HIRDLS

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(3164-SV012-TRF)
Issue 1

HIGH RESOLUTION DYNAMICS LIMB SOUNDER

Originator: N Crossland Date: 18 January, 2000

Subject/Title: **FM SVA Vibration Test Report**

Description/Summary/Contents:

The Space View Aperture (SVA) Mechanism Flight Model (FM) has been successfully subjected to workmanship level vibration testing.

Keywords: SVA, FM, Vibration

Purpose of this Document: SVA Test Report

Reviewed/Approved by:			
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EOS

ORIGINAL WHEN RED

SPACE VIEW APERTURE (SVA) ASSEMBLY
FLIGHT MODEL (FM)
VIBRATION TEST REPORT

Responsible Engineer: N Grossland Date: 31 Jan 2000

Quality Assurance: D. G. Bradley Date: 10th Feb. 2000

Project Manager: [illegible] Date: 1 Feb. 00

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1. SUMMARY

This report summarises the workmanship level vibration tests performed on the HIRDLS Space View Aperture (SVA) Assembly Flight Model (FM) .

The test results show that the unit has a first natural frequency of approximately 159 Hz which satisfies the 120 Hz minimum stiffness requirement.

The unit completed workmanship level vibration testing with no detectable structural degradation. No inexplicable variations were detected in the results of the low level sine surveys performed before, during, and after any of the tests.

2. INTRODUCTION

The HIRDLS SVA has been subjected to workmanship level vibration tests. The findings are reported herein.

The purpose of the tests is to demonstrate the ability of the unit to withstand the vibration loads defined in the Requirements Specification (AD 1) and Test Procedure (AD 3) and to confirm that the unit satisfies the specified minimum stiffness requirement.

3. APPLICABLE DOCUMENTS

AD 1	SP-HIR-50 Issue D	Sunshield Subsystem Requirements Specification
AD 2	HR2L040 Issue 05	Space View Aperture Assembly BOM
AD 3	TP-MMS-451 Issue 3	Space View Aperture Assembly FM Test Procedure
AD 4	IL2712	HIRDLS SVA FM Vibration Test Log Book
AD 5	HDRLS-PA-018	SVA FM Test Readiness Review Minutes
AD 6	TR-MMS-424 Issue A	EM SVA Vibration Test Report

4. TEST ITEM

The test item is the SVA FM as defined in Bill of Materials AD 2. Figure 1 shows the location of the 4 tri-axial accelerometers used to monitor unit responses and defines the test axes.

Testing was carried out in accordance with the Test Procedure (AD 3) and amendments agreed during the Test Readiness Review (TRR) and recorded in AD 5.

5. TEST LOCATION AND EQUIPMENT

5.1 Test Location

The SVA FM was subjected to qualification level testing in the Environmental Test Laboratory, MMS, Portsmouth, England, over the period 18–19 January 2000.

5.2 Test Equipment

Repeat testing was performed using the Derritron VP2500 vibrator for the vertical (Z) axis and the Derritron VP1200 vibrator for the 2 lateral axes.

The Genrad Spectral Dynamics 2552B controller was used for both sine and random vibration testing. A 2 point average control strategy was adopted; the 2 points being at opposite diagonal corners of the vibration jig.

Endevco accelerometers and Kistler charge amplifiers were used to monitor and control the tests. All data was stored and subsequently analysed on the Cranfield Data Systems EDASP 7610 data analyser.

A full equipment list and calibration data is contained in the Environmental Test Log Books (AD 4) which is available for examination at the location detailed in Section 5.1.

6. VIBRATION TEST SEQUENCE

Workmanship level vibration testing was carried out in accordance with the sequence specified in Table 6-1.

Test No	Description	Axis	Table
1	Jig survey	Y	7.1-1
2	Low level sine survey	Y	7.1-1
5	Workmanship level random	Y	7.3-1
6	Low level sine survey	Y	7.1-1
7	Jig survey	X	7.1-1
8	Low level sine survey	X	7.1-1
11	Workmanship level random	X	7.3-1
12	Low level sine survey	X	7.1-1
13	Jig survey	Z	7.1-1
14	Low level sine survey	Z	7.1-1
17	Workmanship level random	Z	7.3-1
18	Low level sine survey	Z	7.1-1

Table 6-1 Workmanship Vibration Test Sequence

7. VIBRATION TESTS

7.1 Jig Survey

Vibration jig surveys were performed by a single sweep increasing in frequency as defined in Table 7.1-1.

AXIS	FREQUENCY (Hz)	ACCELERATION	SWEEP RATE (Oct/min)
ALL	5 - 2000	± 0.2g	2

Table 7.1-1 Jig and Low Level Sine Survey

7.2 Low Level Sine Survey

Low level sine surveys were performed by a single sweep increasing in frequency as defined in Table 7.1-1.

7.3 Workmanship Level Random Test

Workmanship level random vibration testing was performed to the levels and duration defined in Table 7.3-1.

AXIS	FREQUENCY (Hz)	PSD (g^2/Hz)	DURATION
ALL	20 20 – 160 160 - 250 250 - 2000 2000	0.01 +3 dB / octave 0.08 -3 dB / octave 0.01	1 minute
	Overall	7.4g RMS	

Table 7.3-1 Workmanship Random Vibration Levels

8. RESULTS

A complete record of all test data is available for examination at the location detailed in Section 5.1.

The following occurrence report covers deviations observed during testing :-

HR.NCR.00001.MMS Incorrect frequencies in random specification

Corrected frequency break points were authorised for random vibration testing. Due to a clerical error, the break points defined in the Test Procedure were not in accordance with those defined in the General Interface Requirements Document (GIRD).

Also reported are changes in low level sine survey responses performed before and after the initial, Y axis, workmanship test. These were accepted on the basis that the mechanism includes a compressed tubular seal, pre-tensioned springs, and several moving parts and hence, would be susceptible to a 'settling-in' process. No significant changes were observed during X and Z axis testing. This initial 'settling-in' phenomenon was noted during the initial EM tests (refer to AD 6).

Several response plots are included herein as Figures 2 – 19.

Overall Grms levels for Positions 1 (Door) and 3 (Motor) are summarised in Table 8-1 below.

	Overall level (G_{rms})	
Test axis	Posn 1	Posn 3
X	10.13	27.83
Y	23.11	14.57
Z	12.19	25.67

Table 8-1 Mechanism Vibration Levels

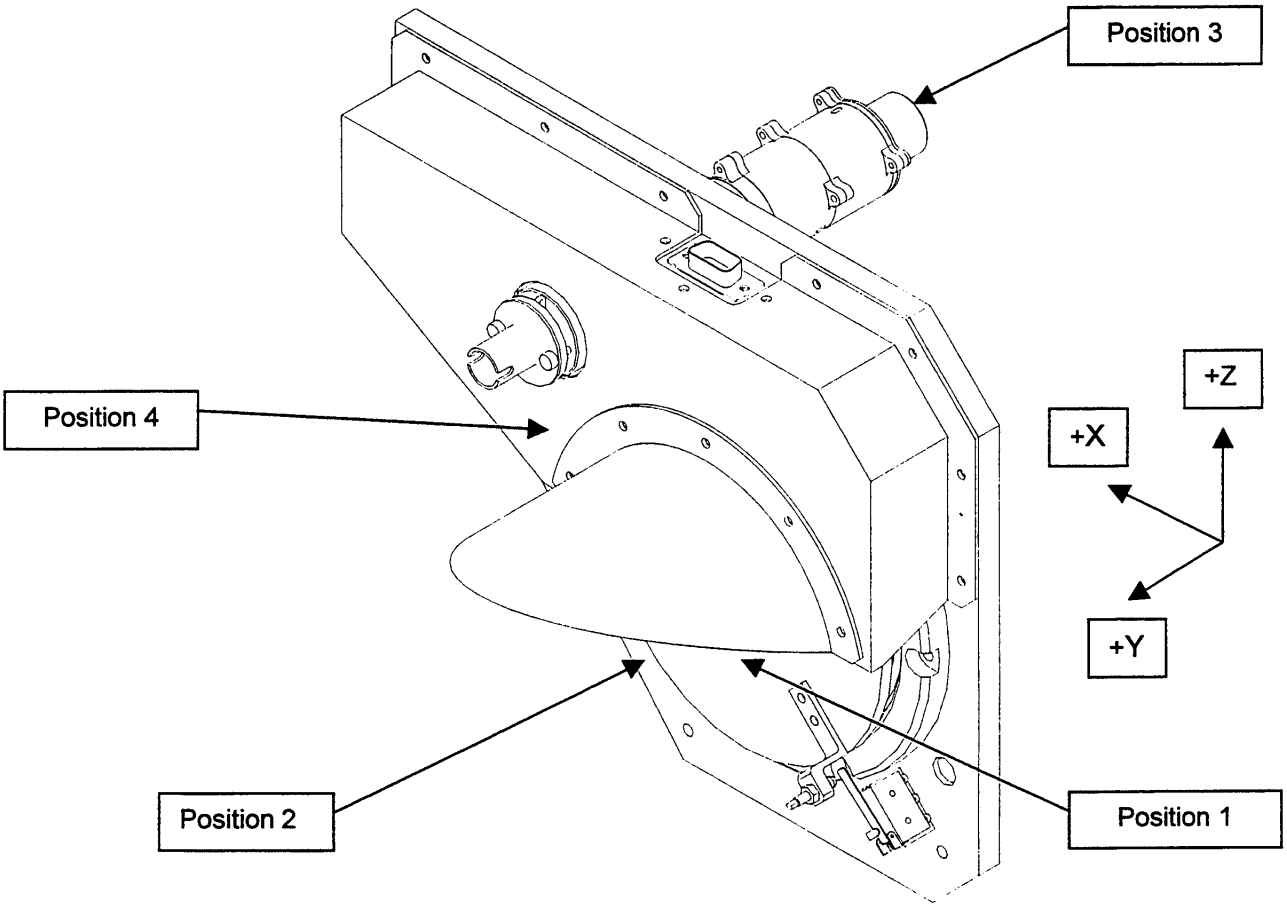
9. CONCLUSIONS

1. The SVA FM has been shown to have a first natural frequency of approximately 159 Hz which satisfies the minimum stiffness requirement of 120 Hz. This correlates well with the EM Qualification unit first frequency of 154 Hz (refer to AD 6).

2. The SVA FM has been subjected to workmanship level vibration tests without detectable mechanical failure.

3. No inexplicable variations were detected in the results of the low level sine surveys performed before, during and after any of the tests.

4. The SVA FM has been successfully subjected to workmanship level vibration tests in each of the 3 axes. The Environmental Test Certificate is included as Figure 14.



Position 1	Door
Position 2	Baseplate
Position 3	Motor
Position 4	Cover

Figure 1 Test Item Monitoring Equipment

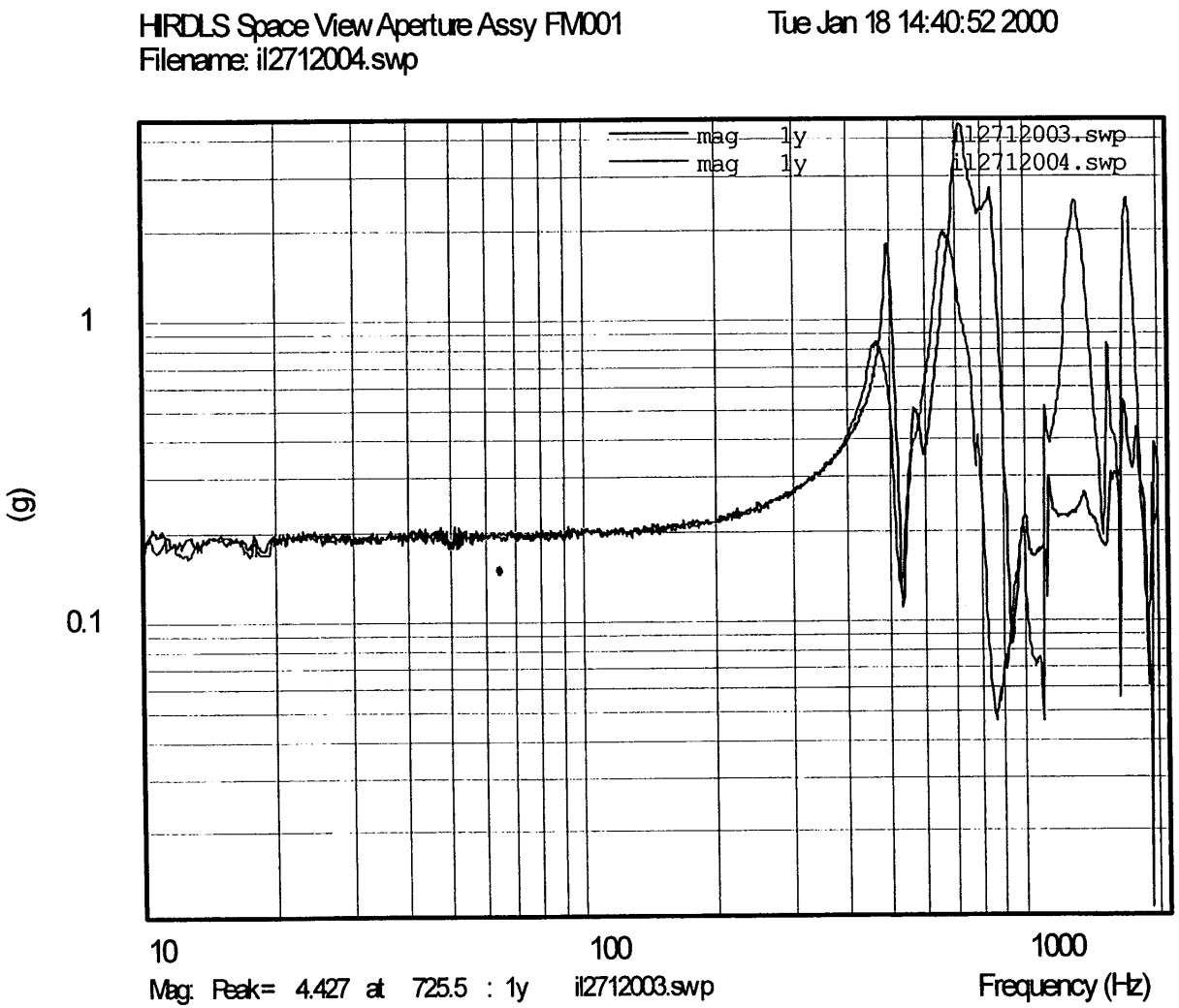


Figure 2 **Pre and Post Workmanship Test low level sine responses – Position 1y in-axis**

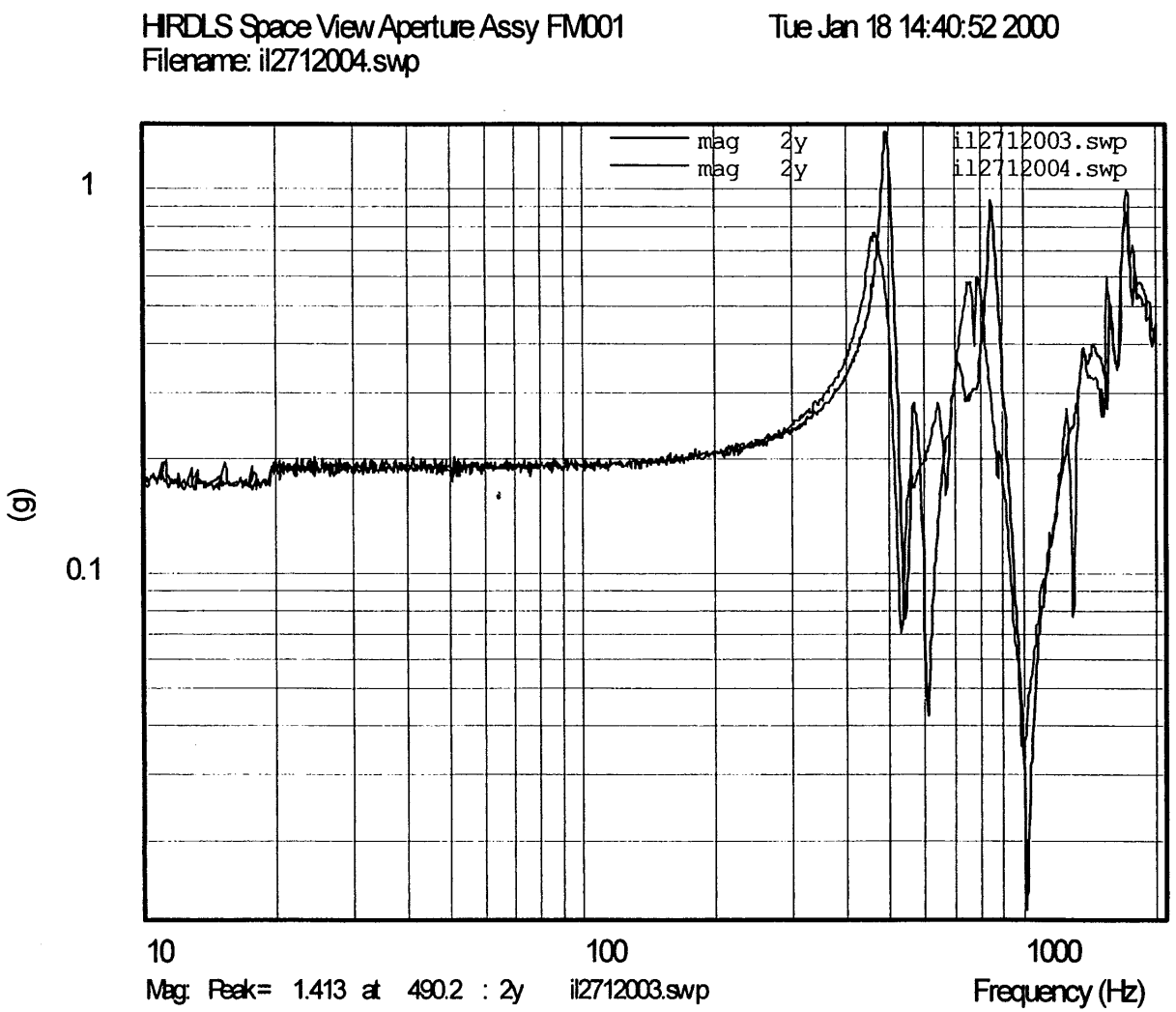


Figure 3 Pre and Post Workmanship Test low level sine responses – Position 2y in-axis

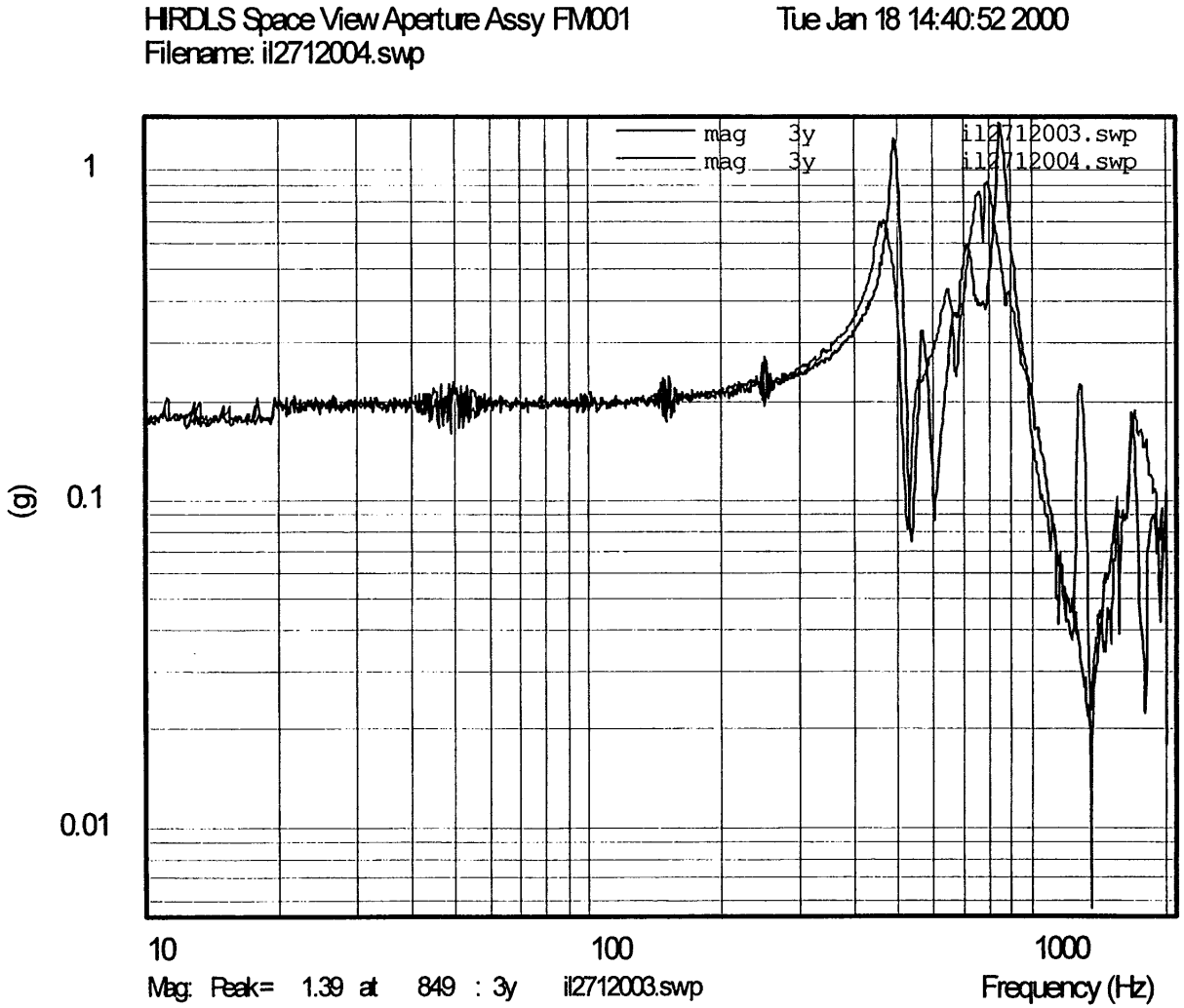


Figure 4 **Pre and Post Workmanship Test low level sine responses – Position 3y in-axis**

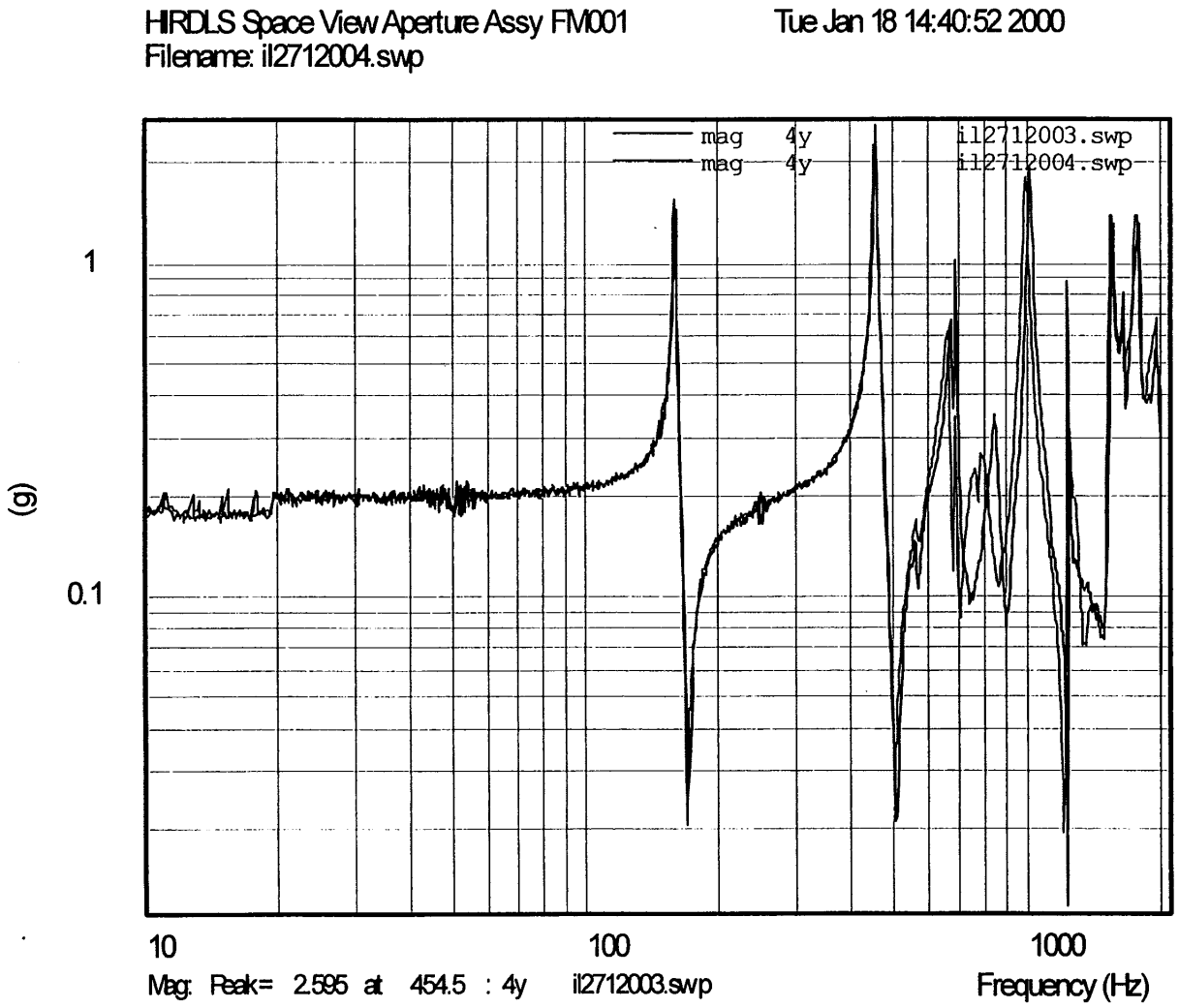


Figure 5 **Pre and Post Workmanship Test low level sine responses – Position 4y in-axis**

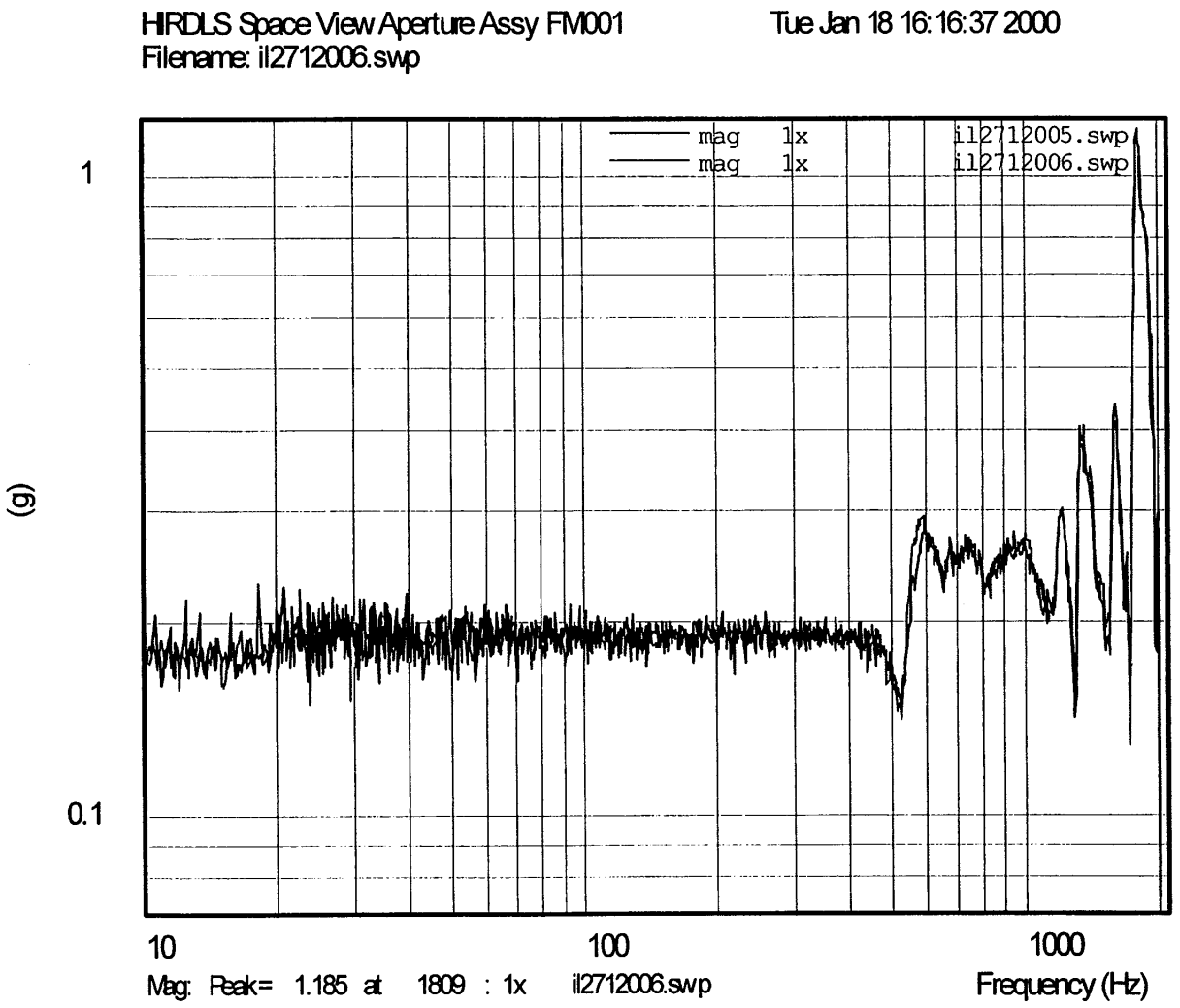


Figure 6 Pre and Post Workmanship Test low level sine responses – Position 1x in-axis

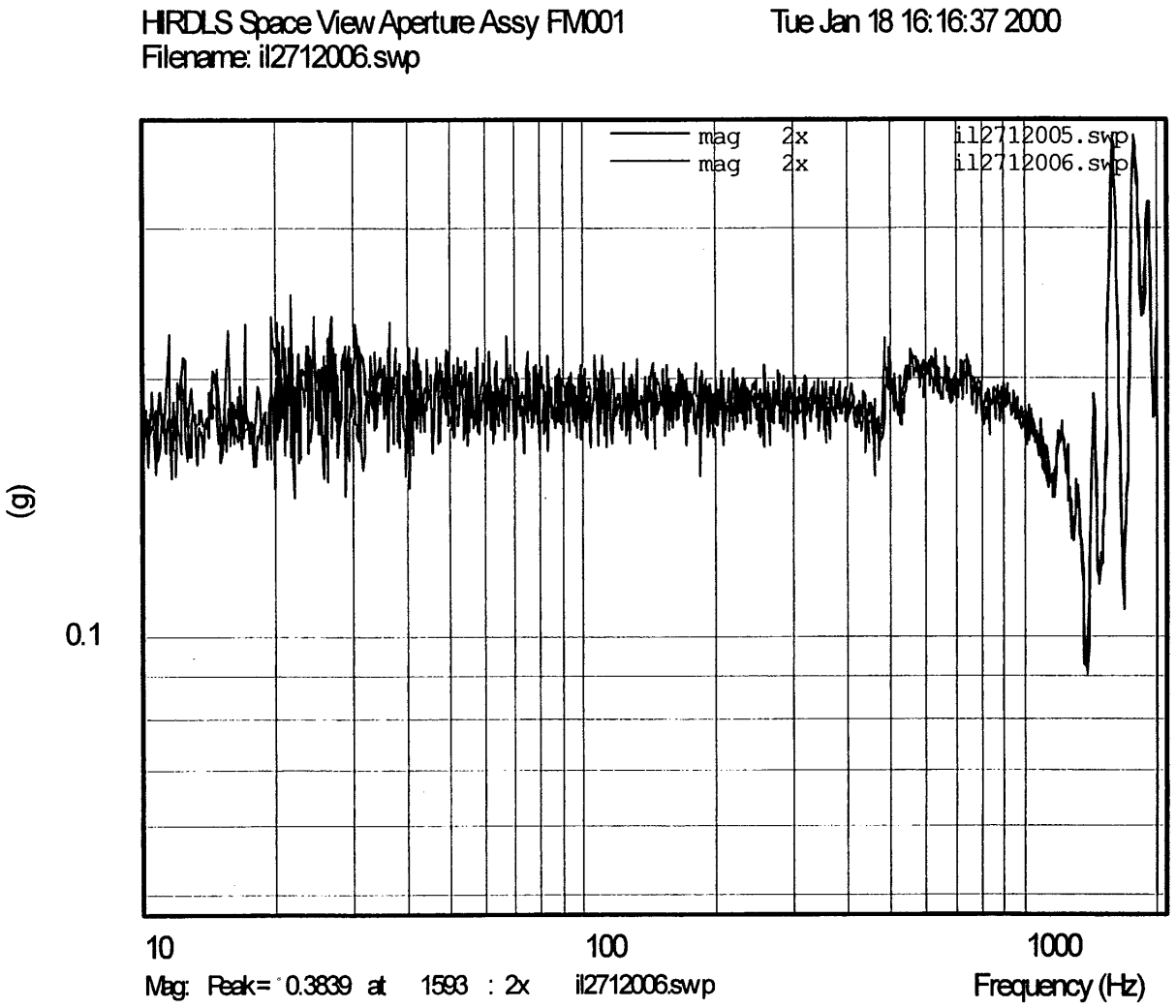


Figure 7 **Pre and Post Workmanship Test low level sine responses – Position 2x in-axis**

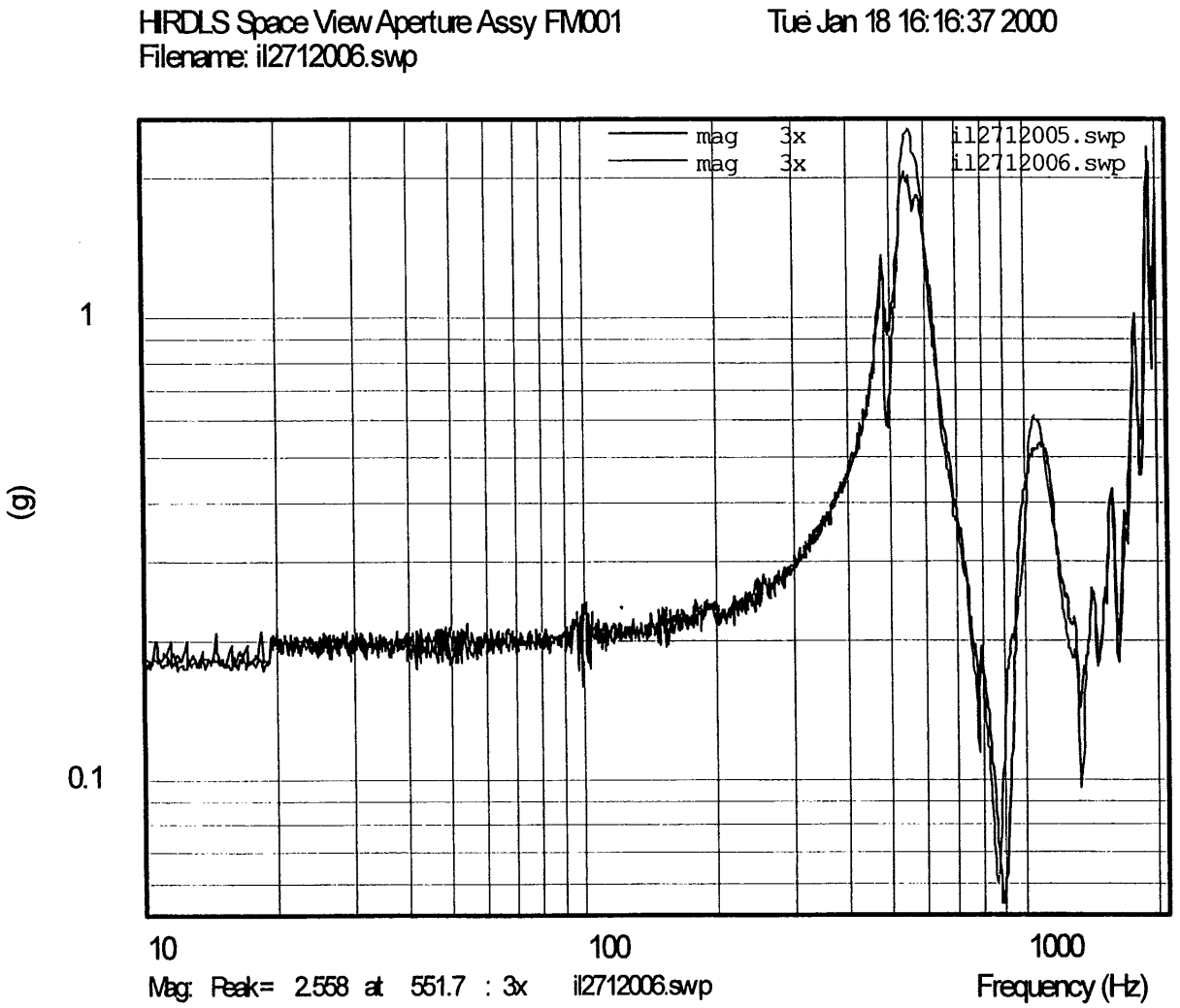


Figure 8 Pre and Post Workmanship Test low level sine responses – Position 3x in-axis

HIRDLS Space View Aperture Assy FM001 Tue Jan 18 16:16:37 2000
Filename: il2712006.swp

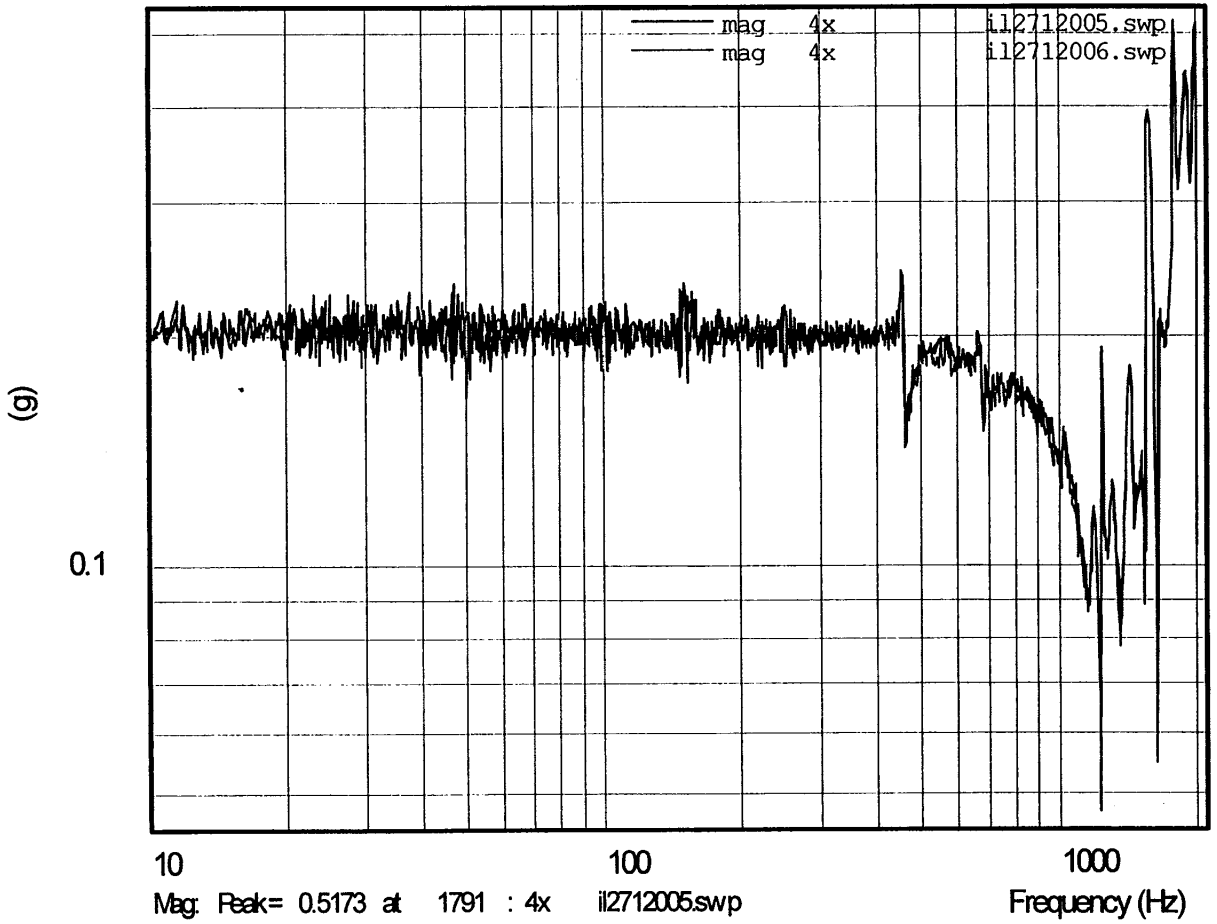


Figure 9 **Pre and Post Workmanship Test low level sine responses – Position 4x in-axis**

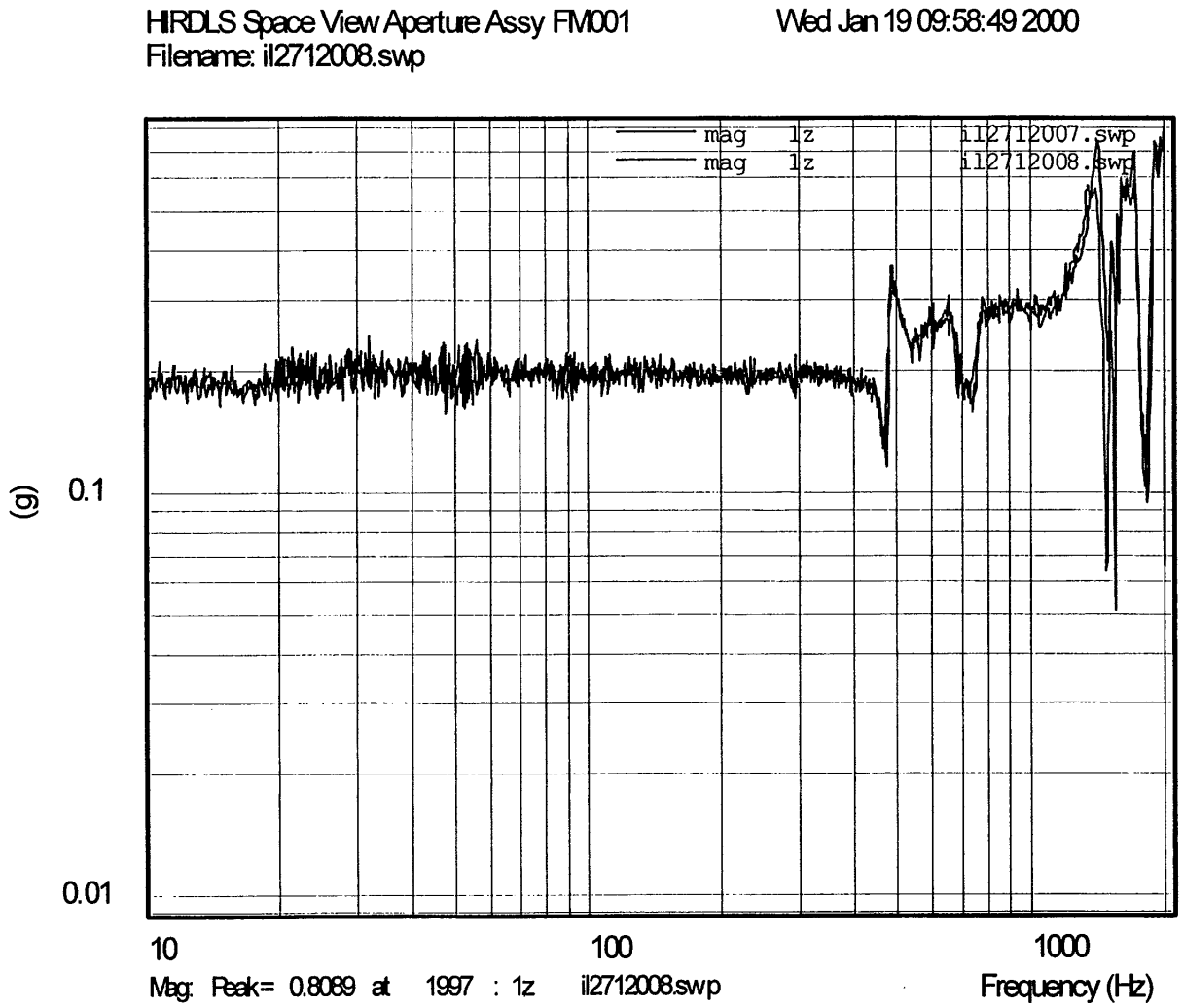


Figure 10 Pre and Post Workmanship Test low level sine responses – Position 1z in-axis

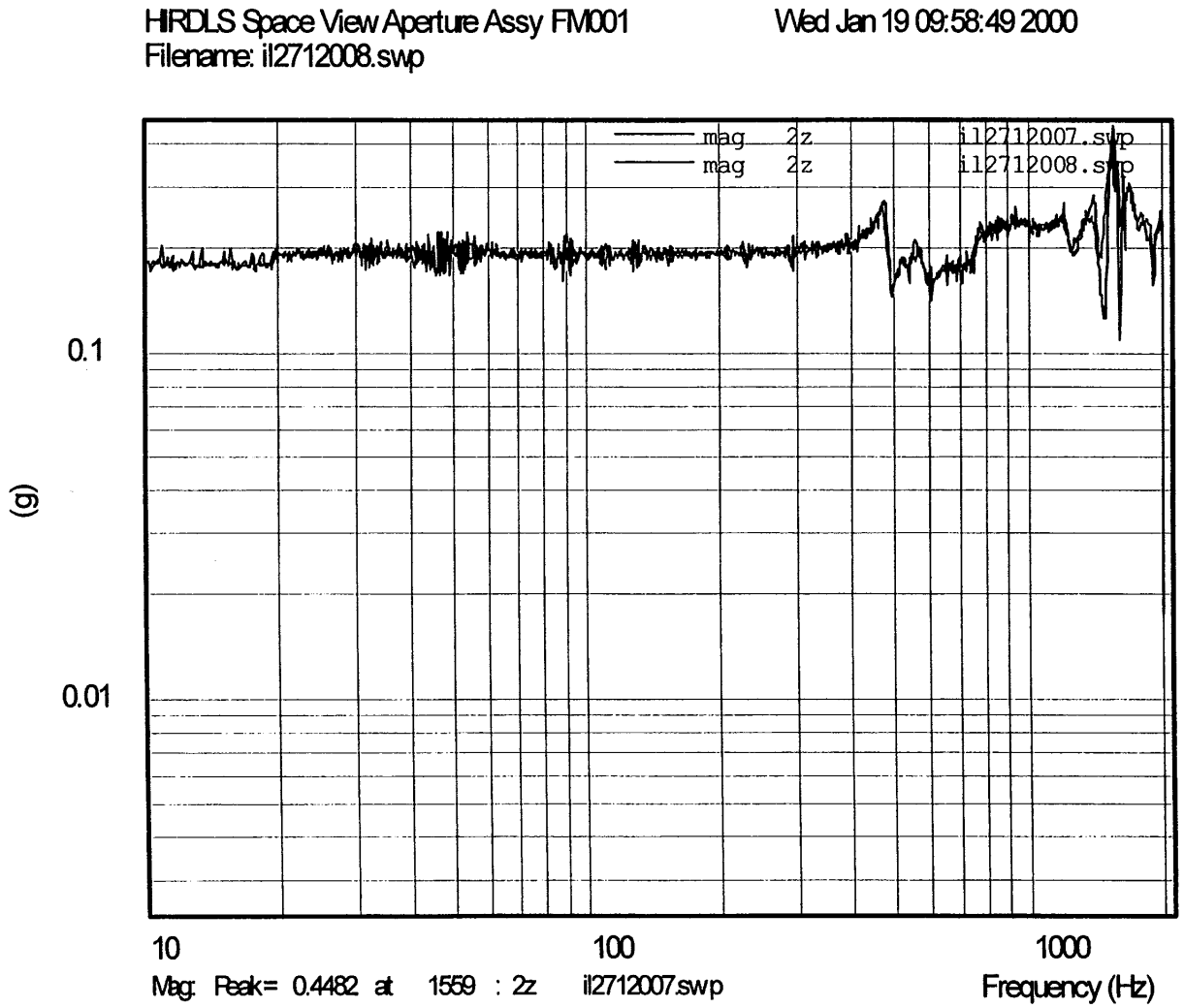


Figure 11 Pre and Post Workmanship Test low level sine responses – Position 2z in-axis

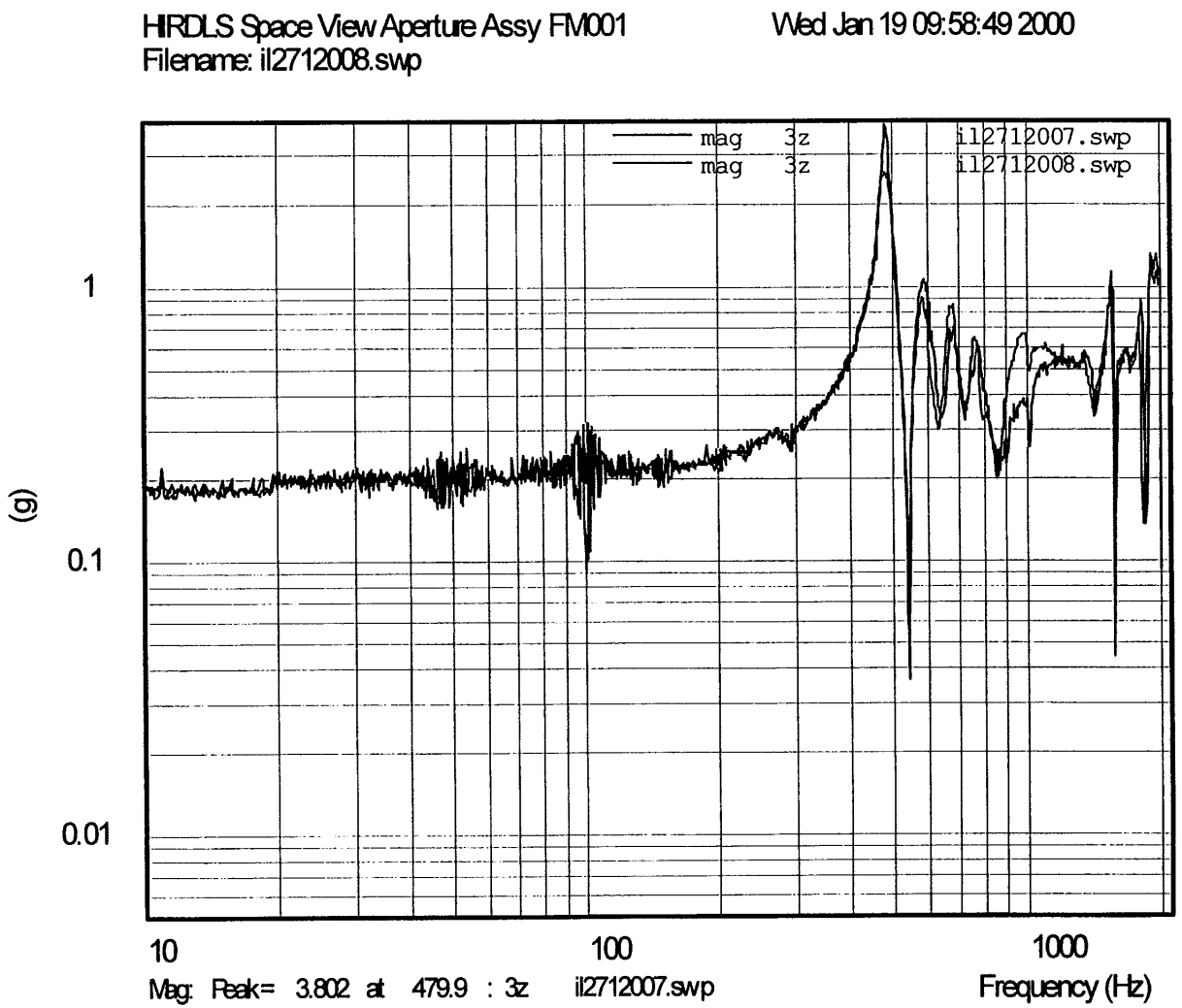


Figure 12 Pre and Post Workmanship Test low level sine responses – Position 3z in-axis

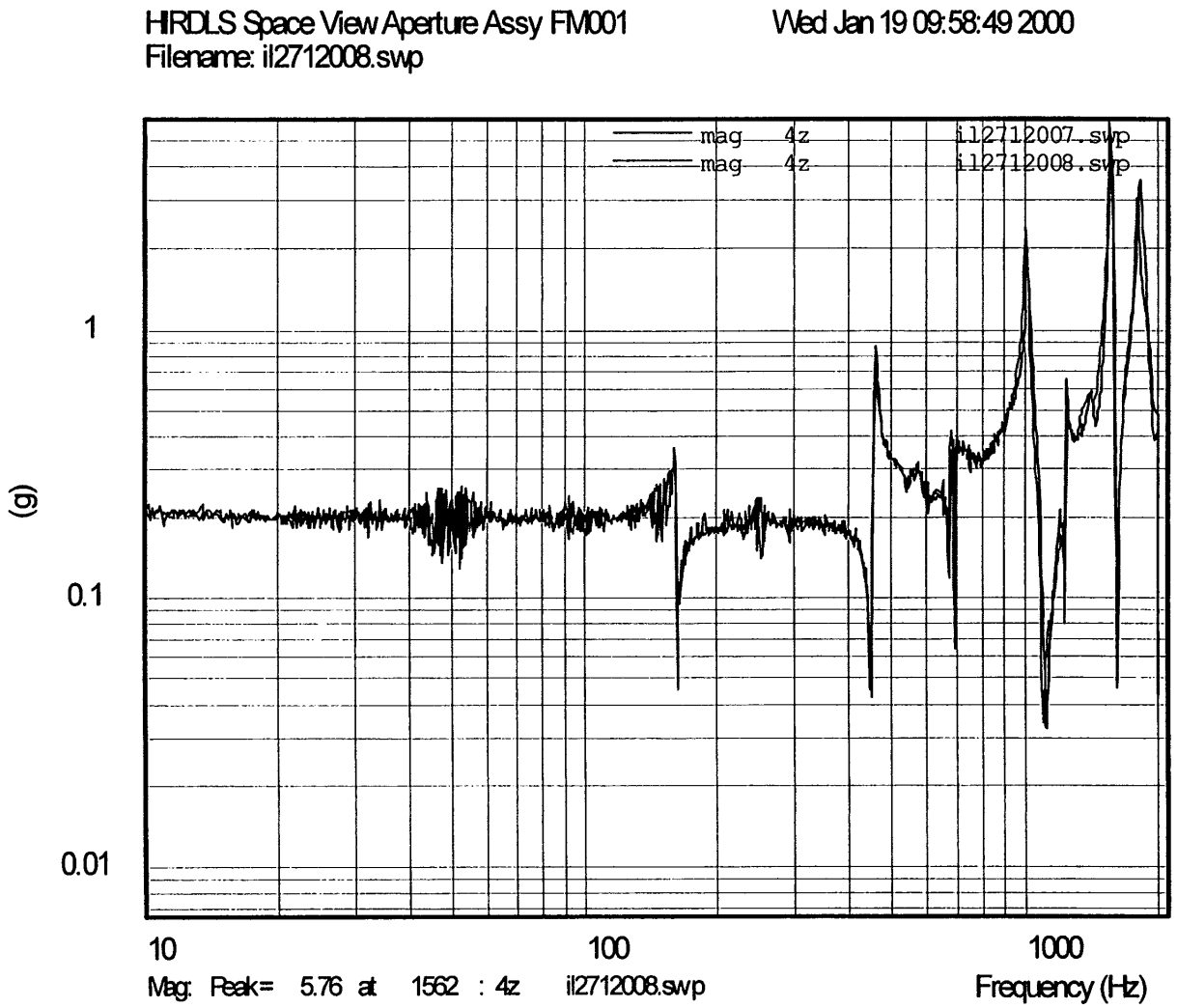


Figure 13 Pre and Post Workmanship Test low level sine responses – Position 4z in-axis

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NAMAS
TESTING
No. 0093

TEST CERTIFICATE

[redacted] 0093 [redacted] IL2712-1

Matra Marconi Space (UK) Ltd HIRDLS F.A.O. N. Crossland (Ext 5409)	[redacted] N/A
Acceptance Vibration of Space View Aperture Assembly.	
Drawing Number: HR2L040, Issue 05.	
FM001.	
18th January 1999.	
3164-SA028-TPF, Issue 3. (Section 4.5)	
O.R:- HR.NCR.00001.MMS.	
All testing carried out in accordance with test procedure. All results held in EVT logbook IL2712.	

The tests detailed above are certified to have been carried out to the requirements of the contract/order unless otherwise stated above. This certificate is issued in accordance with the quality control arrangements granted by our **UKAS TESTING** accreditation.

AUTHOR: G. M. STANCOMBE MMS 120 UK

DATE: 24/1/00

APPROVED BY: S W. FORSTER

(Signature and print name)
FOR AND ON BEHALF OF THE
ENVIRONMENTAL TEST LABORATORY MANAGER.

Page 1 of 1

Registered office: The Grove, Warren Lane, Stanmore, Middlesex., HA7 4LY . No 2519610

Figure 14 Environmental Test Certificate

DISTRIBUTION LIST

INTERNAL	EXTERNAL
N Crossland	N Morris (RAL)
I Stewart	

CHANGE RECORD

CHANGE NUMBER	CLASS	CHANGE DETAILS	ISSUE
3164- 00362	-	First Issue	1