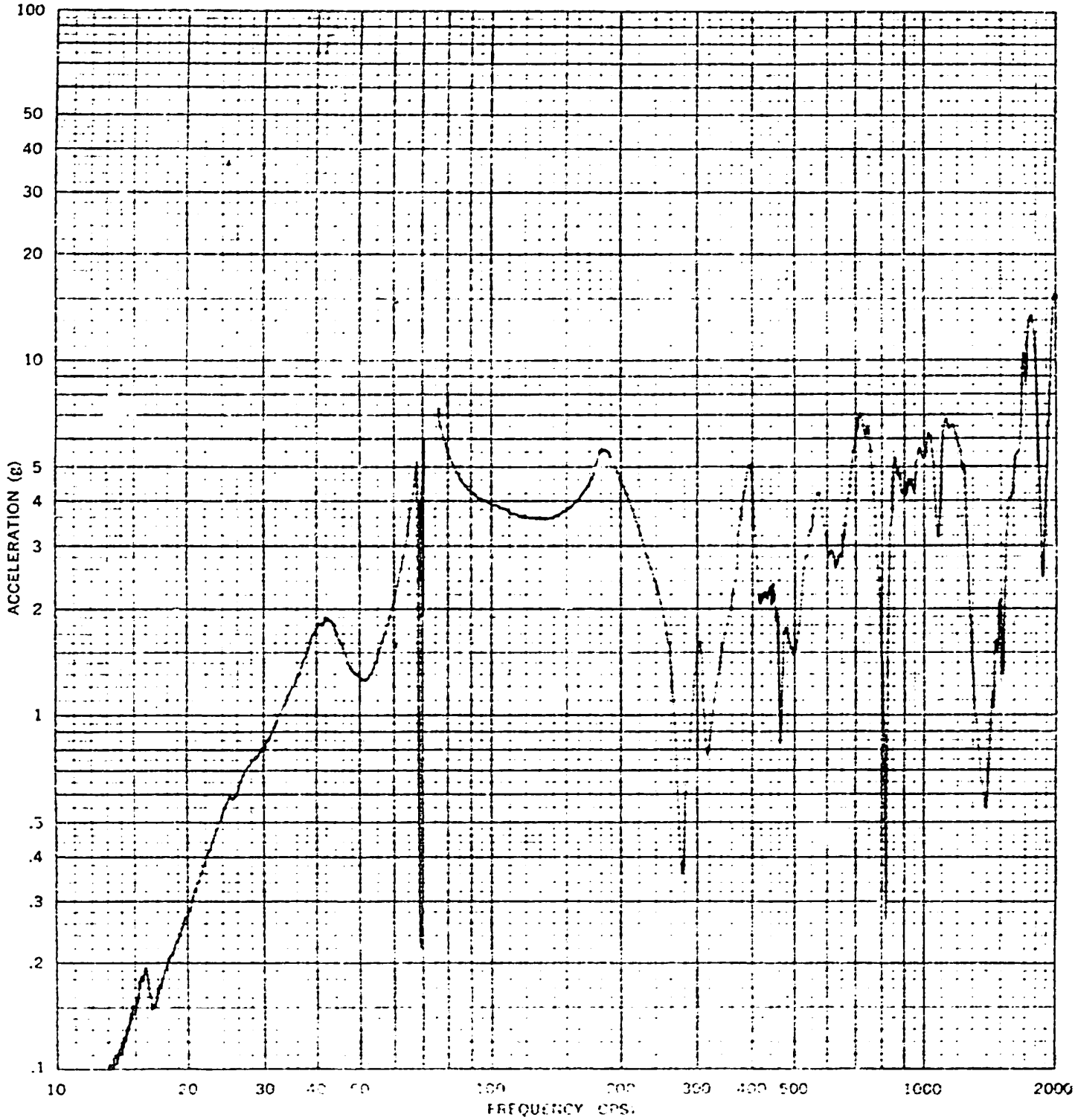
AXIS [illegible] FIGURE [illegible]

FILTER BANDWIDTH [illegible] CPS PAGE [illegible]

UNCLASSIFIED

[redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF [illegible]

WITH INPUT ALONG THE [illegible] AXIS, AT [illegible] °F T- [illegible]

ACCEL. LOCATION [illegible] REF. SYM. [illegible]

FIGURE REFERENCE [illegible] TEST DATE [illegible]

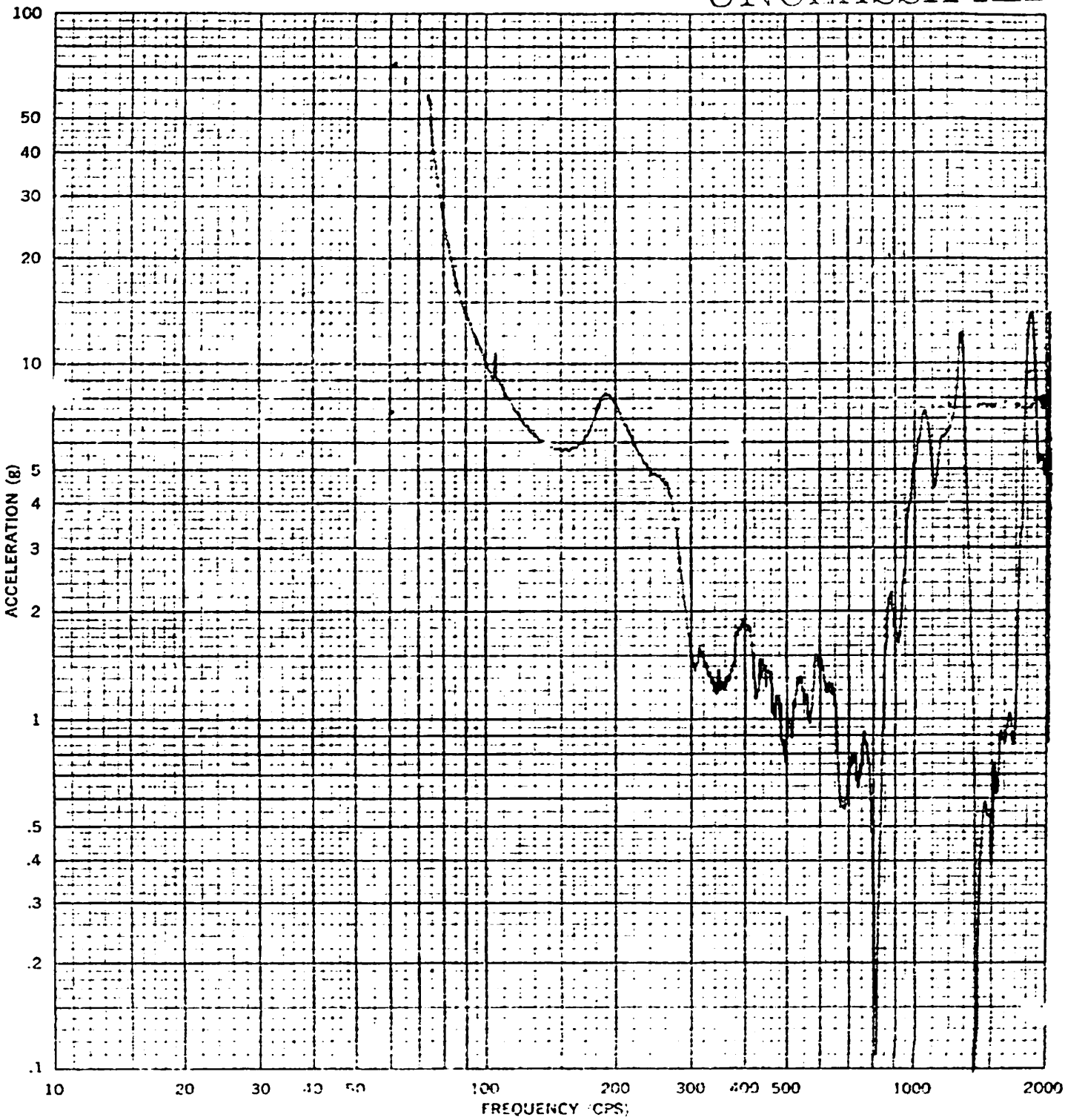
AXIS [illegible] FIGURE [illegible]

FILTER BANDWIDTH [illegible] CPS PAGE [illegible]

UNCLASSIFIED

[redacted]

[redacted] UNCLASSIFIED



VIBRATION TEST OF W45 Type 5A 8g Cycling - 2nd Run

WITH INPUT ALONG THE Vertical AXIS, AT Room Temp. °F T- 10/56

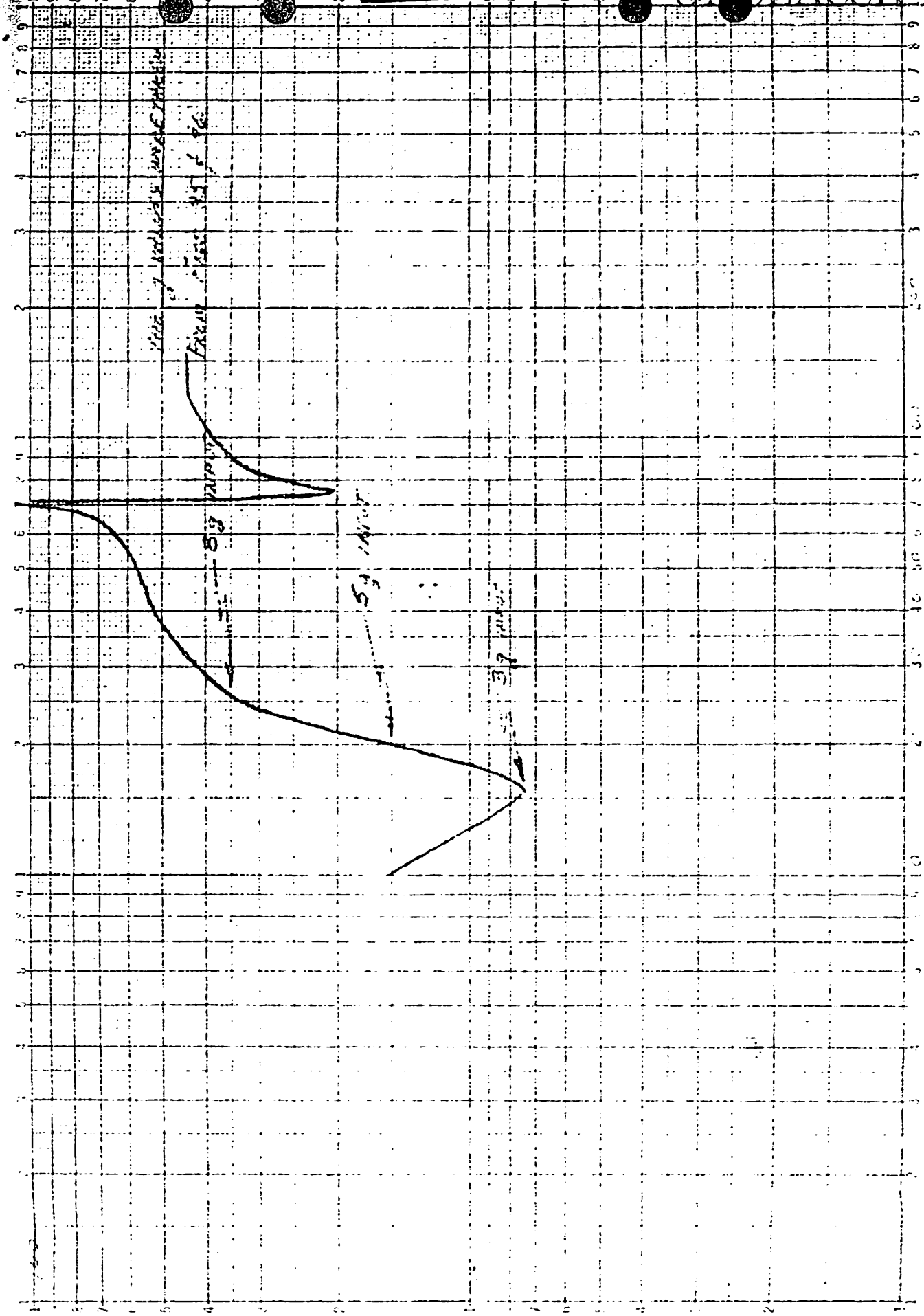
ACCEL. LOCATION At Fwd. Break 0 REF. SYM.

FIGURE REFERENCE 1 TEST DATE 12/14/64

AXIS Vertical FIGURE 39

FILTER BANDWIDTH 10 CPS PAGE 44

UNCLASSIFIED

[redacted]

1139