

**SPECTROGRAPHIC IMAGER
FLIGHT DETECTOR ASSEMBLY**

QUALIFICATION VIBRATION

Test Procedure

Dwg No 8117-W7 Rev A
Space Sciences Laboratory
6 April, 1998

SIGNATURES

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1.0 SCOPE

1.1 Introduction

This document describes the test procedure to be used in the qualification vibration testing of the SI Flight Detector Assemblies. It defines test responsibilities, test equipment, environmental conditions and sequence of events required to conduct the Sine Sweep, Sine Vibration and Random Vibration tests.

1.2 Test Objectives

The objective of this test is to meet the requirements as described in EM number S-8089-SYS-003B from SwRI. The plan is to verify that SI detectors can successfully withstand acceptance level environment stress and subsequently function to its specific performance. The ETU detector assemblies have already been tested to Qualification levels when they were vibrated at CSL as a part of the integrated Spectrographic Imager assembly. Therefore, the flight detector assemblies will be tested to Acceptance levels.

1.3 Test Specimen

1.3.1 Identification

The test specimens are the SI flight detectors. The general layout of each of the units is shown in Attachment #1. "Test Specimen and Configuration"

The size of the assembly is approximately:

Height = 6 inches
Width = 5 inches
Depth = 8 inches
Mass = 1.65 kg

1.3.2 Functional Configuration:

The accelerometers are to be applied at strategic locations as described in Attachment #2 "Accelerometer Location".

2.0 Documents

2.1 Applicable Documents

[1]	8110-A4 Rev B	FUV Integration and Test Flow
[2]	S-8089-SYS-003B	Instrument Environments

3.0 CONDITIONS

3.1 Personnel, Responsibilities

The following personnel are required for the performance of this test:

Test Director – responsible for the test preparation, test coordination, test hardware handling, test procedure application, and all decision concerning the test specimen and the testing documents.

Test Conductor(s) – Operators supplied by vibration test contractor.

3.2 Safety and Precautions

Normal safety precautions for aerospace optics shall be observed. The test item must be kept packed as long as possible.

3.3 Test Facilities and Equipment

This test will be performed at Viking Laboratories, or other suitable contractor.
 Following is a list of equipment and instrumentation required for vibration tests.

No.	Designation and Description	Supplier	Requirements
1	Vibration Exciter	Vib Contractor	N/A
2	Transverse Table 24" x 24"	Vib Contractor	N/A
3	Vibration Control and Data Handling System	Vib Contractor	Calibrated
4	Accelerometers	Vib Contractor	Calibrated
5	Vibration Test Fixture	Vib Contractor	N/A
6	Torque Wrenches	Vib Contractor	Calibrated
7	Tool Box: Isopropyl Alcohol, wipes, Camera	Vib Contractor	N/A
8	Log Book	UCB	N/A
9	Equipment Calibration Table	Vib Contractor	N/A
11	Test Items	UCB	N/A

3.4 TEST SEQUENCE

	Test Sequence Designation	Description
	TS101	Test Readiness Review
Facility Survey		
	TS201	X axis Sine Sweep
	TS202	X axis Sine Vibration
	TS203	X axis Random Vibration
Vibration Test in X axis		
	TS301	X axis Sine Sweep
	TS302	X axis Sine Vibration
	TS303	X axis Random Vibration
	TS304	X axis Sine Sweep
	TS305	Visual Inspection
Vibration Test in Y axis		
	TS401	Y axis Sine Sweep
	TS402	Y axis Sine Vibration
	TS403	Y axis Random Vibration
	TS404	Y axis Sine Sweep
	TS405	Visual Inspection
Vibration Test in Z axis		
	TS501	Z axis Sine Sweep
	TS502	Z axis Sine Vibration
	TS503	Z axis Random Vibration
	TS504	Z axis Sine Sweep
	TS505	Visual Inspection
Inspection	TS601	Post test visual Inspection

3.5 TEST SPECIFICATIONS

3.5.1 Equipment Accuracy

Tolerances of measured variables are the following:

-Sinusoidal Vibration	10%
-Random Vibration	PSD ± 2 dB; gRMS $\pm 10\%$
-Frequencies	10%
-Time	10%

3.5.2 Vibration Axis

The vibration axes correspond to the SI Detector reference axes (Xi, Yi, Zi). See Attachment #1.

3.5.3 Test Levels

The test levels are in accordance with Engineering Memorandum number S-8089-SYS-003B. Vibration test levels will be at the Qualification level.

3.5.3.1 Sine Vibration

Input:	Frequency Range (Hz)			Displacement Amplitude or Acceleration
<i>Axial axis</i> (Z)	10	to	20	.20 inch DA
	20	to	100	4.0 G o-p
<i>Lateral axes</i> (X,Y)	10	to	50	.008 inch DA
	50	to	100	1.0 G o-p
Sweep rate:	2 oct/min; 1 sweep			
Duration:	turn off vibrations soon as acceleration level is reached at the end of the frequency range.			
Documentation:	acceleration vs time plots for all accelerometers			

3.5.3.3 Random Vibration

Frequency (Hz)	Levels (PSD - G²/Hz) Qual & Protoflight
20	0.026
20-50	+6 db/oct
50-800	0.16
800-2000	-6db/oct
2000	0.026
Overall	14.1 Grms

Duration: three minutes in each axis

Tolerances: PSD +- 3 db
Overall +- 10%
Duration +- 10%/-0%

Application: All three axes

3.6 FAILURE CRITERIA AND FAILURE REPORTING

All failures shall have specific details determined at the time of discovery written down in the Test Item Logbook.

3.6.1 Failure

A failure shall be considered to have occurred in the Test Item for any of the following reasons:

- a) Physical damage or yielding found during the test or during the post-vibration inspection of the item.
- b) Any significant shift in the resonant frequencies of the instrument structure couple with significant decrease (softening) in the structural stiffness
- c) Any significant shift in the optical alignment of the item
- e) Test item no longer meets its specified functional performance

3.6.2 Test Failure

Other types of failures do not constitute test item failure. They may require retest as a Result of the Material Review Board (MRB) decisions:

- a) Failure of test instrumentation;
- b) Deviation of the vibration facility from specified tolerances;
- c) Deviations from the vibration test procedure.

5.0 TEST SET-UP

5.1 Test Configuration

The test item will be mounted to the vibration facility tables for excitation in the X, Y and Z axis. See figures in Attachment #2 "Test Set-Up". Vibration is performed one axis at a time.

5.2 Test Fixtures

The test fixture provides the interface between the test item and vibration table. See figures in Attachment #2 "Test Set-Up". It does not require qualification testing as part of the vibration test.

5.3 Accelerometers Installation

The locations of all accelerometers are listed in Table 1, Attachment #3. The listing contains accelerometer identifications with a description of their location.

The location of all the test item accelerometers is shown in Figures 3.1 & 3.2 of Attachment #3. These figures show the location of each accelerometer on the various parts, and should be utilized for locations during installation.

6.0 **TEST PROCEDURE** (Step by Step)

Step No.	<u>Procedures:</u> Test Set-Up and Check Out	Date	Test Conductor
101	Test readiness review (TS101)		
201			
201.1	Unpack test item		
201.2	Fit check test fixtures		
201.3	Verify that the hardware is in accordance with the definition in section 1.3 “Test Specimen” and not physically altered during transportation.		
201.4	Perform TS201 (Sine Sweep).Ref.Sec.3.5.3.1		
201.5	Test Conductor to collect test data and review test input for conformance. Record run designation _____.		
201.6	Record first global eigenfrequency:_____.		
201.7	Perform TS202 (Sine Vibration) Ref. Sec. 3.5.3.2.		
201.8	Test Conductor to collect test data and review test input for conformance. Record run designation_____		
201.9	Perform TS203 (Random Vibration) Ref. Sec 3.5.3.3.		
201.10	Test Conductor to collect test data and review test input for conformance. Record run designation_____		

6.0 **TEST PROCEDURE** cont'd (Step by Step)

Step No.	Procedure: Test in X axis TS301-305	Date	Test Conductor
301	X axis Sine Sweep		
301.1	Wipe mounting with alcohol		
301.2	Mount test item, for excitation in the X axis. Ref. Fig.2.1 Attachment #2.		
301.3	Mount monitor and control accelerometers to test item. Ref. Fig.3.1 & 3.2 of Attachment #3		
301.4	Take photos of set-up and measurement locations.		
301.5	Perform Sine Sweep. Ref. Sec. 3.5.3.1		
301.6	Test Conductor to collect test data and review test input for conformance. Record run designation_____		
301.7	Record first global eigenfrequency: _____.		
302	Perform Sine Vibration. Ref. Sec. 3.5.3.2.		
302.1	Test Conductor to collect test data and review test input for conformance. Record run designation_____		
303	Perform Random vibration. Ref. Sec.3.5.3.3		
303.1	Test Conductor to collect test data and review test input for conformance. Record run designation_____		
304	Perform Sine Sweep. Ref. Sec. 3.5.3.1		

6.0 **TEST PROCEDURE** cont'd (Step by Step)

Step No.	Procedure: Test in X axis	Date	Test Conductor
304.1	Test Conductor to collect test data and review test input for conformance. Record run designation_____		
304.2	Record first global eigenfrequency:_____		
305	Perform visual Inspection refer to Table 2 of Attachment #4.		

6.0 **TEST PROCEDURE** (Step by Step)

Step No.	<u>Procedures:</u> Test in Y axis	Date	Test Conductor
401	Mount test fixture and test item on transverse table, for excitation in Y axis; See Fig. 2.2 of Attachment #2.		
401.1	Mount monitor accelerometers to test item. Ref. Fig. 3.1 of Attachment #3.		
401.2	Take photos of set-up and measurement locations.		
401.3	Perform TS202 (Sine Sweep).Ref. Sec.3.5.3.1		
401.4	Test Conductor to collect test data and review test input for conformance Record run designation _____.		
401.5	Record first global eigenfrequency:_____.		
402	Perform TS402 (Sine Vibration) Ref. Sec. 3.5.3.2.		
402.1	Test Conductor to collect test data and review test input for conformance. Record run designation_____		
402.2	Perform TS203 (Random Vibration) Ref. Sec. 3.5.3.3.		
402.3	Test Conductor to collect test data and review test input for conformance. Record run designation_____		

6.0 **TEST PROCEDURE** cont'd (Step by Step)

Step No.	Procedure: Test in Y axis TS401-405	Date	Test Conductor
404	Y axis Sine Sweep		
404.1	Test Conductor to collect test data and review test input for conformance. Record run designation_____		
404.2	Record first global eigenfrequency: _____.		
404.3	Perform visual Inspection refer to Table 2 of Attachment #4.		

6.0 **TEST PROCEDURE** cont'd (Step by Step)

Step No.	<u>Procedures:</u> Test in Z axis	Date	Test Conductor
501	Mount test fixture and test item on vertical vibration table, for excitation in Z axis; See Fig 2.3 of Attachment #2.		
501.1	Mount monitor accelerometers to test item. Ref. Fig. 3.1 of Attachment #3.		
501.2	Take photos of set-up and measurement locations.		
501.3	Perform TS202 (Sine Sweep).Ref. Sec.3.5.3.1		
501.4	Test Conductor to collect test data and review test input for conformance Record run designation _____.		
501.5	Record first global eigenfrequency:_____.		
502	Perform TS402 (Sine Vibration) Ref. Sec. 3.5.3.2.		
502.1	Test Conductor to collect test data and review test input for conformance. Record run designation_____		
502.2	Perform TS203 (Random Vibration) Ref. Sec 3.5.3.3.		
502.3	Test Conductor to collect test data and review test input for conformance. Record run designation_____		

6.0 **TEST PROCEDURE** cont'd (step by step)

Step No.	Procedure: Test in Z axis TS501-505	Date	Test Conductor
504	Z axis Sine Sweep		
504.1	Test Conductor to collect test data and review test input for conformance. Record run designation_____		
504.2	Record first global eigenfrequency: _____.		
504.3	Perform visual Inspection refer to Table 2 of Attachment #4.		

ATTACHMENT # 1

TEST SPECIMEN AND CONFIGURATION

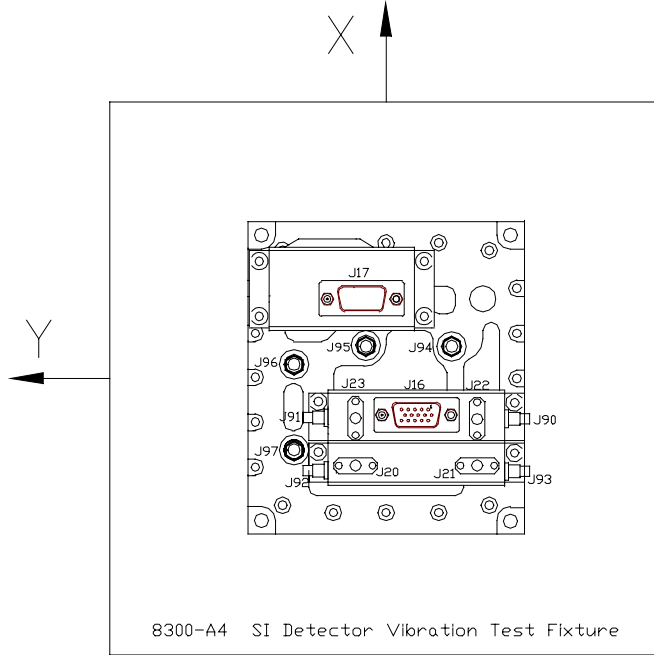


Figure 1-1 -- General Layout

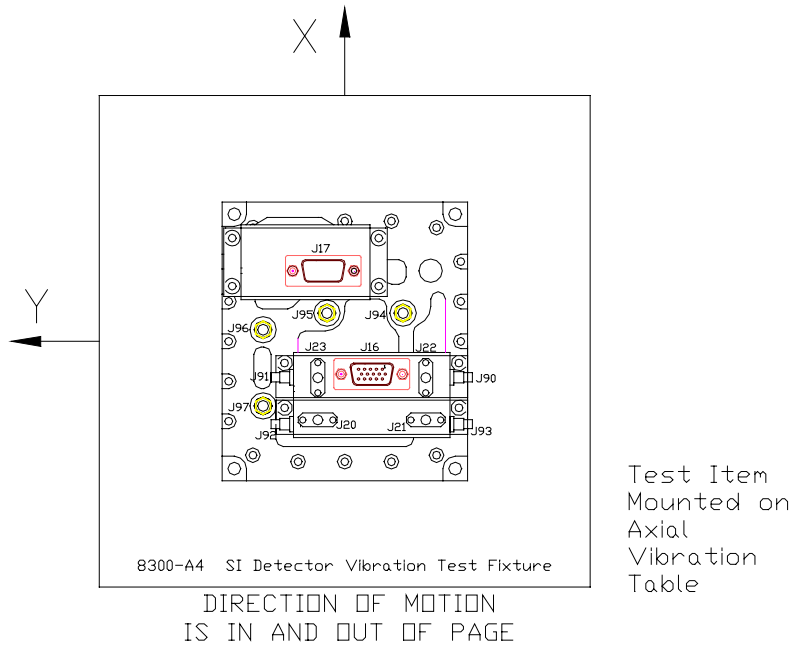


Figure 2-1 -- Set-up for Z axis Vibration

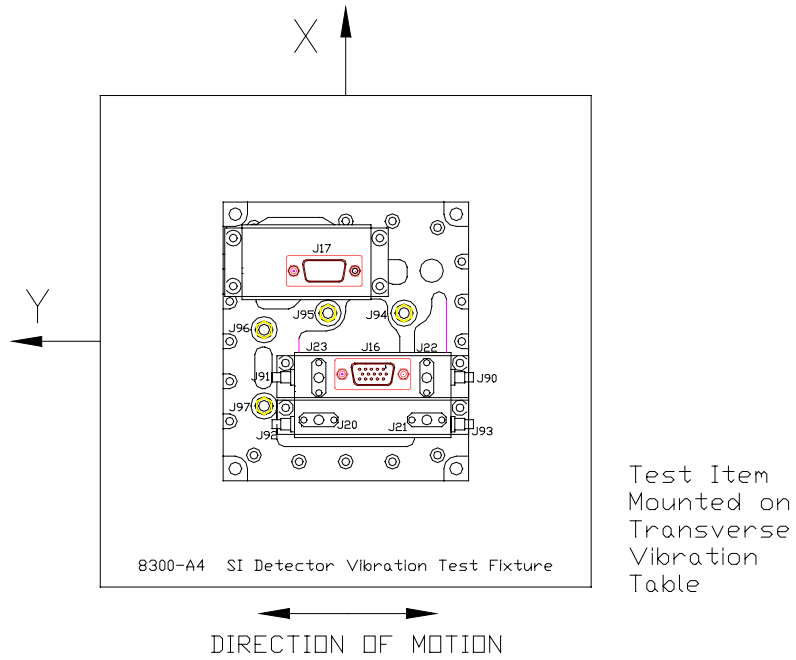


Figure 2-2 --Set-up for Y axis Vibration

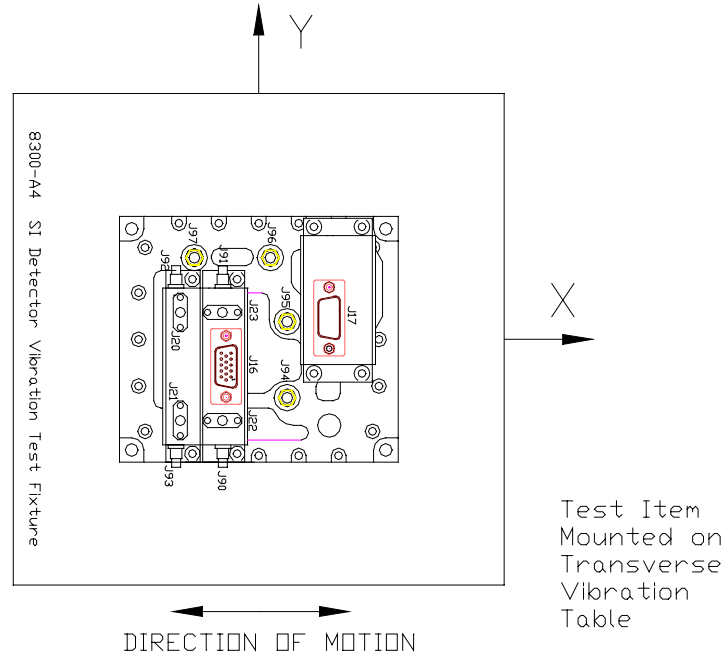
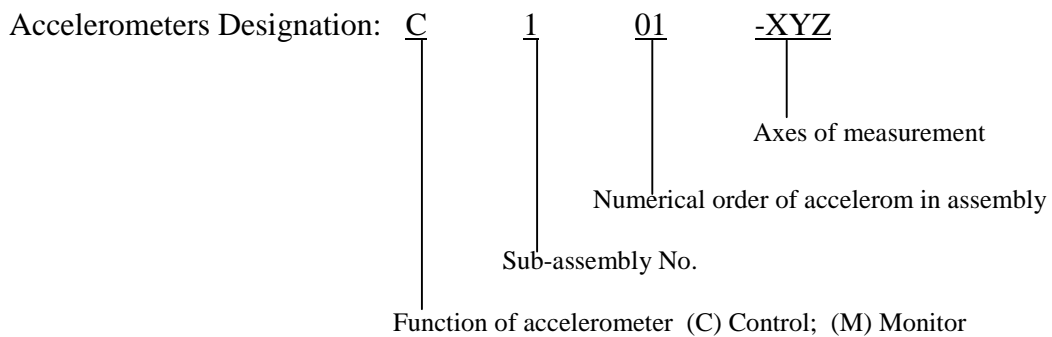


Figure 2-3 -- Set-up for X axis Vibration

Table 1: Accelerometer Designation and Location

Designation	Serial No.	Location Description
		1. Test Fixture
		2. Detector Back Plate
		3. Pre-Amplifier Box
		4. HVPS Box
		5. As directed by TC



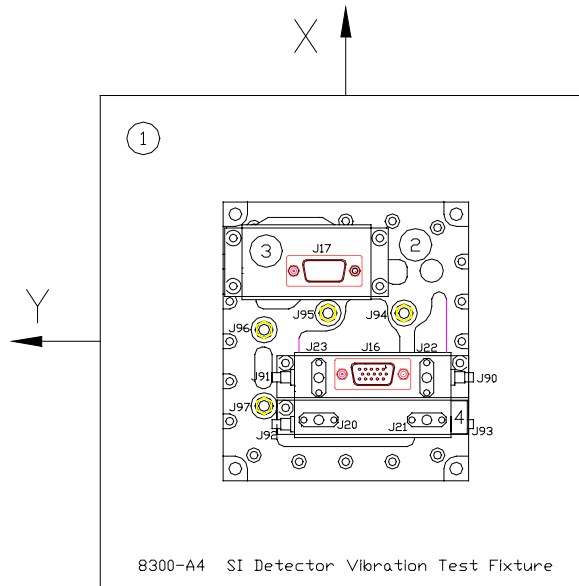


Figure 3-1 -- Accelerometer Locations, Plan View

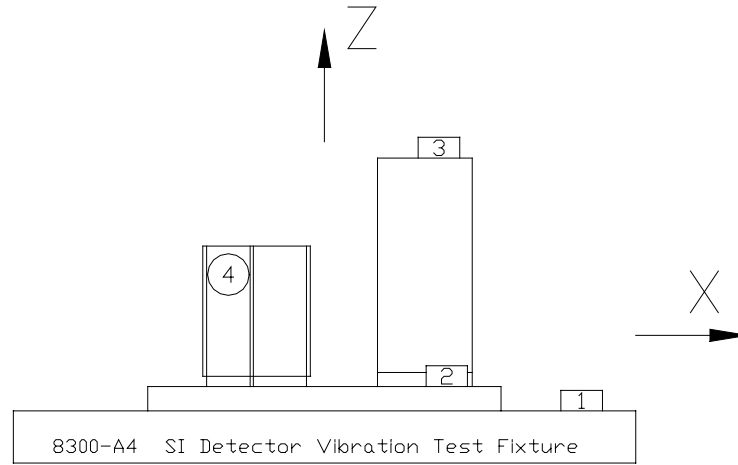


Figure 3-2 -- Accelerometer Locations, Elevation View

Table 2: Post Test Visual Inspection Record

INSPECTION	SIGNATURE	COMMENTS
: 1. Test item integrity 2. 3. 4.		

TC / Date