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QUALIFICATION TEST REPORT

APOLLO X-RAY ASTRONOMY EXPERIMENT (S-17)

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QUALIFICATION TEST REPORT

APOLLO X-RAY ASTRONOMY EXPERIMENT (S-17)

TYPE I DOCUMENT

NASA Approval Pending

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Houston, Texas

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HOUSTON, TEXAS

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28 November 1966

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Approved: Riccardo Giacconi

Riccardo Giacconi
Vice President
Space Research and
Systems Division

FOREWORD

This document describes the Qualification Test Program that was performed on the Apollo X-ray Astronomy Experiment, as specified in Appendix E, Section 3.1.5 of contract NAS 9-4841. It is submitted in accordance with Article II, Item 9 of this contract. It is classified as Type I data and requires NASA approval within 10 days of the date of transmittal.

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1.0 INTRODUCTION

This report describes the Qualification Test Program that was conducted on the Apollo X-ray Astronomy Experiment (S-17) to verify the inherent capability of the design to meet the performance and environmental requirements of the contract. It includes a description of each test performed, data and results obtained, analyses of all failures, and conclusions. Where possible copies of the actual test data have been included. However, this was not possible in some cases due to the bulk of the records. In these instances the data has been summarized in the Test Description (Section 10.0). All original data is available at AS&E for NASA review if required.

A companion report ASE-1470 entitled "Qualification Test Report for the Apollo Scientific Data System (T4, S-17)" presents the results on the qualification testing of the S-17 Data Handling System. The EMI sections of these reports are common since this test was run with the Experiment and Data System connected in order to duplicate the flight configuration as accurately as possible.

2.0 TEST ARTICLE

The equipment tested consisted of the following:

a. X-ray Astronomy Sensor (S-17)
P/N 4688-1-0 Ser. No. 2

b. X-ray Astronomy Electronics (S-17)
P/N 104-700-001 Ser. No. 2

3.0 APPLICABLE DOCUMENTS

The Qualification Test Program was conducted in accordance with the requirements of NAS 9-4841 as contained in the following documents:

ASE-1168	Qualification Test Program, Apollo X-ray Astronomy Experiment (S-17) - 30 November 1965, NASA approved 13 December 1965.
ASE-1333	Apollo X-ray Astronomy Experiment Environmental Test Procedure - 7 July 1966.
ASE-QPS-745.3D Rev. E	Environmental Qualification Test Requirements - 13 September 1965.
MIL-STD-810A	Military Standard Environmental Test Methods for Aerospace and Ground Equipment, - 23 June 1964.
MIL-E-5272C	Military specification - Environmental Testing, Aeronautical and Associated Equipment, General Specification for, - 13 April 1959.
MIL-I-26600	Military Specification, Interference Control Requirements, Aeronautical Equipment, - 1 June 1962.
ASPO-EMI-10A	Addendum to MIL-I-26600 - 17 October 1963.

4.0 TEST FACILITY

All tests were performed at AVCO/Research and Advanced Development Division in Wilmington, Massachusetts, except EMI which was performed at AVCO/Missile Systems Division in Lawrence, Massachusetts, and Acoustics which was performed at NASA-MSC in Houston, Texas.

Standard government environmental test procedures and facilities were used with calibrated test equipment traceable to the National Bureau of Standards.

Environmental equipment was operated by AVCO (and NASA) personnel and the experiment tests were performed by AS&E personnel. AS&E Quality Control witnessed all tests and verified test performance and data.

5.0 PRE-TEST REQUIREMENTS

Prior to start of environmental testing the Pre-Delivery Acceptance Test was performed. This included review of all logs and records, inspection of equipment, verification of workmanship and conformance to drawings, and demonstration of performance. The test was witnessed and bought off by the Government Inspector (DCASR). Data is contained in Attachment I.

6.0 FUNCTIONAL TEST

A Functional Test was performed before and after each environment to determine effect of environment on performance. For certain environments the Functional Test was also performed while the Experiment was operating in the environment. Equipment set-up for this test was as shown in Figure 1. The Functional Test consisted of five parts: 1) Digital Test, 2) Power Consumption, 3) Calibration Cycle, 4) Star Sensor Test, and 5) Sun Sensor Test as follows:

6.1 Digital Test

The GSE was set up to perform the Auto Mode Digital Test by setting switches as follows:

a. INHIBIT switches in the ON (UP) position.

b. MASTER RESET switch depressed.

c. Desired input count set on the PATTERN GENERATOR switch.

d. MODE CONTROL switch set to the DIGITAL position.

e. ADDRESS SELECT switch set to the AUTO position.

f. ERROR MODE control set to AUTO CYCLE.

g. All other controls set to the OFF position.

h. Clock started by depressing the CLOCK push button switch.

The selected input count was then injected into each digital counter, and the outputs sampled by the GSE and compared to the inputs. The entire test is performed automatically; if an error occurs the test stops and the malfunctioning channel is indicated on the GSE.

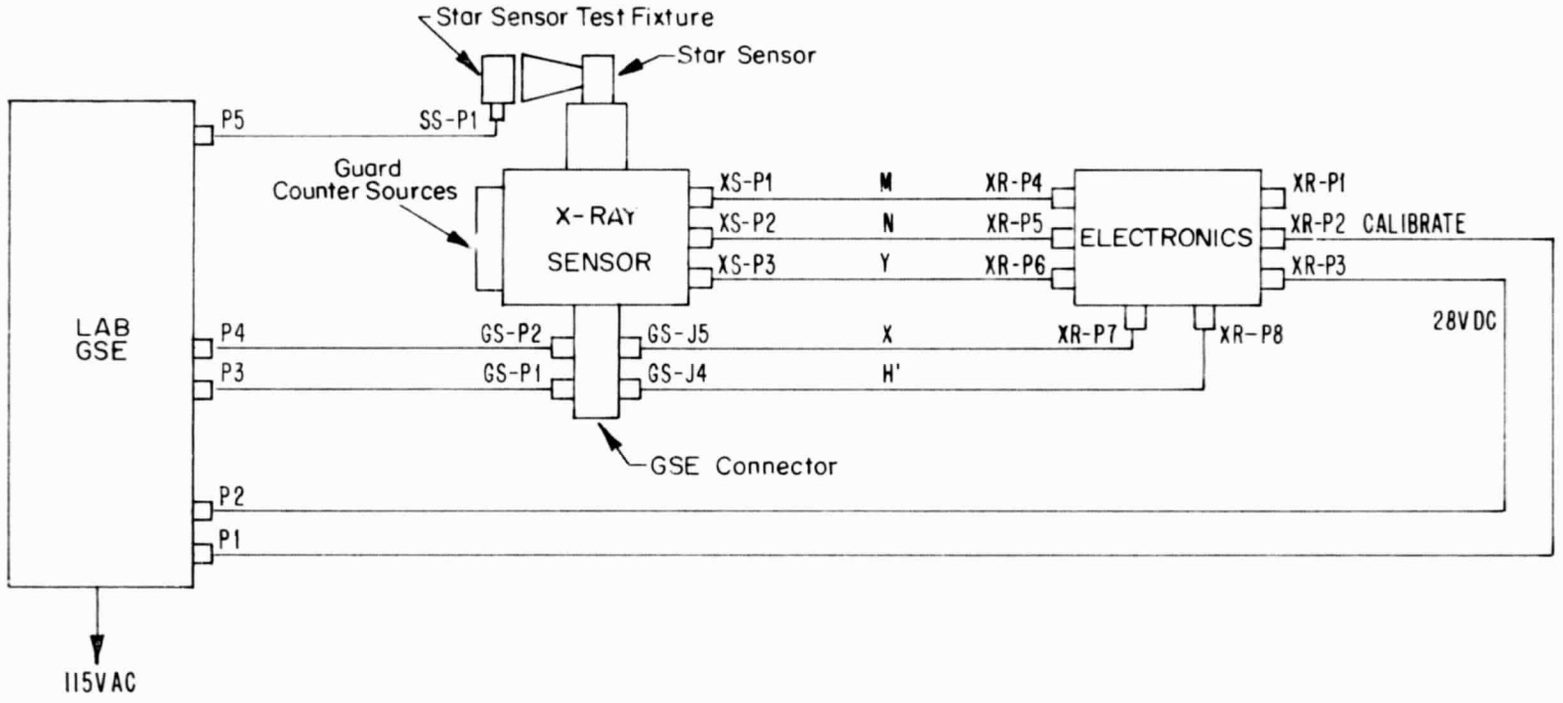


Figure 1

EQUIPMENT CONNECTION FOR FUNCTIONAL TEST

This test checks the operation of all experiment digital circuits. Satisfactory operation requires that the test be completed without errors.

6.2 Power Consumption

Experiment input voltage was adjusted to 27.5 VDC and the current was measured. Voltage and current values were recorded.

The equipment was operating properly if the values obtained after the environment were within ± 5% of those recorded before the environment.

6.3 Calibration Cycle

The GSE was set up to perform the Experiment Calibration Cycle by setting switches as follows:

a. INHIBIT switches to OFF (DOWN) position.
b. MASTER RESET switch depressed.
c. MODE CONTROL switch in CALIBRATE position.
d. ERROR MODE control to CONTINUOUS.
e. ADDER CONTROL switch to ON.
f. All PATTERN GENERATOR switches to ONE position.
g. ADDRESS SELECT to AUTO.
h. Remaining controls to OFF.
i. CLOCK push button switch depressed.
j. DISPLAY RESET and CALIBRATE INITIATE switches depressed simultaneously.

X-ray sources are then automatically placed in front of the position counters and the experiment accumulates data in the normal in-flight manner. During the first 30 seconds of the calibration cycle the system operates at half-gain; for the next 30 seconds it operates at full gain. The cycle is ended automatically after 60 seconds.

The outputs of the ten digital channels were recorded at the end of the first 30 seconds as well as at the end of 60 seconds. Also, the outputs from all Count Rate Meters were measured with a Digital Voltmeter and recorded.

Calibration was performed five times in succession and the results averaged. This is required to achieve statistically significant figures. The X-ray background was also measured (for 100 sec) before and after the calibration runs. Proper equipment operation was determined by a qualitative analysis of the data. Note that some variations in counting rates are acceptable due to the random nature of the excitation.

This test verifies the operation of the complete X-ray detection system since it is an end-to-end test that simulates the actual experimental operation.

6.4 Star Sensor Test

The Star Sensor Test Fixture was attached to the front of the Star Sensor and power applied. The sun sensor was covered. With a Digital Voltmeter connected to the GSE the four quadrant voltages, the two VDU output voltages and the brightness voltage were read and recorded.

This test places a weak simulated "star" at infinity but close to the optic axis of the star sensor. It is an end-to-end test of this unit with both telemetry and VDU outputs being verified.

The equipment was operating satisfactorily if the values of the four quadrant voltages and the two VDU output voltages obtained after each environment were within 0.2v of those recorded before the test, and the brightness voltage was approximately 3.5 to 4.0v. The 0.5v tolerance on brightness voltage is necessary because the brightness output changes significantly with changes in Test Fixture lamp voltage. The exact position of the Test Fixture on the star sensor is also critical and will affect the output voltages rather significantly.

6.5 Sun Sensor Test

The purpose of the Sun Sensor is to provide a signal which closes the Star Sensor shutter when the Sun shines on its face. This prevents damage to the sensitive Star Sensor photocathode. During ground operation it provides the same protection from ambient room light levels. To test the Star Sensor the Star Sensor Test Fixture must be attached and the Sun Sensor then covered to allow the shutter to open.

Proper operation of the Sun Sensor is verified as follows: the Star Sensor Test Fixture is attached and power is applied, while the Sun Sensor is exposed to room light. The brightness output voltage is then read with a digital voltmeter; it should be approximately zero volts. The Sun Sensor is then covered and the Brightness voltage read again. It will read approximately three to four volts, depending upon the Test Fixture lamp voltage. The Sun Sensor is again uncovered causing the Brightness voltage to go to zero; the shutter closing can also be determined by an audible click in the Star Sensor.

7.0 TEST SUMMARY

The following environmental tests were performed:

Test	Date	Results
High Temperature (Attempt No. 1)	25-27 July 1966	Failed
Low Temperature	1-2 August 1966	Passed
High Temperature (Attempt No. 2)	2-4 August 1966	Passed
Acceleration	9-10 August 1966	Passed
Random Vibration	12-15 August 1966	Passed
Thermal Vacuum (Attempt No. 1)	16-18 August 1966	Failed
Vacuum (Attempt No. 2)	19 August 1966	Passed
Shock	26-27 August 1966	Passed
Sinusoidal Vibration	29-31 August 1966	Passed
EMI	27 September 1966 - 7 October 1966	Passed with Waiver
Acoustics	10-14 October 1966	Passed

8.0 FAILURE SUMMARY

Two experiment failures occurred during the Qualification test program, as follows:

Item	Type of Failure	Cause of Failure	Date	Corrective Action
High voltage power supply	Voltage drop at high temperature	Defective component	8/1	Repaired and requalified
X-ray detector and preamp.	High voltage break-down in vacuum	Air bubble in potting	8/17	Requalified replacement unit

Failure reports are included as Attachment II.

9.0 TEST SEQUENCE

Several deviations to the approved test sequence were made, with NASA concurrence. These were necessitated by schedule difficulties with the AVCO environmental facilities and the need to complete the qualification test program as rapidly as possible. Had the original test sequence been followed the test program completion would have been delayed approximately one month. Table I shows both the intended and the actual test sequence.

TABLE I -- TEST SEQUENCE

INTENDED	ACTUAL
Low Temperature	High Temperature
High Temperature	Low Temperature
Temperature-Altitude	High Temperature
Acceleration	Acceleration
Random Vibration	Random Vibration
Sinusoidal Vibration	Temperature-Altitude
Shock	Shock
Acoustic Noise	Sinusoidal Vibration
EMI	EMI
	Acoustic Noise

10.0 TEST DESCRIPTION

10.1 High Temperature - Attempt No. 1

a. Test Equipment

ITEM	MANUF	MODEL	S/N	CAL DATE
Temperature Chamber	American Research Corp.	ALT 64-100500H 1 PG1X565FT-216	245	7/66
Recorder Controller	Bristol	22XN17X-T25	645031	7/66
Temperature Recorder	Brown Instrument	153X11PS-X-27	5267	6/66

b. Test

The experiment was placed in the temperature chamber and connected to the Lab. GSE outside the chamber (Ref. Figure 1). Two thermocouples were attached, one to the Sensor tungsten shielding and the other to the Electronics box. Their outputs were monitored and recorded on a chart recorder. A Functional Test was performed with the equipment at ambient temperature (Data is included in Attachment III, p. 1-4). The chamber temperature was then raised to +160^{o}F, and experiment power was applied. Relative humidity was maintained at 15%.

c. Results

After operating in this environment approximately 12 hrs. a Functional Test revealed that the two high voltage power supplies had failed. The temperature was returned to ambient, the supplies were removed and a failure analysis was performed. A crack was found in the substrate material of one of the capacitors. This crack shorted out the capacitor and caused the supply to fail. Complete details are contained in Failure Report

Q1 and Q2 (Attachment II).

Two new supplies were pre-tested and installed in the Experiment for continuation of qualification testing. Since another temperature chamber became available the normal test sequence ((Low. temp, then High Temp.) was resumed.

10.2 Low Temperature

a. Test Equipment

ITEM	MANUF	MODEL	S/N	CAL DATE
Temperature Chamber	Conrad	WB1000-30-30	6537	4/66
Recorder Controller	Brown Inst.	152C15P-239E-91	885702	4/66
Temperature Recorder	Brown Inst.	153X11PS-X-27	5267	6/66

b. Test

The experiment was placed in the temperature chamber and connected to the Lab. GSE. A Functional Test was performed at ambient temperature, and proper equipment operation was verified. The chamber temperature was then lowered to -60°F in three hours and the experiment temperature allowed to stabilize. Experiment power was applied and the equipment operated for 4 hours. During this time the chart recorder (driven by thermocouples on the experiment) indicated that the experiment temperature was going below -60°. Subsequent investigation revealed that the AVCO technician had inserted the wrong temperature chart on the chamber temperature recorder/controller. The temperature was thus adjusted to maintain a constant -60° experiment temperature for the remainder of the four hour soak. The temperature record is included as Figure 2. Note that a corrected temperature scale has been marked on it.

CHAMBER TEMPERATURE RECORD

LOW TEMPERATURE

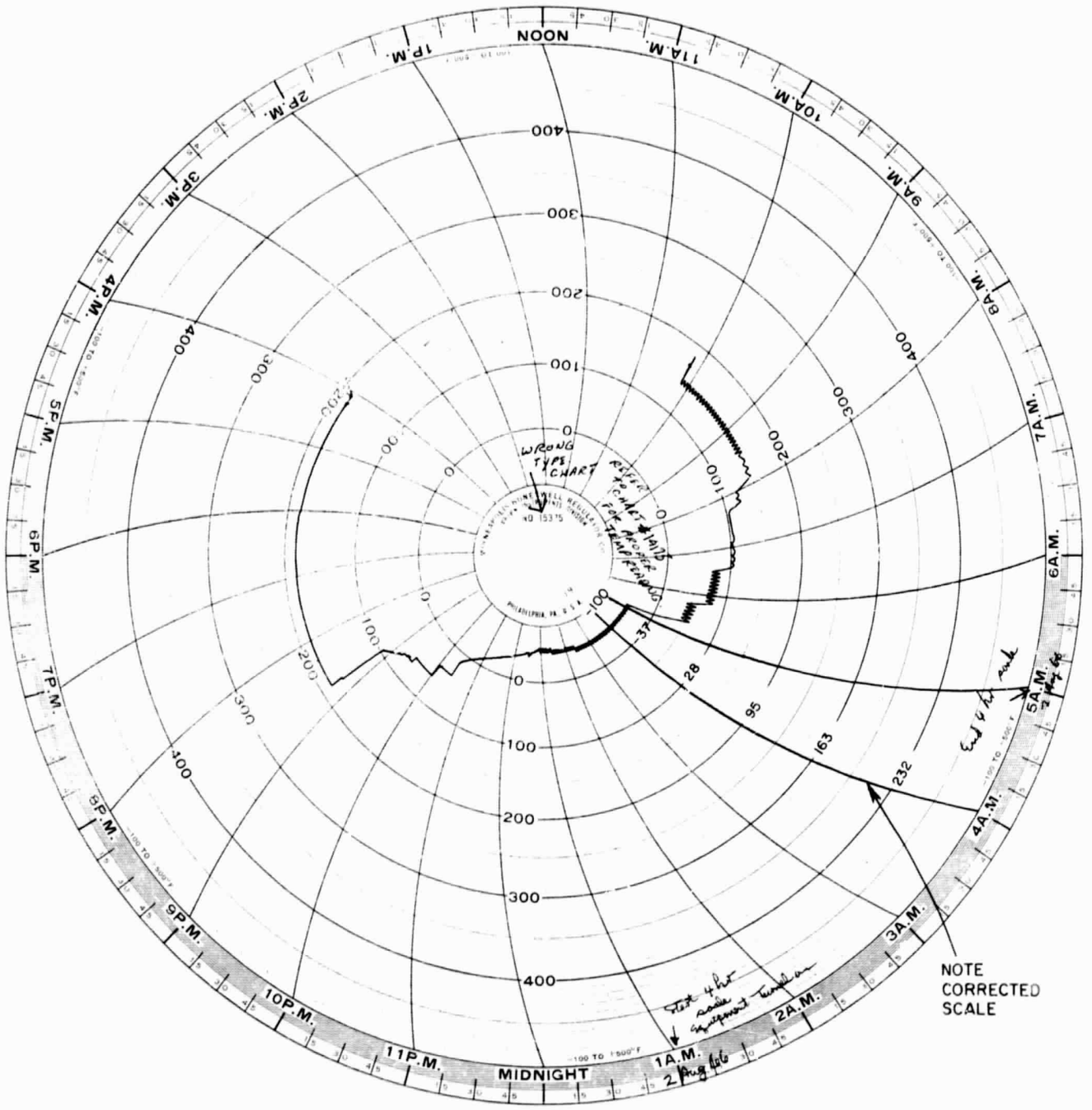


Figure 2

DG-158

1455

Chamber temperature was then returned to 70°F and the experiment temperature allowed to stabilize for four hours.

c. Results

Functional tests were performed before and after the environmental exposure, as well as at half hour intervals during exposure. No difficulties were encountered. Data agreement was acceptable and no damage occurred. A copy of the data is included in Attachment III, p. 5-9.

10.3 High Temperature - Attempt No. 2

a. Test Equipment

ITEM	MANUF	MODEL	S/N	CAL DATE
Temperature Chamber	Conrad	WB1000-30-30	6537	4/66
Recorder Controller	Brown	152C15-P-239E-91	885702	4/66
Temperature Recorder	Brown	153X11PS-X-27	5267	6/66

b. Test

The high temperature test was performed immediately following the low temperature test. The equipment remained in the same chamber, connected as before. A new temperature chart was inserted and chamber temperature was raised to +160°F in one hour. Power was applied and the experiment operated for 20 hours. (See Figure 3). Relative humidity was approximately 10%. Specimen temperature was monitored and recorded continuously on the chart recorder. After 20 hours exposure time, chamber temperature was returned to +70°F and power was removed. Experiment temperature was allowed to return to ambient overnight.

c. Results

Functional tests were performed at half hour intervals

CHAMBER TEMPERATURE RECORD

HIGH TEMPERATURE

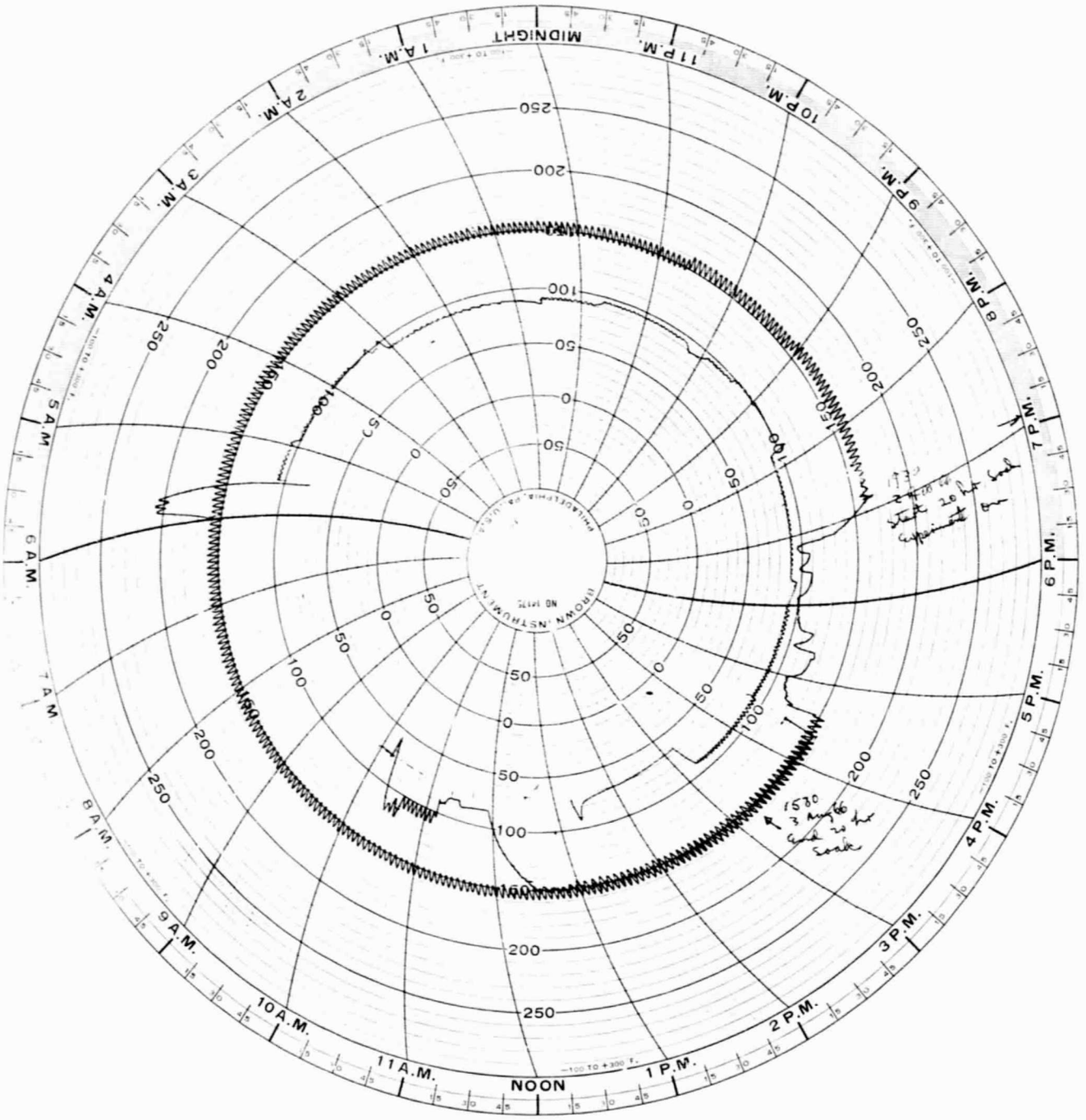


Figure 3

DG-159
1455

throughout the test. They were also performed at ambient temperature before and after the environment exposure. All data agreed and no damage was evidenced. Data is included in Attachment III, p. 10-14.

10.4 Low and High Temperature - Star Sensor

a. Test Equipment

ITEM	MANUF	MODEL	S/N	CAL DATE
Temperature Chamber	Tenney	TMUF-3-100350	5923	3/66
Power Supply	Power Design	TW-4005	600-048	3/66
Digital Voltmeter	Digitec	201P	8221C	4/66

b. Test

The Star Sensor and Sun Sensor were removed from the Qual Unit at the start of temperature testing to replace the Sun Sensor with an improved model having faster time constant. Because of scheduling problems the temperature tests were continued on the remainder of the Experiment and the Star Sensor and Sun Sensor were qualified separately at AS&E for these two tests only.

The units were placed in the temperature chamber and cables brought out to a test fixture. A power supply was attached and a digital voltmeter used to measure the output signals. Equipment temperature was monitored using a thermistor located within the Star Sensor. Chamber temperature was lowered to -60°F and power was applied after one hour stabilization. The equipment was operated for four hours and then returned to 70°F. After an appropriate Functional Test, the chamber temperature was raised to $+160^{\circ}$F. After two hours stabilization time, power was applied and the equipment operated for 20 hours. Tests were performed and the temperature was returned to ambient. After three hours the Functional Test was repeated.

c. Results

The Star Sensor Functional Tests were performed before and after the environmental exposures, as well as during each environment. Sun Sensor operation was also verified each time. No difficulties were encountered; all data was acceptable. Data is included in Attachment III, p. 9 and p. 14.

10.5 Acceleration

a. Test Equipment

ITEM	MANUF	MODEL	S/N	CAL DATE
Rotary Accelerator	Genisco	E-185	8	--
Eput and Timer	Berkeley	7350	RAD-231	7/66
Recorder	Sanborn	150	85	6/66
Accelero-meter	Statham	A5a-20-350	6035	6/66

b. Test

The Experiment was connected as in Figure 1, and a Functional Test was performed. The accelerometer was then attached to the rotary accelerator arm at the test specimen location (57 in. from center). The accelerometer output was connected to the recorder and the system was calibrated from 1 to 10g's. The Sensor package was then attached to the accelerator arm with the baseplate facing the outside chamber wall and the accelerometer was mounted on it. The accelerator rpm was set to provide 1.0g acceleration and was then increased manually to obtain an accelerometer output increasing linearly from 1.0g to 6.0g in 150 seconds.

The accelerator was then stopped slowly and the test was repeated with the Electronics package. The pertinent portion of the test records have been reproduced in Figure 4.

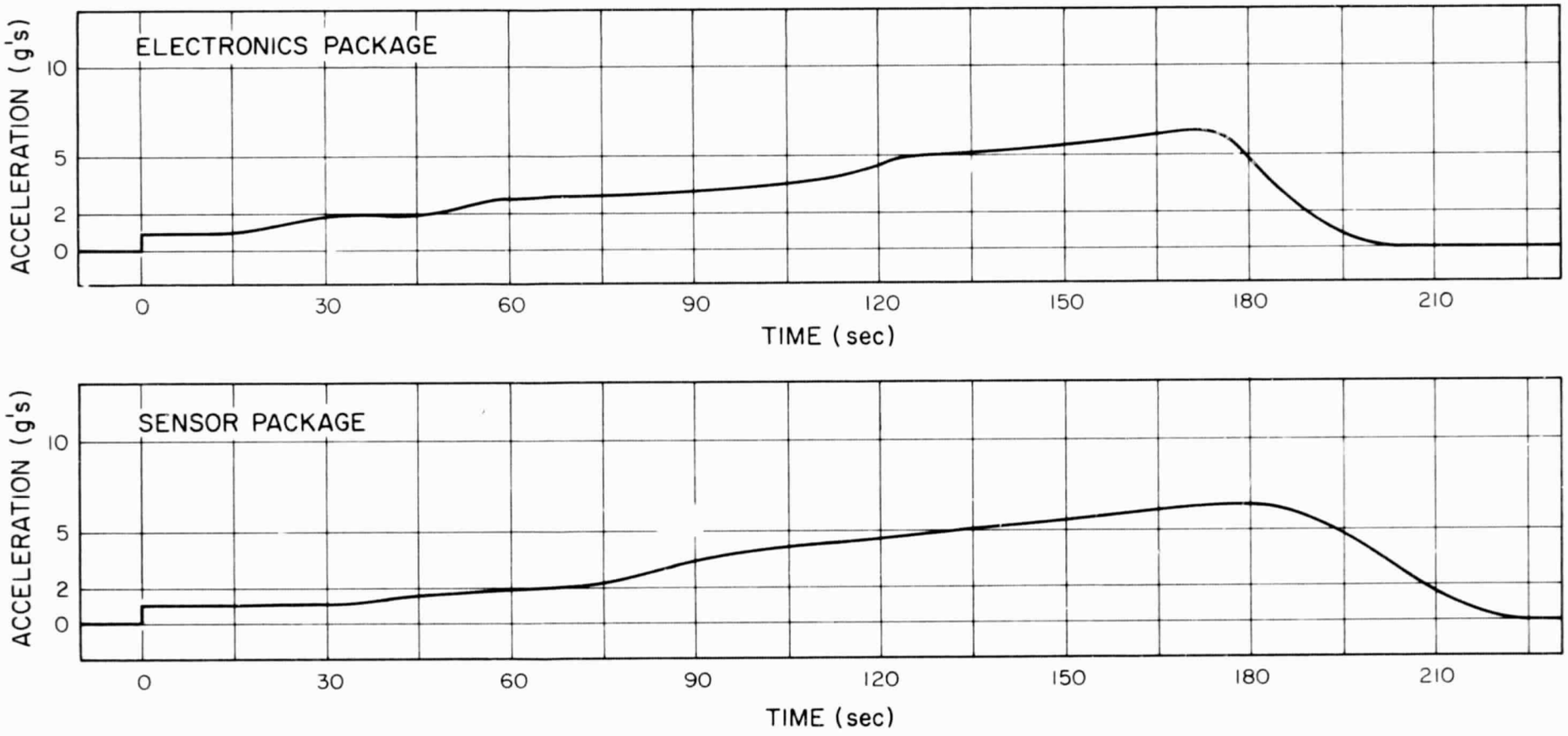


Figure 4

LONGITUDINAL ACCELERATION

c. Results

The accelerometer output was monitored in real time and recorded on the recorder to verify that the proper acceleration curve was obtained. Functional tests were performed before and after acceleration. Both specimens were also visually inspected for damage. No problems occurred and experiment operation was satisfactory. Data is contained in Attachment III, p. 15-18.

10.6 Random Vibration

a. Test Equipment

ITEM	MANUF	MODEL	S/N	CAL DATE
Shaker	Ling	182	17	--
Spectral Analyzer Equalizer	Aero Geo Astro	RM101A	3166-2, 3, 4	5/66
Accelero-meter	Endevco	2213C	JA08	8/66

b. Test

A vibration test fixture was mounted on the shaker and the accelerometer was attached and calibrated. The X-ray Sensor was then secured to the fixture using the normal spacecraft attach points. Random vibration was then applied along the longitudinal axis. Because of the shaker capacity limit the test was performed in eight steps, each covering a narrow band of frequencies. Duration of vibration was 2 1/2 minutes in each band.

Figure 5 shows a plot of spectral density vs. frequency; both the specification curve and the actual input are shown. Three sigma clippers were used to limit acceleration peaks of the applied vibration and filter bandwidths were 12.5 cps from 20 to 400 cps, 25 cps from 400 to 1200 cps, and 50 cps from 1200 to 2000 cps. Sampling time was fifteen seconds.

The Sensor and vibration fixture were next placed on the slip table, the shaker was rotated and the test was repeated in the tangential and radial axes. The same tests were then performed on the Electronics package. Data is shown in Figures 5, 6 and 7.

c. Results

Each unit was monitored during vibration and carefully inspected afterwards; no damage was evidenced. After both units were vibrated a Functional Test was performed. The data was compared to the pre-vibration data and no degradation of performance was noted. Data is contained in Attachment III, p. 19-22.

10.7 Temperature - Altitude

a. Test Equipment

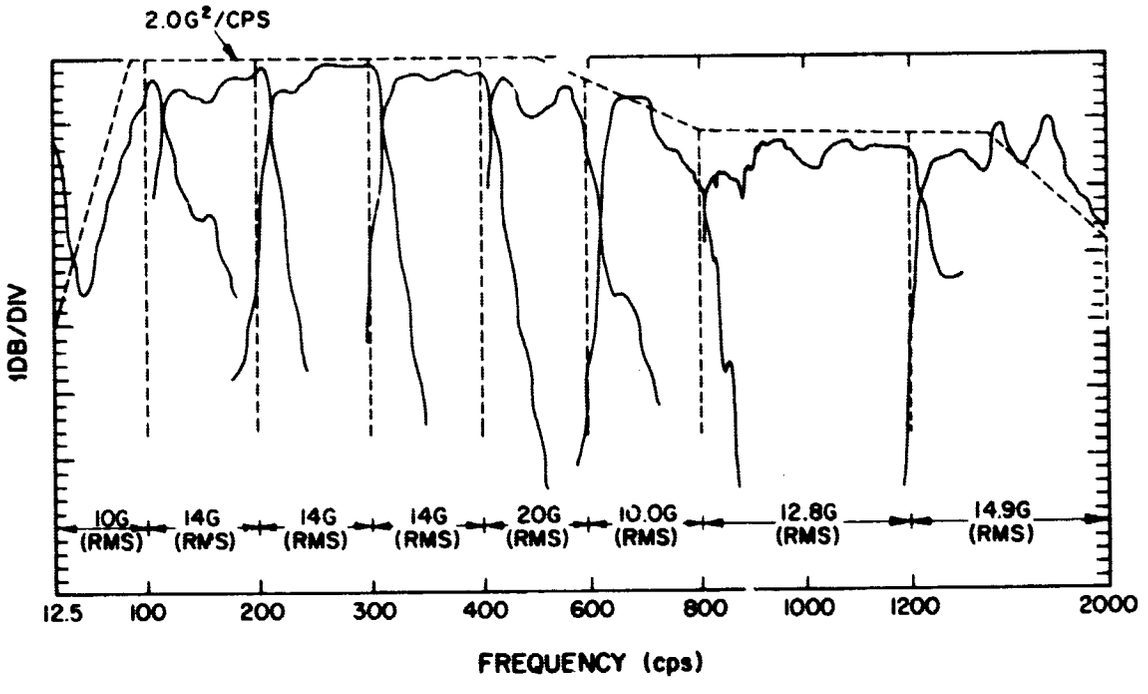
ITEM	MANUF	MODEL	S/N	CAL DATE
Thermal Vacuum Chamber	AVCO-RAD	--	TE1667	--
Ionization Gauge	Veeco	RG-75K	X27071	4/66
Ionization Gauge Control	Vacuum Products	--	30755	4/66
Temperature Recorder	Bristol	IM-IPG560-21-T6-T11-T13-T40-T68-T82	654848	4/66

b. Test

The experiment (Sensor and Electronics) and the Data System (DHS and Compt. A) were both placed in the vacuum chamber, within the specially constructed thermal shroud. They were each connected to GSE outside the chamber through a special connector plate. A Functional Test was then performed and proper equipment operation was verified. The

RANDOM VIBRATION

ELECTRONICS – LONGITUDINAL AXIS



SENSOR – LONGITUDINAL AXIS

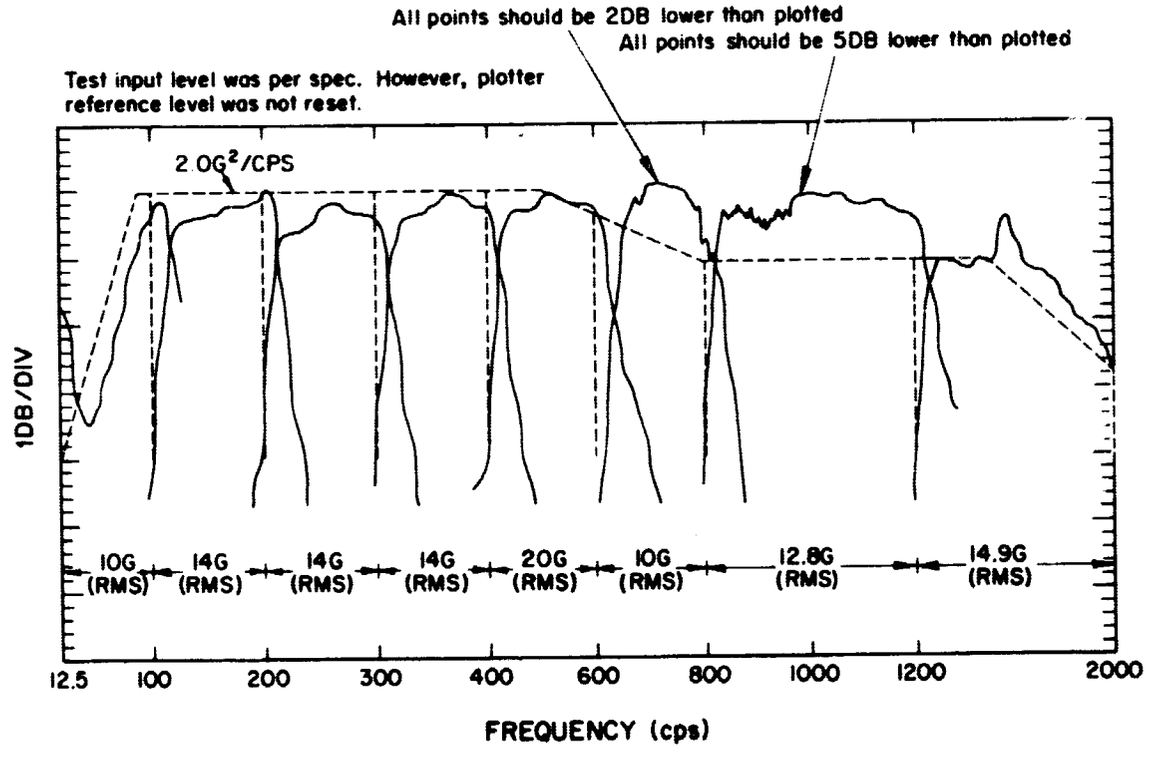
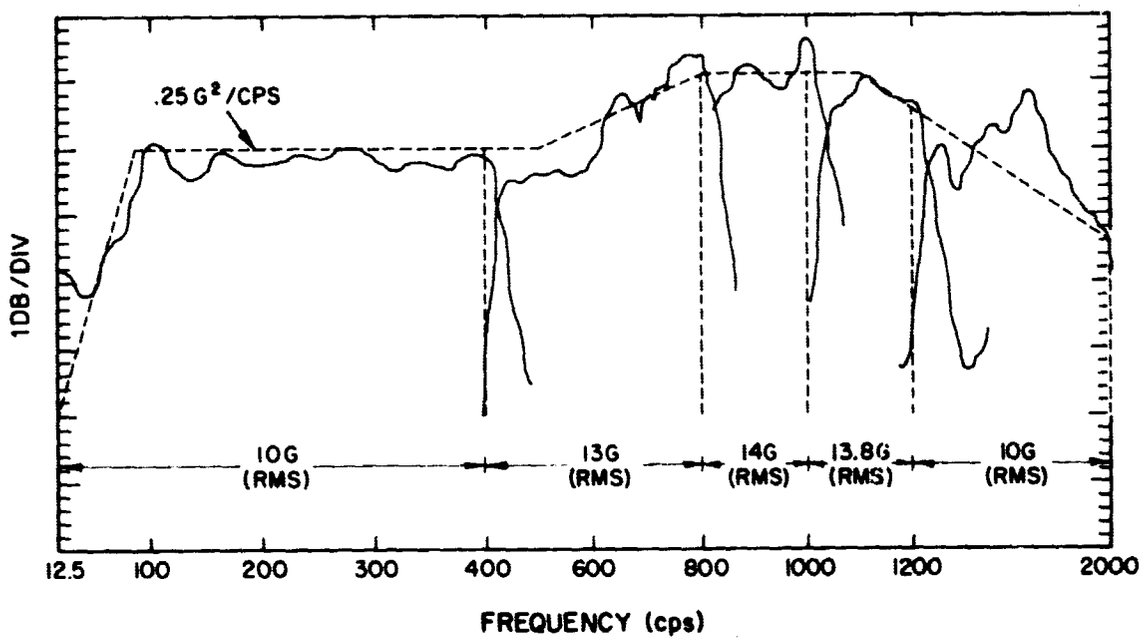


Figure 5

RANDOM VIBRATION

ELECTRONICS-TANGENTIAL AXIS



SENSOR-TANGENTIAL AXIS

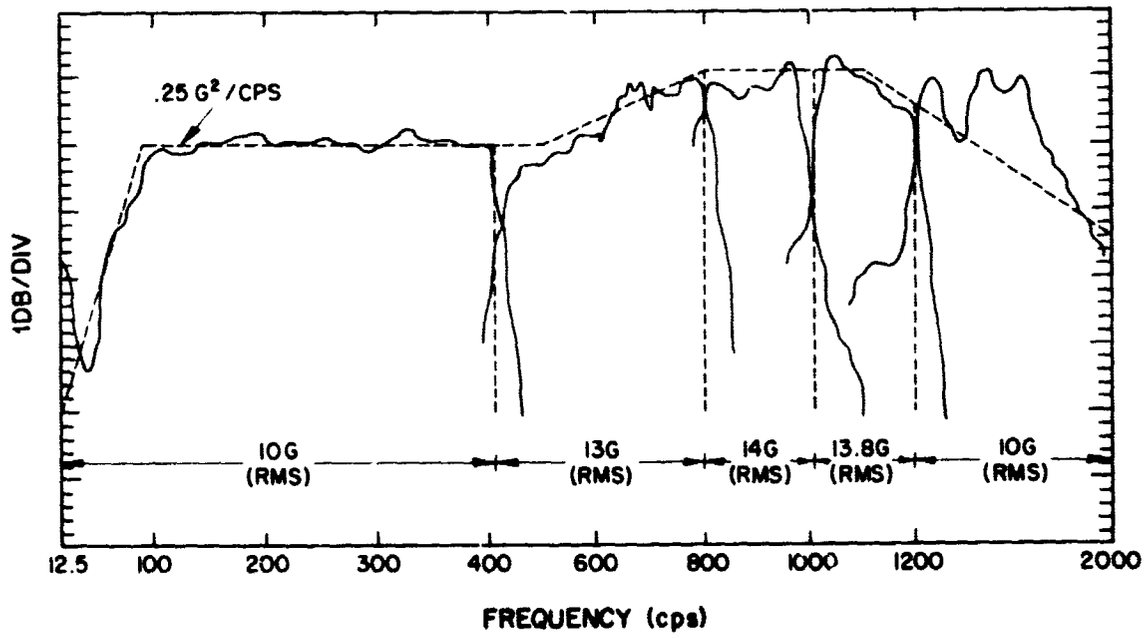
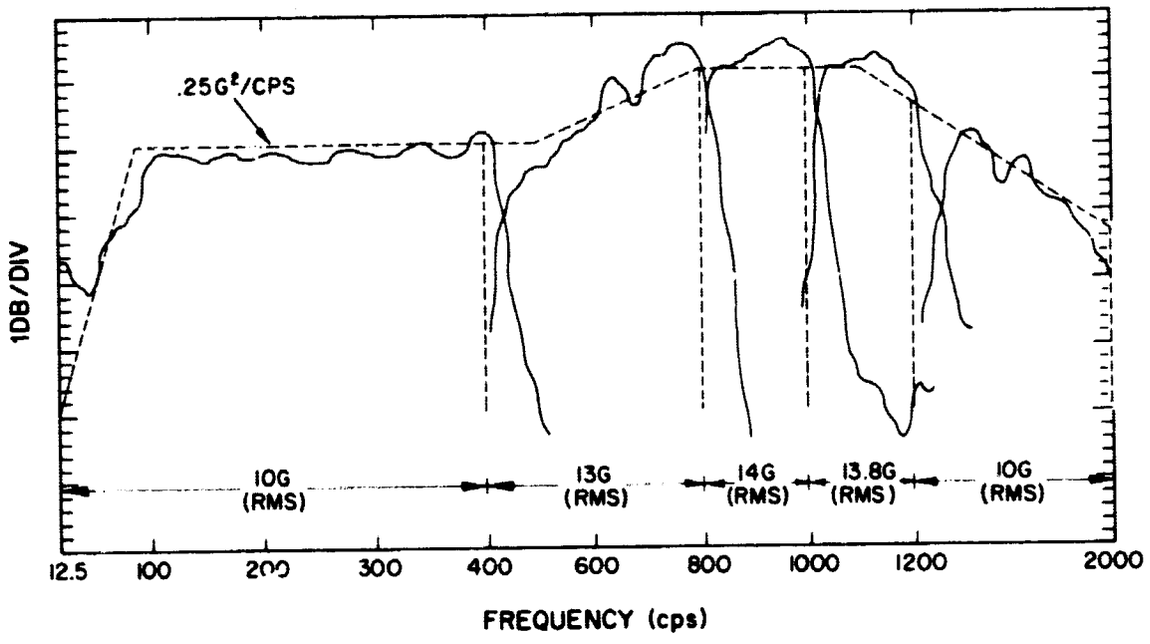


Figure 6

RANDOM VIBRATION

ELECTRONICS – RADIAL AXIS



SENSOR – RADIAL AXIS

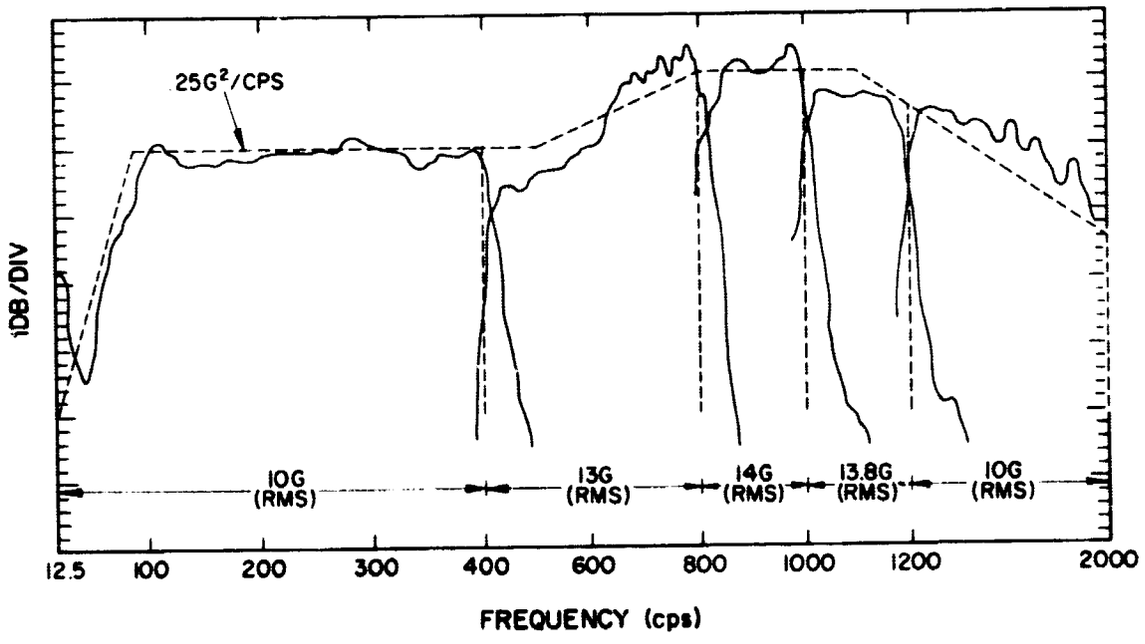


Figure 7

chamber was then evacuated to 10^{-6} psia (5.17×10^{-5} mm Hg) with the temperature held at ambient. Pressure was held constant for two hours, then experiment power was applied. The temperature was raised to $+160^{\circ}F$ in approximately 45 minutes and then lowered immediately to 0° in 45 minutes. It was raised again to $+160^{\circ}F$ in 45 minutes to complete one cycle. Fifteen more cycles were then completed with the equipment operating and the pressure held below 10^{-6} psia. Temperature and pressure were then returned to ambient.

Chamber pressure and shroud wall temperature were monitored continuously and recorded. Figure 8 shows a plot of values recorded at the high and low temperature points (approximately 45 minute intervals).

c. Results

Throughout the test Functional Tests were performed at half hour intervals. From the time of initial equipment turn-on a large number of spurious pulses were obtained in the channels fed by one of the two high voltage power supplies, particularly in the +Y guard channel. This was believed to be due to a faulty counter and the test was continued in the hope that it would correct itself (a leaky counter would eventually be pumped out and stop affecting other channels). However, this did not occur. At the conclusion of the test the suspect counter was replaced with a new one and the chamber pressure was reduced to 10^{-6} psia again. All equipment then operated normally. After five hours pressure was returned to ambient. The thermal portion of the test was not repeated since thermistors within the equipment had indicated only a 5° temperature excursion throughout the entire test cycle. Based on this and the fact that seven of the eight counters withstood the complete 20 hour environmental test, the new counter was installed and the test program continued, with NASA concurrence. A failure report and analysis of the counter is given in

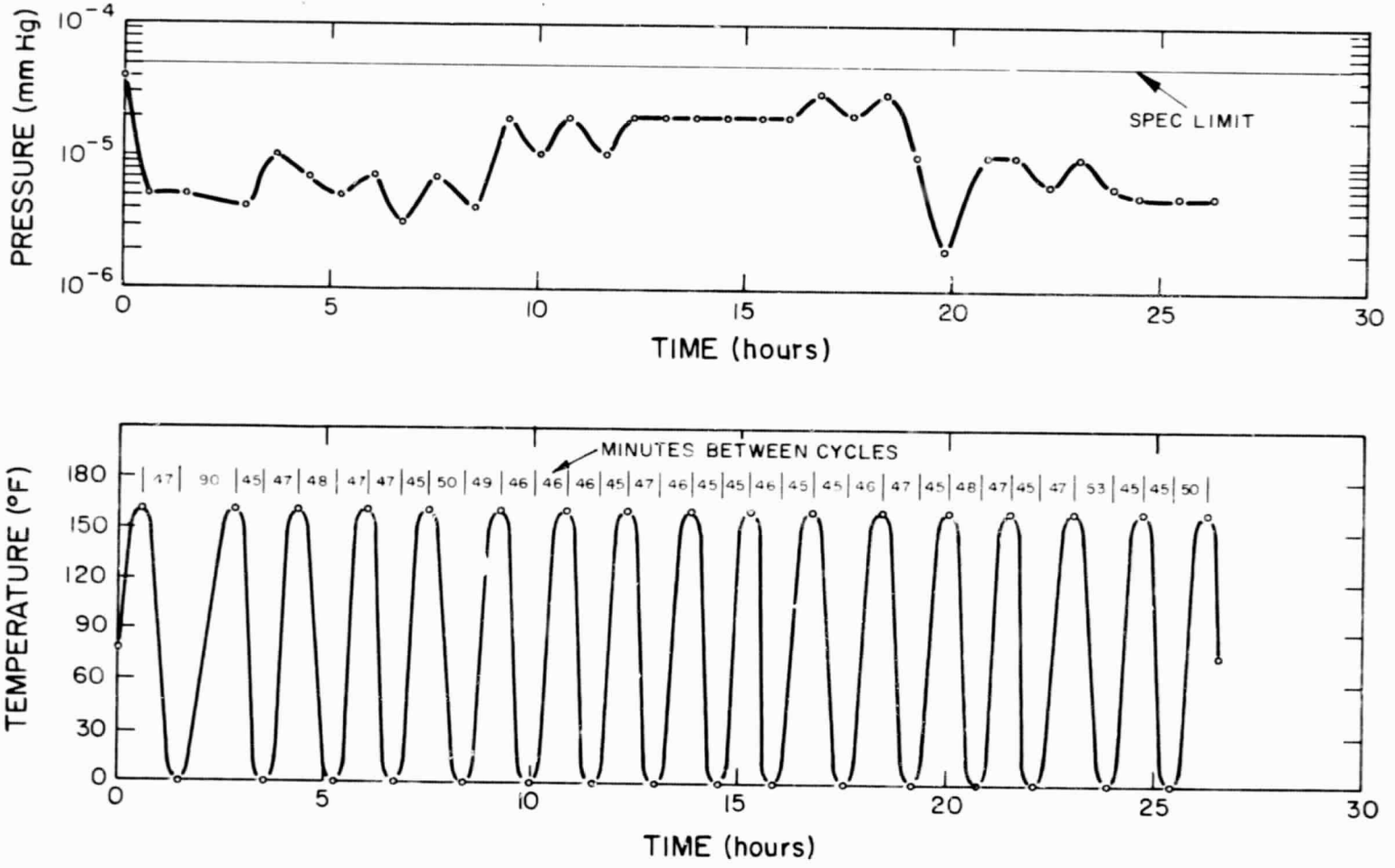


Figure 8

TEMPERATURE-ALTITUDE TEST

Attachment II. Pre- and post-environment data is contained in Attachment III, p. 23-26.

10.8 Shock

a. Test Equipment

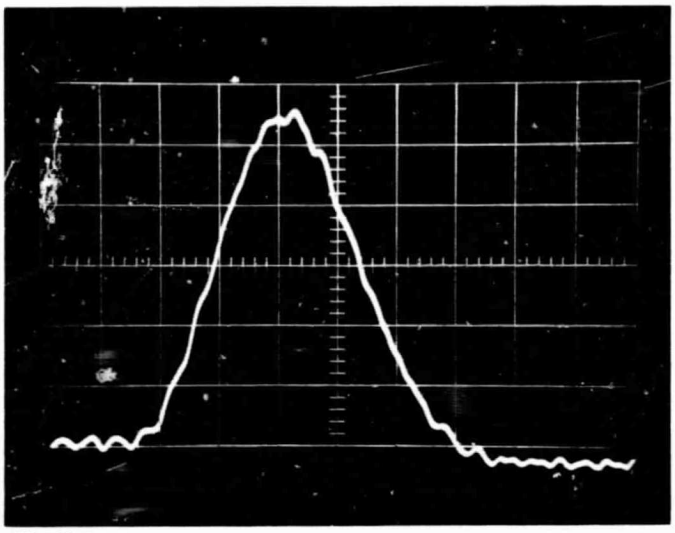
ITEM	MANUF	MODEL	S/N	CAL DATE
Shock Machine	AVCO-RAD	SM-030	7224	--
Cathode Follower	Columbia Research Labs.	4000R	1504	12/65
Calibrator	Ballantine	420	1302	3/66 & 9/66
Band Pass Filter	Krohn-Hite Corp.	330-M	1312	6/66
Oscilloscope	Tektronix	535	7910	5/66
Preamp.	Tektronix	53/54D	1961	4/66
Accelero-meter	Endevco	2213C	JA04	8/66

b. Test

The experiment was connected as in Figure 1 for the Functional Test. The Sensor and Electronics were then disconnected and packed in their shipping containers. The accelerometer was attached to the shock machine, the system was calibrated, and the shock machine was adjusted to produce a 30g half-sine shock for 11 $\pm$ 1 mil sec.

The Electronics box was placed on the shock machine and secured with nylon straps. It was raised to the required height (approximately 4 in.) and allowed to free fall onto the appropriate rubber pad to produce the required shock pulse. The pulse was displayed on a scope and photographed (See Figure 9). After verifying the correctness of the pulse obtained, the box was rotated 90° and the test repeated. It was again rotated and the test repeated s o as to apply the shock pulse in each of three mutually perpendicular directions. (Figure 9).

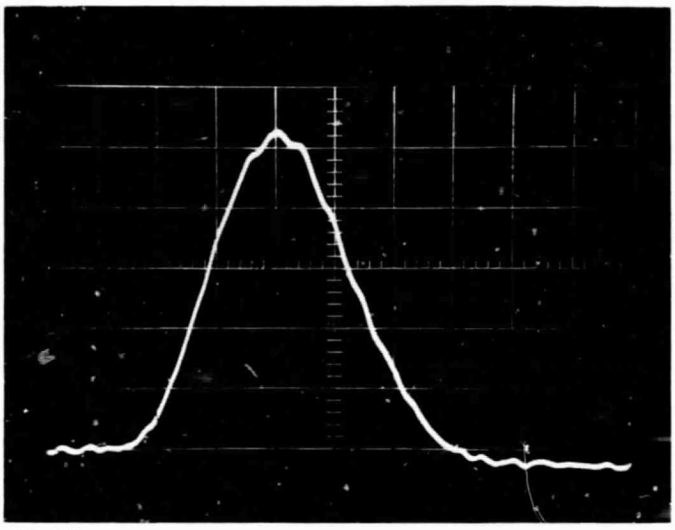
SHOCK PULSES
ELECTRONICS PACKAGE



DG-152

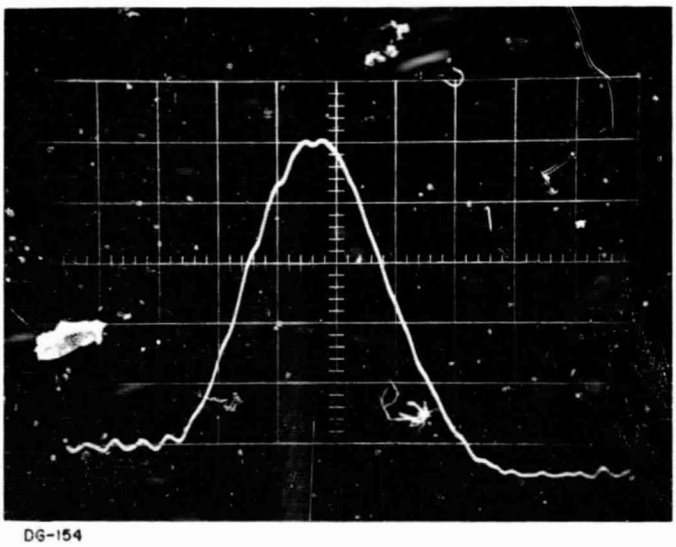
LONGITUDINAL AXIS

SCALE:
Vertical — 6g/cm
Horizontal- 2μsec/cm



DG-153

TANGENTIAL AXIS



DG-154

RADIAL AXIS

Figure 9

The identical test was then performed for the Sensor package. Shock pulses obtained are shown in Figure 10.

c. Results

Both shipping containers were inspected and no damage was observed. The containers were opened and the equipment was inspected; no damage occurred here either. The units were then removed and Functional Test performed. All items operated properly and data agreed with the pre-test data. (See Attachment III, p. 27-30.)

10.9 Sinusoidal Vibration

a. Test Equipment

ITEM	MANUF	MODEL	S/N	CAL DATE
Shaker	Ling	182	17	--
Controls	Unholtz-Dickie	E-105	3166-6, 3166,-4,-2	5/66
Oscillograph	CEC	5-123	3166-5	5/66
Accelero-meter	Endevco	2213C	JA08	8/66

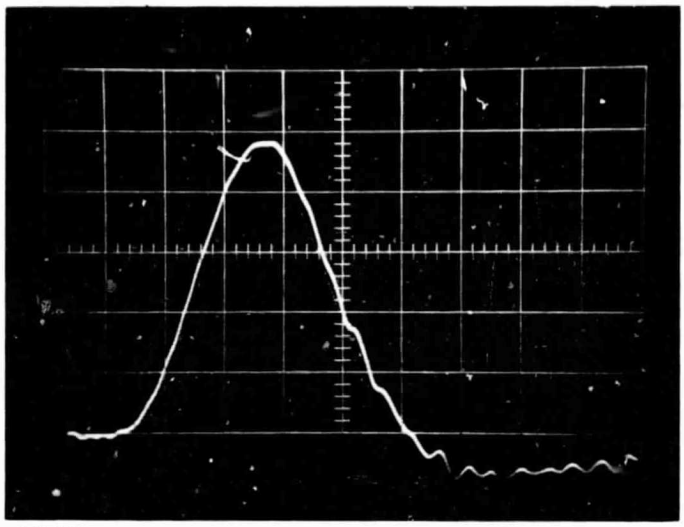
b. Test

The Electronics package was placed in its shipping container. An accelerometer was attached to the vibration fixture which was mounted on the shaker. The system was then calibrated and the Electronics package was secured to the fixture. Sinusoidal vibration was applied with frequency sweeping logarithmically from 5 to 500 cps and back to 5 cps in 15 minutes. Test levels were as follows:

Freq. (cps)	5 to 8	8 to 26.5	26.5 to 52	52 to 500
LEVEL	0.4 in DA	± 1.3g	0.036 in DA	± 5.0g

Note that 0.4 in DA was applied from 5 to 8 cps and ± 1.3g from 8 to 26.5 cps,

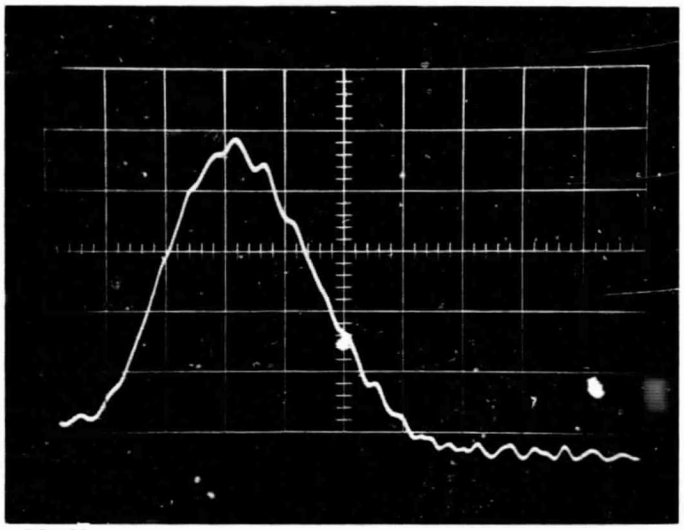
SHOCK PULSES
SENSOR PACKAGE



DG-155

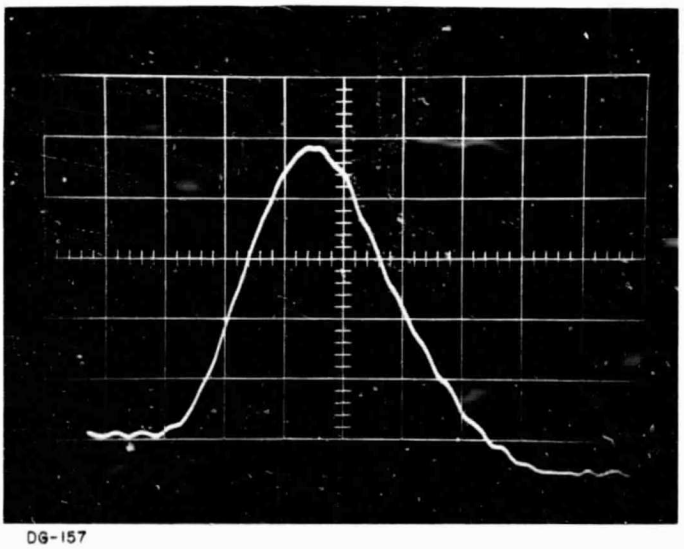
LONGITUDINAL AXIS

SCALE:
Vertical — 6g/cm
Horizontal- 2μsec/cm



DG-156

TANGENTIAL AXIS



DG-157

RADIAL AXIS

Figure 10

whereas the test specification required ± 1.3g from 5 to 26 cps. This deviation was necessitated by the limit of the available shaker, which was a maximum of 0.4 in DA. The spec limit would have required shaker excursion of 1.014 in DA at 5 cps, decreasing to 0.4 in DA at 8 cps.

The test was performed twice in each of three mutually perpendicular directions of excitation. The package was then removed and the identical test repeated on the Sensor package in its shipping container.

c. Results

Throughout the test the packages were visually monitored; no anomalies were noted. Also the control accelerometer output was displayed on an oscillograph along with frequency markers. Analysis of these records showed several points where the control system could not maintain the required input levels, as noted in Table II. Discussion with the shaker operating personnel indicates that these are system resonances primarily due to the vibration fixture used. A 1 in. aluminum plate was used, whereas a minimum 1 1/2 in. plate is normally required to avoid plate resonances. This is further substantiated by the fact that fewer and lower resonances were noted during vibration of the Sensor package. The 1 in. plate was not large enough for mounting this package hence a large 2 in. plate was used for vibration in the radial and tangential directions. In the longitudinal direction where a massive fixture several inches thick was used, no resonances were noted. In any event, none of the noted resonances are severe.

Both shipping containers were inspected for damages and none were noted. The instruments were likewise inspected, with no evidence of damage. A Functional Test was then performed, and all results agreed with the pre-vibration data. Data is included in Attachment III, p. 31-34.

TABLE II -- SINUSOIDAL VIBRATION RESONANCE POINTS

Electronics Package

	Frequency (cps)	Actual Level (g)	Spec Level (g)
Longitudinal Axis:	26-52	0.5 to 1.0g spikes	Smooth increase from 1.3 to 5.0g's
	160	6.2	5 ± .5
	180	6.5	5 ± .5
	260	5.9	5 ± .5
Radial Axis:	26-52	0.5 to 1.0g spikes	Smooth increase from 1.3 to 5.0 g's
	330	6.4	5 ± .5
Tangential Axis:	26-52	0.5 to 1.0g spikes	Smooth increase from 1.3 to 5.0 g's
	330	6.4	5 ± .5

Sensor Package

Longitudinal Axis:	No Resonances Noted		
Radial Axis:	11	1.8	1.3 ± .13
	28, 33, 45	0.2 to 0.5g spikes	
	330	5.8	5 ± .5
Tangential Axis:	11	1.8	1.3 ± .13
	33, 45	0.25 to 0.5g spikes	

10.10 Electromagnetic Interference

a. Test Equipment

ITEM	MANUF	MODEL	S/N	CAL DATE
Noise Field Intensity Meter	Empire Device	NF 105	481	8/66
Tuning Unit	Empire Device	TX	481	8/66
Tuning Unit	Empire Device	TA	481	8/66
Tuning Unit	Empire Device	T1	481	8/66
Tuning Unit	Empire Device	T2	481	8/66
Tuning Unit	Empire Device	T3	481	8/66
Impulse Generator	Empire Device	IG-115	219	8/66
Microwave Field Intensity Meter	Polarad	FIM B	1625	8/66
Power Supply	Polarad	FIM P	1625-1	8/66
Tuning Unit	Polarad	FIM L	1625-2	8/66
Tuning Unit	Polarad	FIM S	1265-3	8/66
Tuning Unit	Polarad	FIM M	1625-4	8/66
Tuning Unit	Polarad	FIM X	1625-5	8/66
Signal Generator	Hewlett Packard	606A	6657	6/66
Signal Generator	Hewlett Packard	608 C	247	5/66
Signal Generator	Hewlett Packard	612 A	12	6/66
Receiver	Nems Clark	1670-F	315	9/66
Antenna	Polarad	CA-M	1629-09	--
Antenna	Polarad	CA-L	133	--
Antenna	Polarad	CA-S	131	--
Antenna	Polarad	CA-X	134	--
Antenna	Polarad	CA-B	128	--

ITEM	MANUF	MODEL	S/N	CAL DATE
Reflector	Polaroid	CA-R	134	--
Isolation Transformer	Sola	6220-1A	--	--
Audio Oscillator	Hewlett Packard	200CD	595	--
Tape recorder	Mincom	--	--	--
Oscilloscope	Tektronix	535	7019	9/66
Line Stabilization Network	Filtron	FRS-701A	892-35	--
Line Stabilization Network	Filtron	FRS-701A	892-22	--
Attenuator	Kay Electric	20	K587C	6/66

b. Test

For this test the X-ray Experiment and the Data System were interconnected and tested together. Test setup is shown in Figure 11. To completely test the Data System, portions of the EMI test were repeated to check each of three Data System operational modes, namely

Frog Real Time

X-ray Read In

Tape Recorder Read Out

The X-ray experiment was operated only during the X-ray Read In mode; however, it was subjected completely to all required tests.

Tests were performed in accordance with MIL-I-26600 as modified by ASPO-EMI-10A for Class I equipment. Test equipment, configuration and procedures complied with all requirements contained therein. Tests included, in sequence:

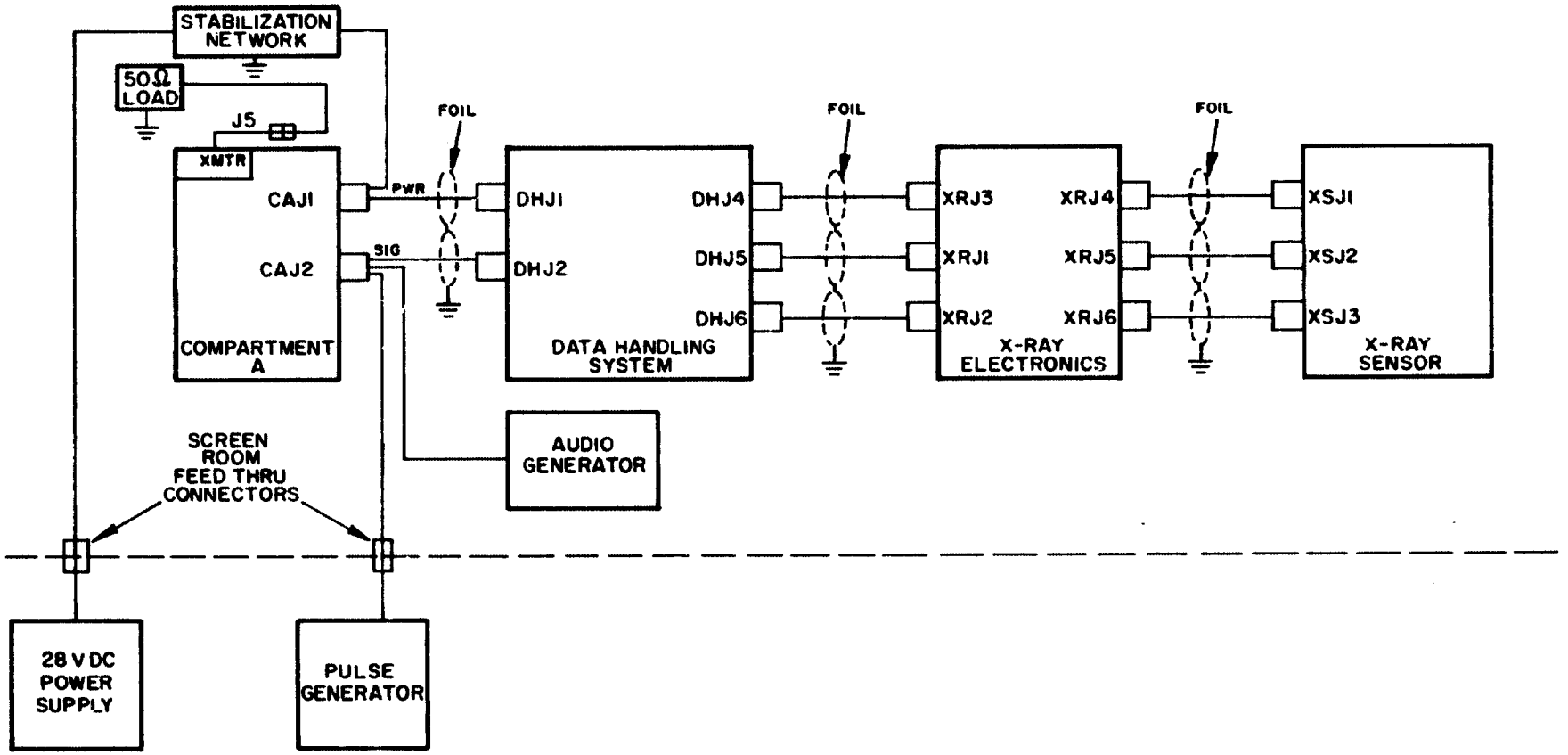


Figure 11

EMI TEST SET-UP BLOCK DIAGRAM

1. Conducted interference -- radio interference voltages, in the frequency range of 0.015 to 25 Mc/sec. were measured on the system input power lines. A minimum of three measurements per octave were made, the measurement frequencies being selected by sweeping the octave band and determining the points of highest interference.

2. Radiated interference - radiated interference fields emanating from the equipment were measured over the frequency range 0.015 to 1000 Mc/sec. Measurement frequencies were selected as in (1) above. Both broadband and narrow band measurements were made.

3. Antenna conducted -- transmitter keydown -- the transmitter was operated into a dummy load. Measurements of spurious and harmonic power output were then made over the frequency range of 0.15 to 10,000 Mc/sec.

4. RF conducted susceptibility -- an RF signal of 100,000 microvolts - from a 50 ohm source - was applied over a frequency range of 0.015 to 10,000 Mc/sec. to the input power lines through the line stabilization network. The equipment was then operated in the X-ray Record and Frog Real Time modes. During the X-ray mode the experiment calibration cycle was energized continuously to obtain the most reliable performance indication. The Data System acquired experiment data in the normal flight manner and this was transmitted via coax to a tape recorder and recorded for subsequent data analysis at AS&E.

5. Audio conducted - a sine wave audio frequency signal of 3 volts rms was applied between the ungrounded input power lead and ground. Frequency was varied from 50 to 15,000 cps. The test was performed in each of the Data System modes as in (4) above.

6. Transient conducted -- fifty volt pulses with a time width of 10 microseconds and a repetition rate of 10 pulses per second were conducted onto each input power lead. This test was performed in each

of the Data System modes outlined in (4) above and the data recorded for analysis.

7. Radio frequency radiated -- the equipment was subjected to a radio frequency established by generating a 100,000 microvolt signal across the test antenna terminals. The frequency range covered was 0.015 to 10,000 Mc/sec. Data was recorded as in (4) above.

c. Results

1. General -- specification limits were exceeded somewhat in conducted interference, radiated interference, and audio conducted susceptibility tests. Performance on all other tests was satisfactory. These results were discussed with NASA/MSC representatives and it was determined that the values were not sufficiently out of spec to warrant a redesign effort. Hence, a waiver to the test specs was requested by AS&E and granted by NASA. (See Attachment IV).

2. Conducted interference -- the measured broadband conducted interference levels for all three modes of operation are shown in Figures 12 through 14. In each mode the levels exceeded the specifications at frequencies around 1 to 2 Mc/sec (Figures 12b, 13b, 14b). Two Filtron SP-226 interference filters were then temporarily inserted in the Compartment A input power lines and the interference levels again measured in one of the modes (Frog Real Time). As shown in Figure 15, all levels were thus reduced to a minimum of 25 DB below the spec limit. Measurements were not repeated in other modes since the intent was only to determine the effect of a typical RF filter. Subsequent analysis of the redesign required to incorporate the filters and discussion with NASA regarding the levels obtained without filters resulted in a waiver being requested and granted.

3. Radiated interference -- the measured broadband radiated interference levels are shown in Figure 16. The spec limits were exceeded at several frequencies in each of the three modes of operation.

BROADBAND CONDUCTED INTERFERENCE
FROG REAL TIME MODE

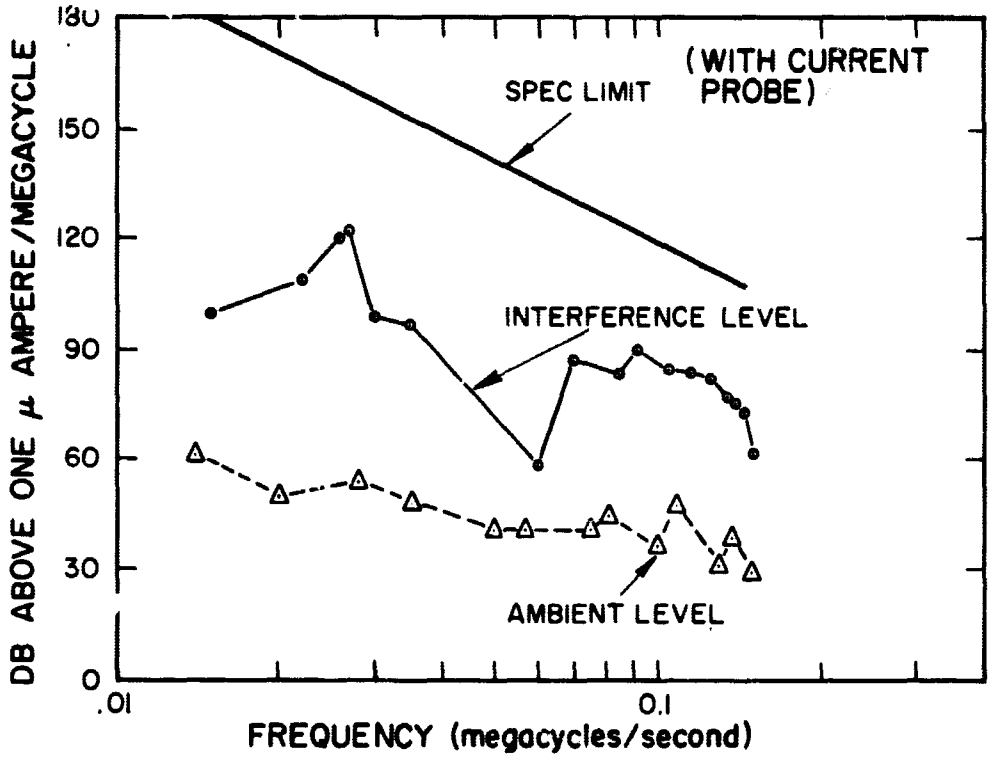


Fig. 12a

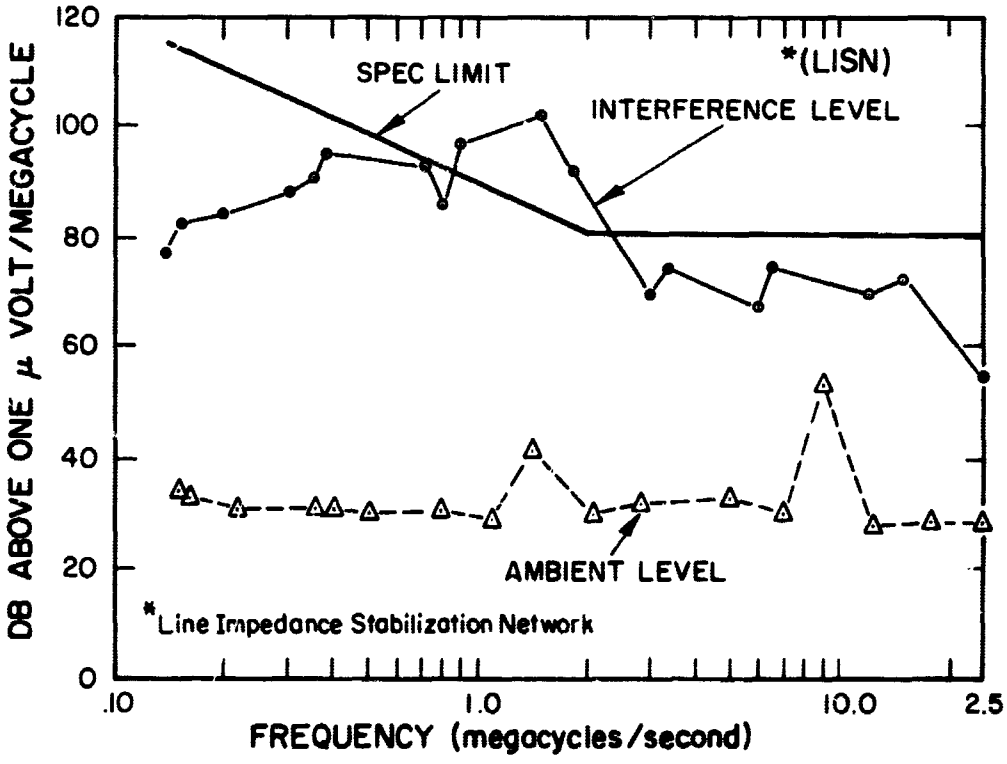


Fig. 12b

1455

BROADBAND CONDUCTED INTERFERENCE

X-RAY RECORD MODE

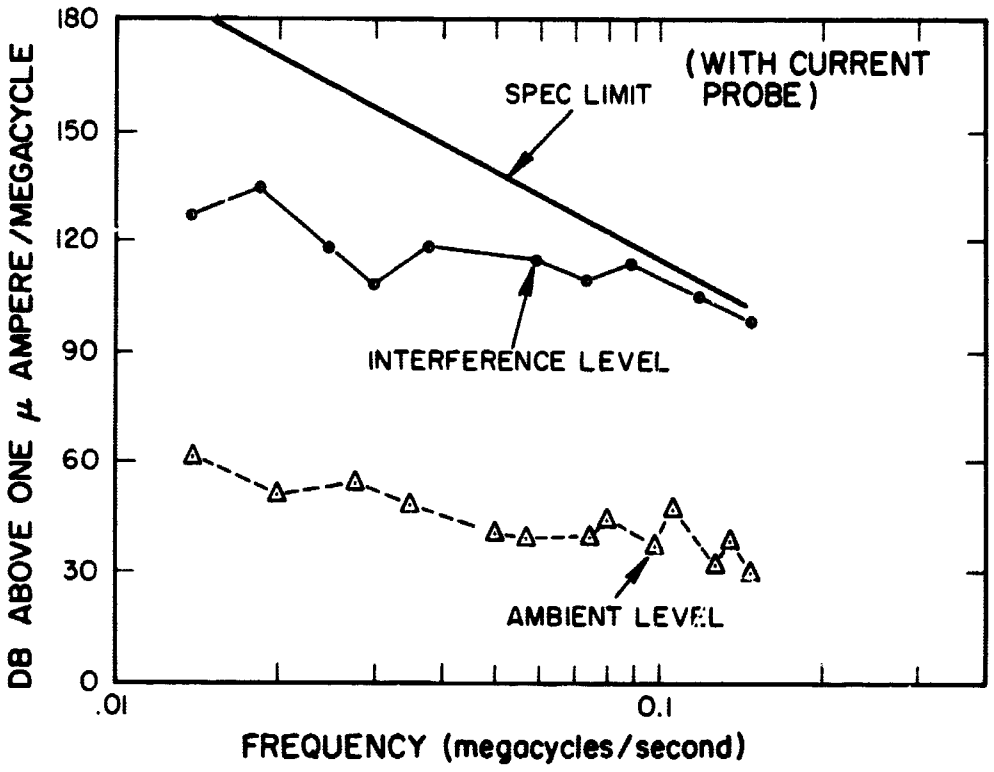


Fig. 13a

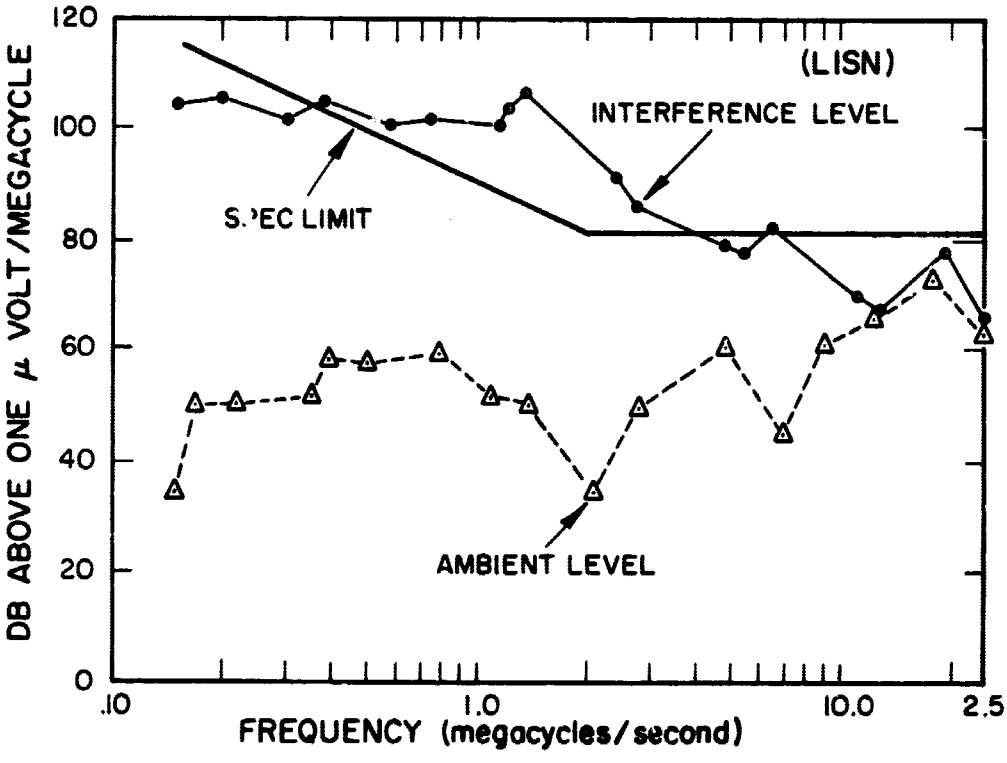


Fig. 13b

1455

BROADBAND CONDUCTED INTERFERENCE
RECORDER READOUT MODE

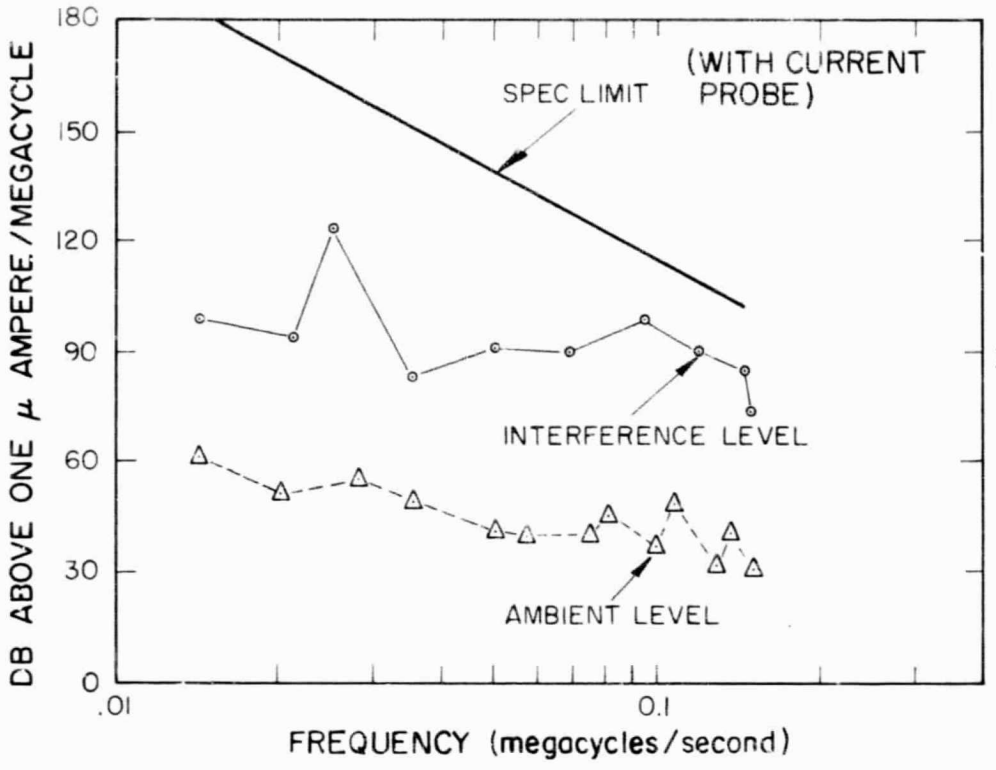


Fig. 14a

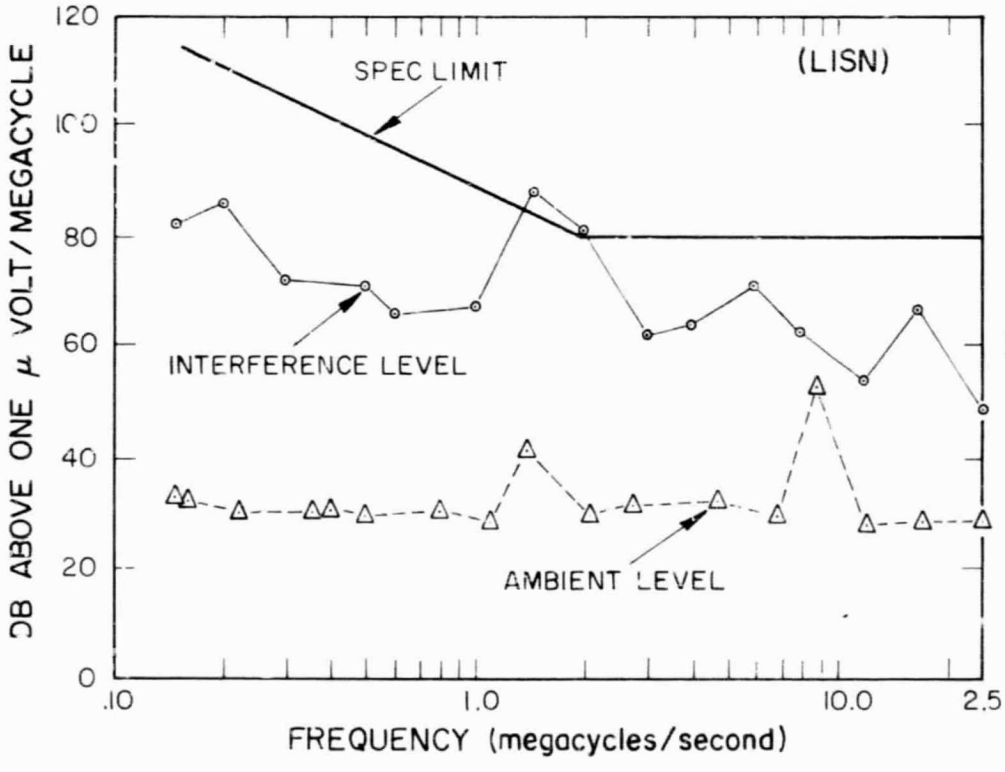
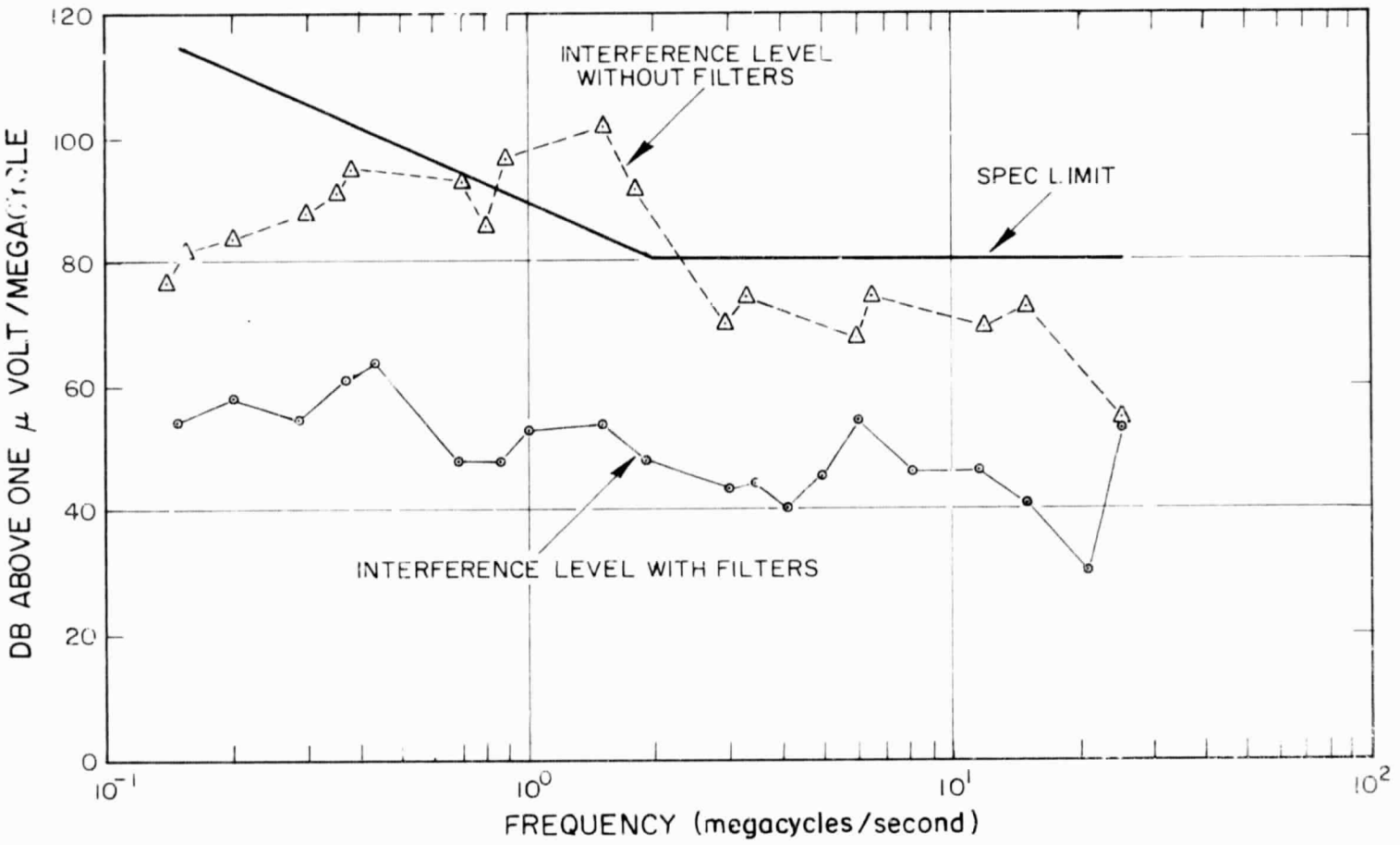


Fig. 14b

1455



BROADBAND CONDUCTED INTERFERENCE WITH AND WITHOUT SP226 FILTERS IN LINE

FROG REALTIME MODE

Figure 15

BROADBAND RADIATED INTERFERENCE

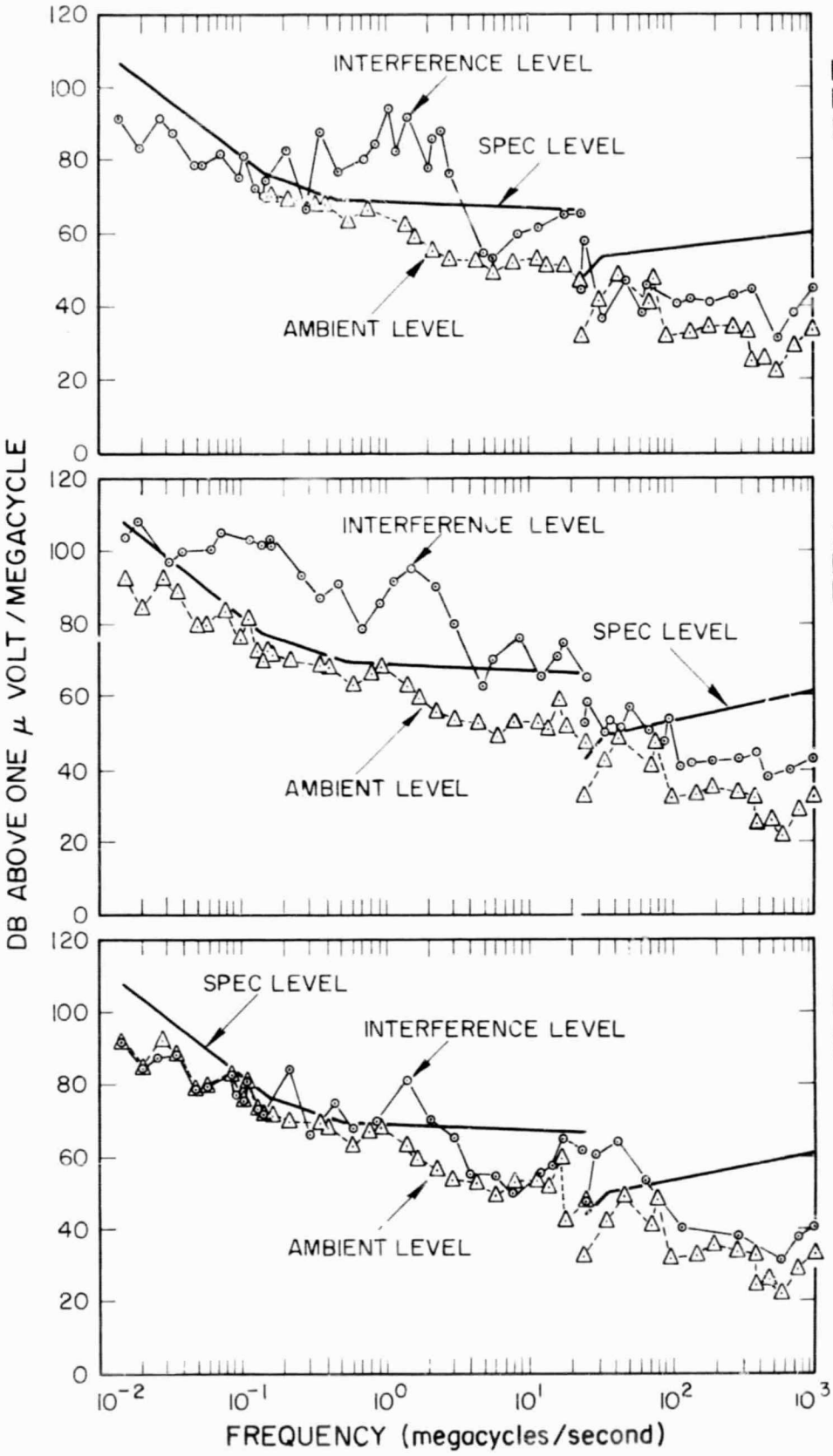


Fig. 16a

Fig. 16b

Fig. 16c

455

Investigation was made to determine the source of radiation. This revealed the major source to be the unshielded interconnecting cables (which AS&E is not supplying for flight and hence were not part of the test specimen). The cables were thus wrapped with aluminum foil and the measurements repeated over the pertinent frequency range. The resulting data is shown in Figure 17. As shown, all levels were brought below specifications except one point in the Frog Real Time mode (Figure 17a) and two in the X-ray Record mode; (Fig. 17b) these three points were only slightly over spec.

A search was also made for narrow band interference signals from 0.014 Mc/sec to 10,000 Mc/sec. Only three signals were detected, two of which exceeded the specification somewhat, namely:

Mode	Freq (mc)	Detected Level (dbμv)	Spec Limit (dbμv)
Frog Real Time	247	39.1	31.5
Frog Real Time	494	24.1	36.0
Recorder Readout	247	41.1	31.5

Investigation indicated that the interference signals were emanating from the transmitter coax cable and TNC connector.

The above results were presented to NASA and a waiver was obtained.

4. Antenna conducted -- transmitter keydown - the transmitter fundamental power output was measured at 144 db above one microvolt (6 watts) in each of the following three modes of operation: Real Time (unmodulated), Frog Real Time, and X-ray Real Time. Therefore, the specification requires that the spurious and harmonic power output be at least (80 + 10log 6) or 87.8 db below the fundamental. As shown in Figure 18, signals detected were at least 95 db below the fundamental which is

BROADBAND RADIATED INTERFERENCE WITH CABLES SHIELDED

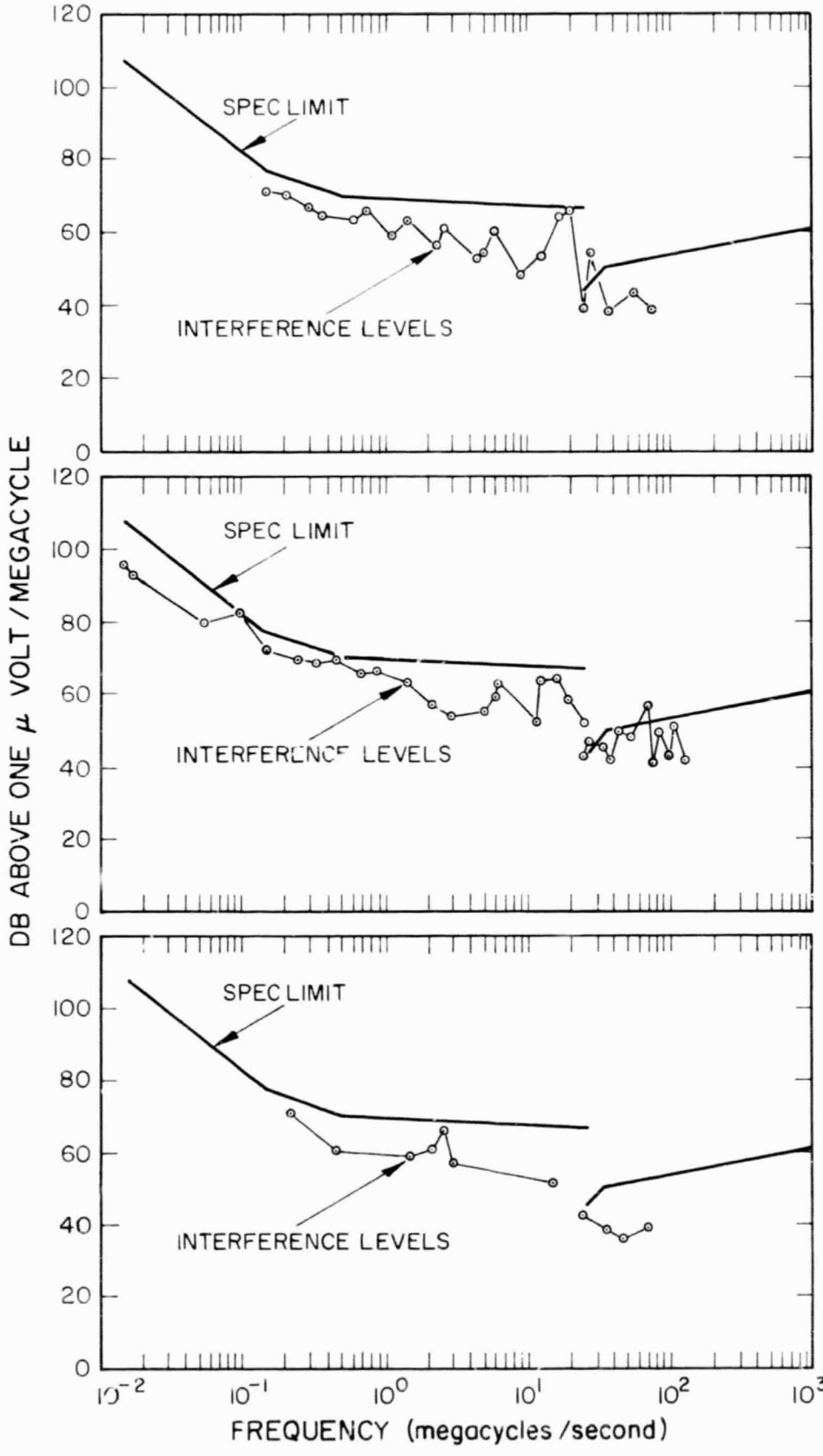


Fig. 17a

Fig. 17b

Fig. 17c

ANTENNA CONDUCTED-TRANSMIT

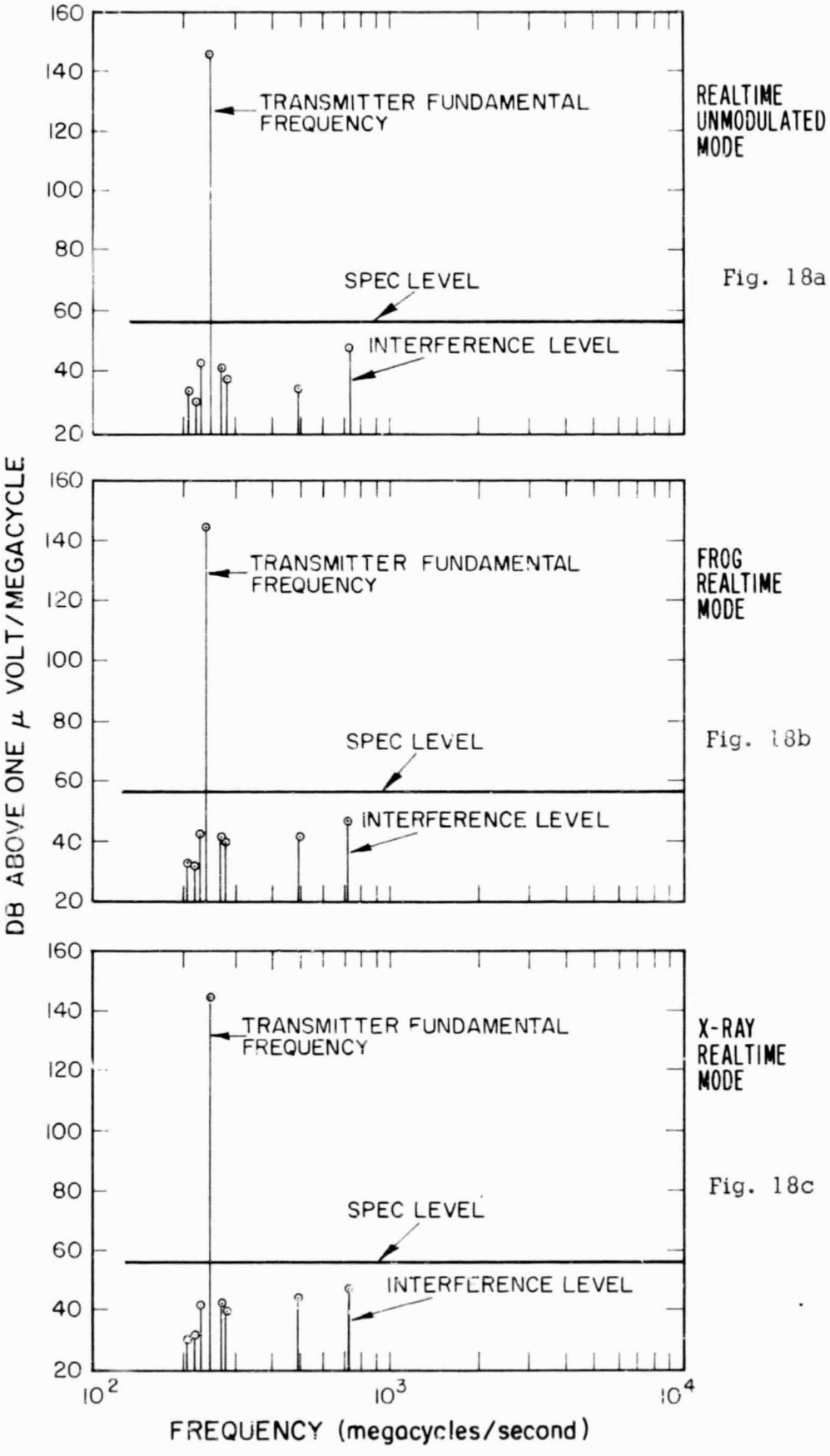


Fig. 18a

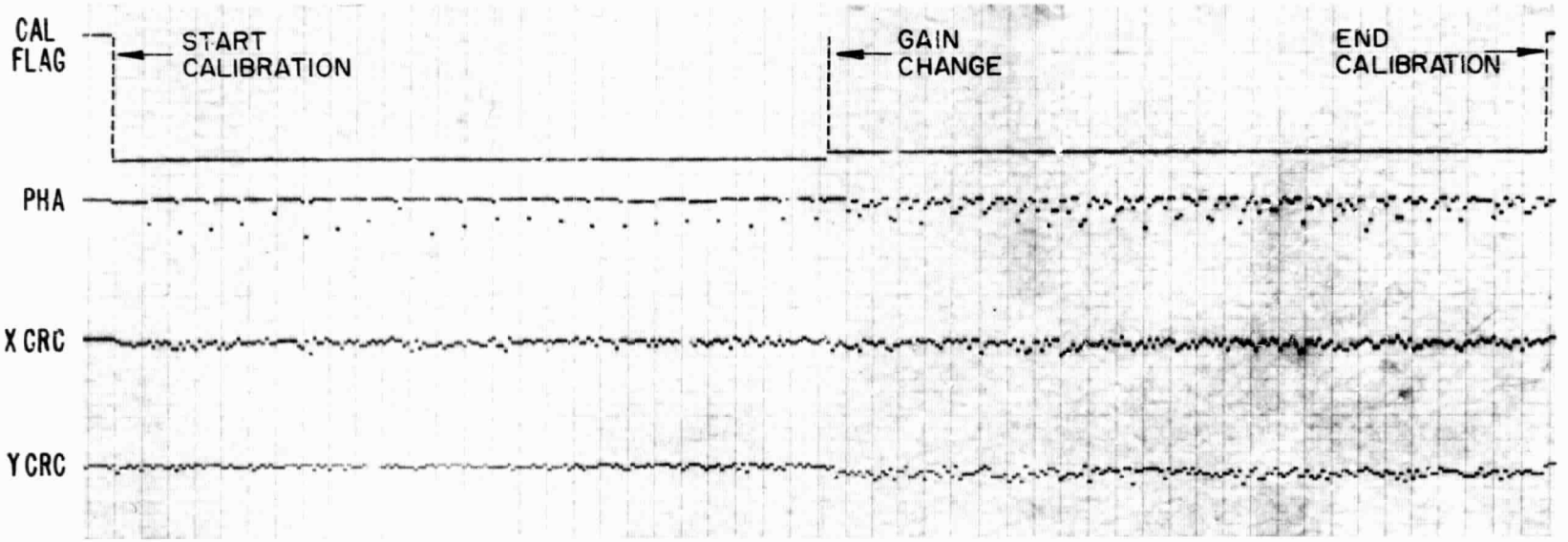
Fig. 18b

Fig. 18c

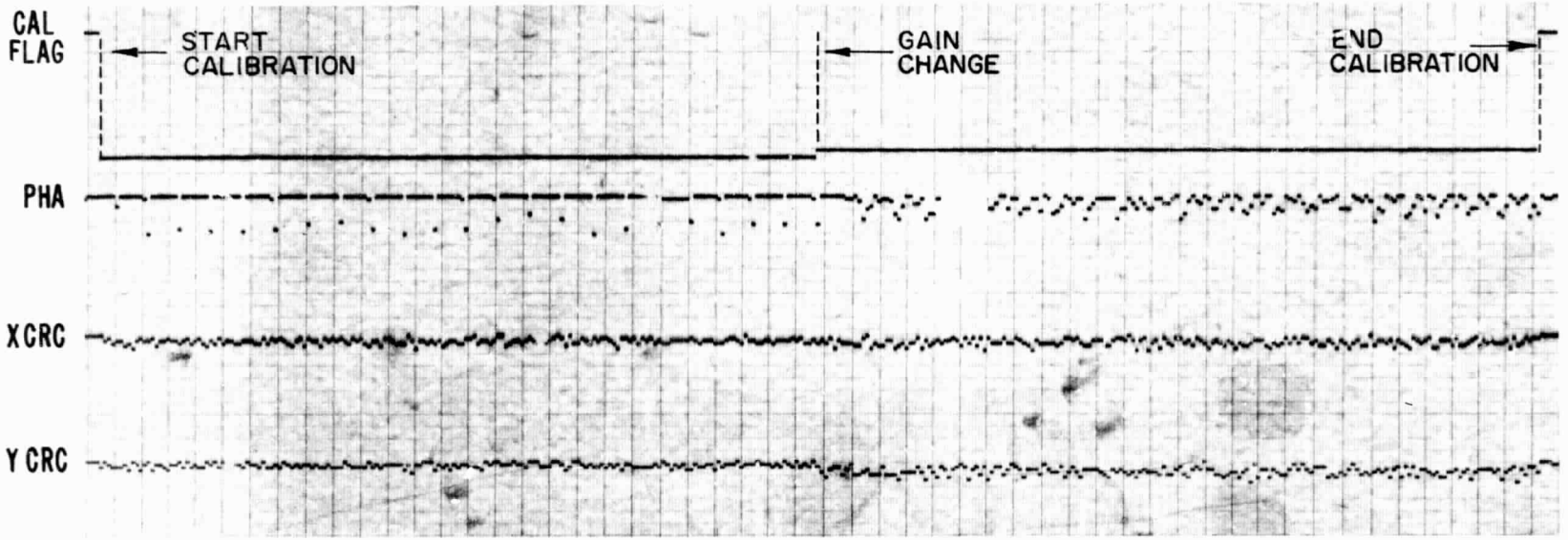
well within specification.

5. Susceptibility - prior to the start of susceptibility tests several X-ray calibration cycles were performed and the data recorded on magnetic tape for subsequent performance comparison. The X-ray calibrate cycle was then activated continuously throughout the X-ray mode susceptibility tests. The tape was annotated to identify each test, test levels, and test frequencies. At the conclusion of the tests the data was played back and analyzed from two standpoints. First the actual values of selected measurements were determined and compared to specifications. Second the records from each portion of the test were compared to each other and to the pre-test records to detect any anomalies, particularly noise. Selected housekeeping signals, such as power supply outputs, as well as the X and Y count rate channels and the PHA channels were analyzed in this manner. No discrepancies were noted and all values were within specifications. Typical results are shown in Figure 19. The upper traces represent the pre-susceptibility data, whereas the lower traces have been chosen at random during one of the susceptibility tests, namely, RF radiated at 580 kc. As can be seen the RF radiation did not cause any degradation in performance and the values obtained in the calibration cycles agree within allowable limits; these are tabulated in Table III.

One system malfunction did occur during the audio conducted susceptibility test. A Compartmant A relay dropped out when the required 3 volt rms signal was conducted on the input power lines at frequencies between 70 and 140 cps. However, this had no effect on the data or system performance since the relay only provides a momentary signal to initiate read in or read out of the tape recorder. Further testing was performed by sweeping at reduced levels to determine the voltage levels that could be sustained without relay drop out. The results are shown in Figure 20.



PRE-SUSCEPTIBILITY



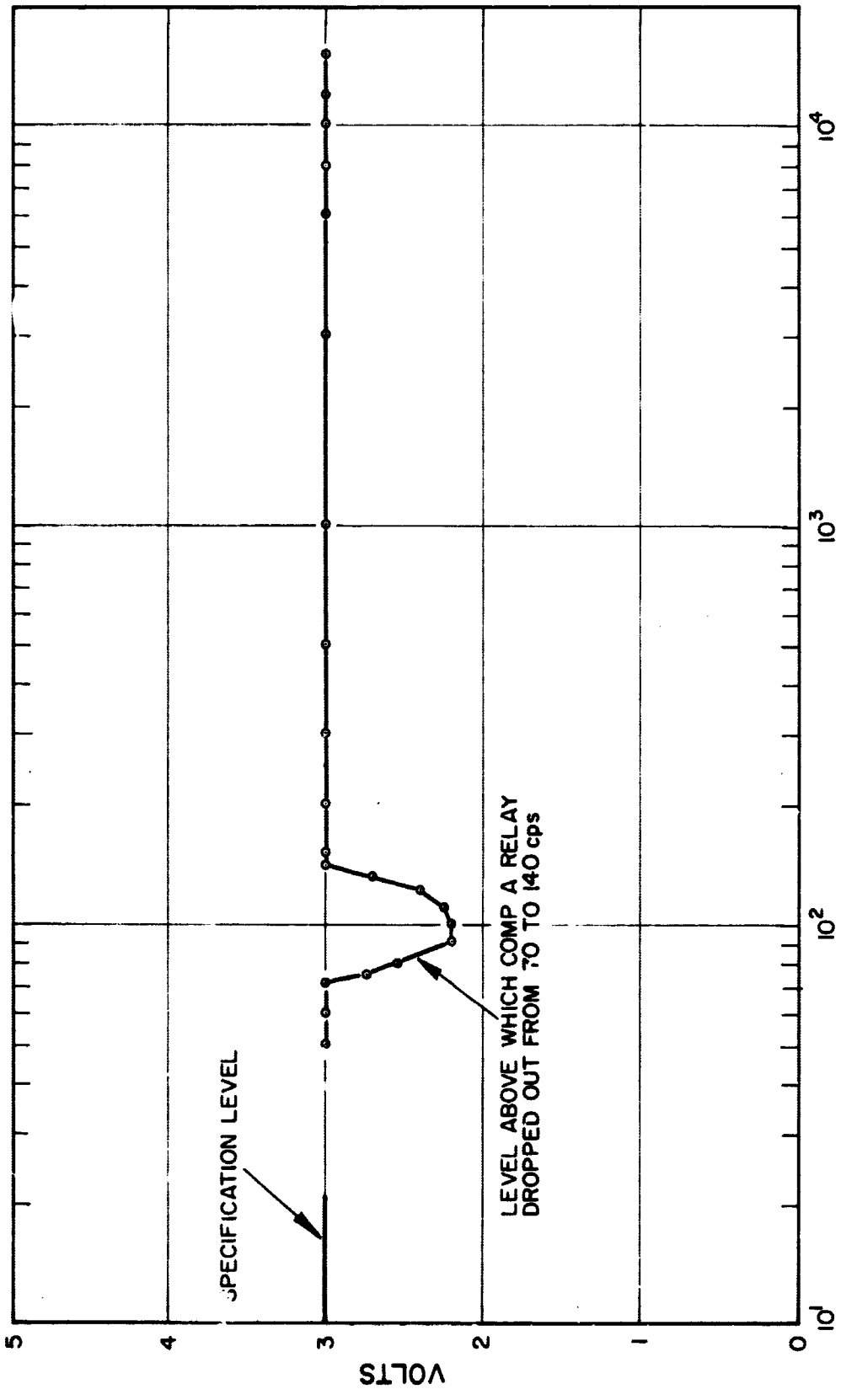
DURING RF RADIATION AT 580 Kc

CALIBRATION DATA

Figure 19

TABLE III -- TOTAL COUNTS DURING CALIBRATION CYCLE-RF RADIATED SUSCEPTIBILITY TEST

Channel		Counts Pre-Susceptibility	Counts RF Radiated at 580 kc
X	60 sec	1646	1704
	30 sec	642	726
Y	60 sec	1438	1504
	30 sec	256	472
PHA 1	60 sec	620	686
	30 sec	464	548
PHA 2	60 sec	36	28
	30 sec	14	2
PHA 3	60 sec	40	46
	30 sec	12	2
PHA 4	60 sec	420	328
	30 sec	10	2
PHA 5	60 sec	268	258
	30 sec	10	2
PHA 6	60 sec	142	188
	30 sec	10	2
PHA 7	60 sec	18	12
	30 sec	10	2
PHA 8	60 sec	90	72
	30 sec	38	22



AUDIO FREQUENCY CONDUCTED SUSCEPTIBILITY

Figure 20

10.11 Acoustics

a. Test Equipment

Reverberation Chamber -- Wylie Labs

Audio Frequency Spectrum Analyzer -- Bruel and Kjaer, No. 8221

Graphic Level Recorder -- Bruel and Kjaer

Crystal Microphones -- Gulton, 1 in., Ser. No. 115 and 158

b. Test

The Experiment Functional Test was performed at AS&E prior to shipment to Houston for the Acoustic Tests, as well as after return. At NASA/Houston the Experiment and Data Handling System were interconnected and tested together. All data was recorded on magnetic tape.

Two microphones were installed in the center of the reverberation chamber and the system was adjusted to provide the required spectrum. The Electronics package was then suspended in the center of the chamber and subjected to the Sound Pressure Levels shown in Figure 21a for 10 minutes.

After removing the Electronics package the X-ray Sensor was suspended in the chamber. Because of the possibility of the 2 mil Be windows fracturing and presenting a toxicity hazard, a hose was connected to the reverberation chamber and exhausted outside of the building. Air samples of the exhaust were taken by safety personnel, who monitored the test.

The Sensor was then subjected to the required Sound Pressure Levels as shown in Figure 21b for 10 minutes.

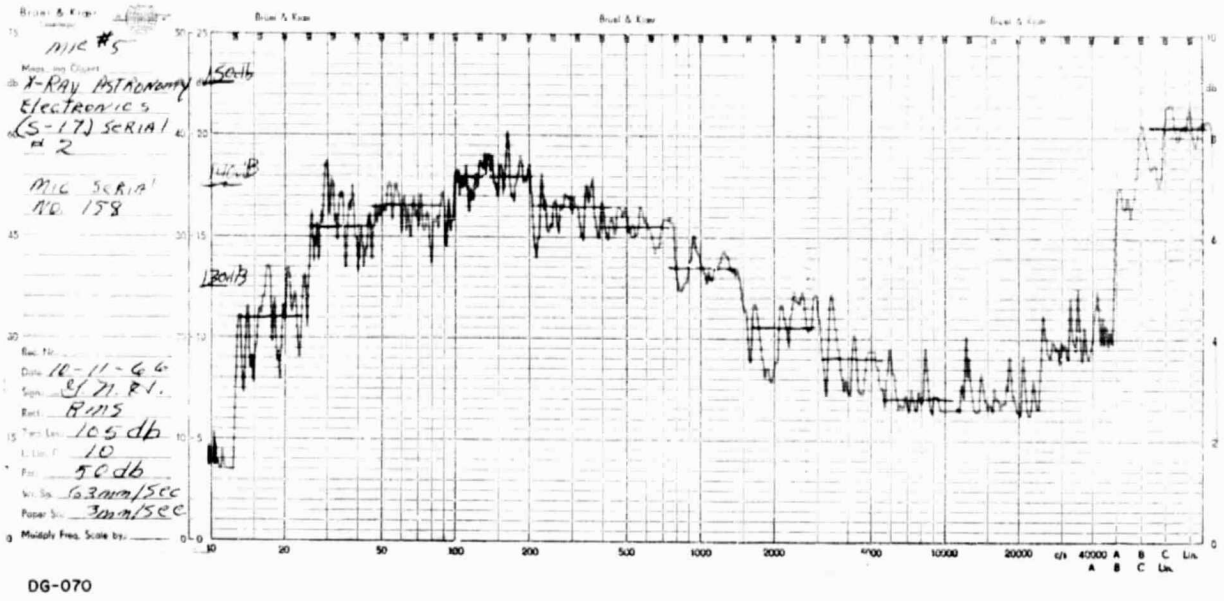
c. Results

Table IV shows the specified and actual Sound Pressure

ACOUSTIC NOISE

SOUND PRESSURE LEVEL VS. FREQUENCY

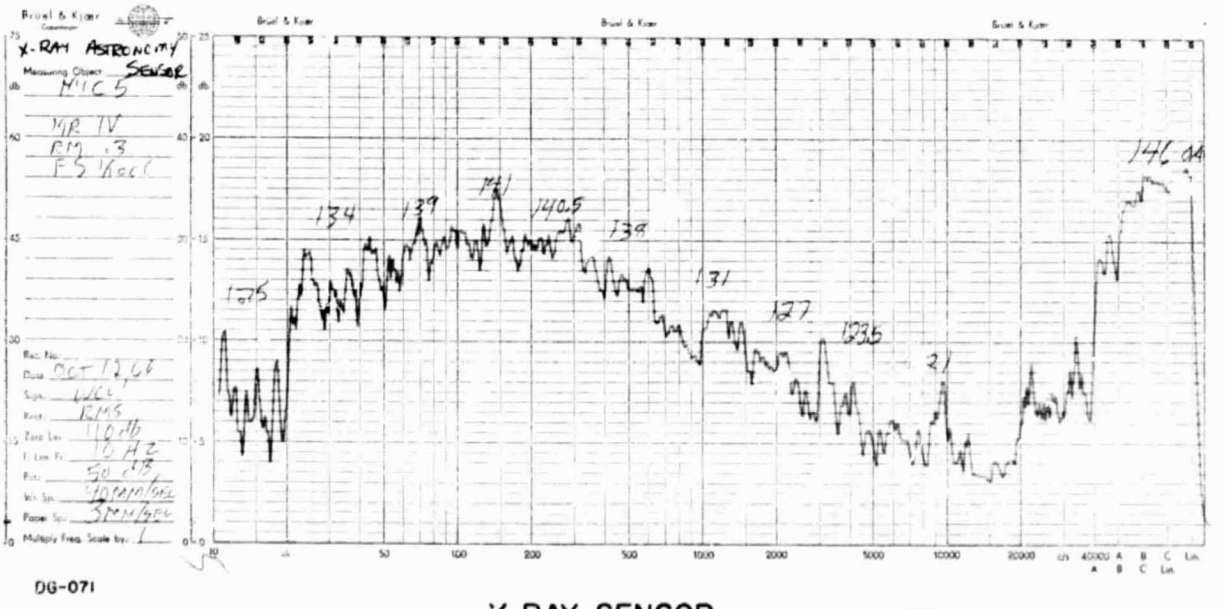
(SPL IN dB Re 0.0002 Dynes/cm^2)



DG-070

X-RAY ELECTRONICS

Fig. 21a



DG-071

X-RAY SENSOR

Fig. 21b

TABLE IV -- ACOUSTIC NOISE SOUND PRESSURE LEVELS

Sensor

Octave Band Center Frequency (cps)	Test Spec Sound Pressure Level (dB)	Measured Sound Pressure Level (dB)
16	127.5	126
31	134	134
63	140	139
125	139	141
250	139	140.5
500	135	138
1000	128	131
2000	121	127
4000	114	123.5
8000	106	121
Overall	146	146

Electronics

16	127.5	127
31	134	136
63	140	138
125	139	141
250	139	138
500	135	136
1000	128	132
2000	121	126
4000	114	123
8000	106	119
Overall	146	146

Levels obtained at the center of each octave band. Note that the equipment was actually overtested at the higher frequency range (from 2kc to 8kc), by a maximum of 15 dB at 8kc. The acoustic facility could not be adjusted to produce lower levels than obtained in this range.

After the tests both items were inspected for damage and then removed from the chamber. The Sensor package was partially disassembled to determine if any of the Beryllium windows were fractured. No damage was found.

After acoustic tests on the Data System and Compartment A, the equipment was again connected and tested. The Experiment was operated in the calibrate mode and the data was recorded on magnetic tape. The tapes were then given to NASA personnel from the Experiment Office who provided an octal print out of the X and Y count rate channels, PHA channels, and Star Sensor data. These were analyzed and the pre- and post-acoustic results were compared. All values were within specifications and no discrepancies were found.

The Functional Test was again performed at AS&E when the equipment was returned. Results were compared to those obtained before shipment to Houston with satisfactory agreement. (Attachment III, p. 35 - 38).

ATTACHMENT I

PRE DELIVERY ACCEPTANCE TEST DATA

DATA SHEET

PRE-DELIVERY ACCEPTANCE TEST

X-RAY ASTRONOMY EXPERIMENT

Serial No.: Sensor 2 Electronics 2

Accepted by:

AS&E Q. A. J. Boczenowski _ DATE: 7/11/66

DCASR Q. A. _____ DATE: _____

TEST DATA

A. Examination of Product

1. Inspection

Conformance to drawings: _____

Sensor: 4688-1-0 Rev. A Electronics: 104-700-001 Rev. C

2. Records Review

Records Complete: _____

Acceptance Test Complete: _____

Assembly Procedures Approved: _____

Part Numbers Recorded: T. Cryan

3. Comments

Inspected by: J. Bozymowski (QA) Date: 7/11/66

DCASR Q.A. Rep: _____ Date: _____

B. Physical Characteristics

1. Envelope

Conformance to drawings: _____

Drawing No.: NAA MH01-12059-117 Rev. A

Verified by: H. Rubino Date: 7/9/66

2. Weight

Sensor: 176.0 Electronics: 49

Weighed by: R. G. /A. M. C. Date: 7/11/66

3. Mounting Hole Locations

Checked against NAA tool plate

Sensor: OK Electronics: OK

Verified by: A. M. Castellano Date: 7/11/66

4. Center of Gravity

Sensor: X= 9.60 Electronics: X= 6.20

Y= 9.025 Y= 5.54

Z= 3.71 Z= 6.20

Reference Point: NAA Datum

Measured by: W. Antrim Date: 7/11/66

C. Performance Tests

1. Ground Isolation Check

Measurement	Sensor	Electronics
Shielding - counters: (Resistance)	> 1 Meg	--
Shield Gr. - Chassis Gr.:	> 1 Meg	> 1 Meg
Shield Gr. - Signal Gr.:	> 1 Meg	> 1 Meg
Chassis Gr. - Signal Gr.:	> 1 Meg	> 1 Meg

Performed by: G. Barrett Date: 7/11/66

2. Input Power

Voltage	Current	
	Quiescent	Active
23	1.46	1.48
27.5	1.32	1.32
30	1.25	1.25

Performed by: G. Barrett Date: 7/11/66

3. Count Rate Meter Calibration

Input Frequency: 1003 cps

CRM Output Volt: X_o 4.005 Y_o 4.005 B_x 1.00

X+ 4.000 Y+ 4.000 B_y 1.00

X- 4.003 Y- 3.997

Performed by: G. Barrett Date: 7/11/66

4. Digital Test

Pulses In	Pass	Fail
50	X	
100	X	
200	X	
500	X	

Performed by: G. Barrett Date: 7/11/66

5. Digital Output Signal Level

Position	Voltage	
	One	Zero
1	4.8	0.2
2	4.8	0.18
3	4.8	0.2
4	4.8	0.2

Performed by: G. Barrett Date: 7/11/66

6. Calibration

Channel	30 SEC	60 SEC
X_o CRC	565	3620
Y_o CRC	760	2628
PHA1	901	1432
PHA2	14	122
PHA3	62	276
PHA4	12	2176
PHA5	8	94
PHA6	0	46
PHA7	10	14
PHA8	98	262

Performed by: G. Barrett Date: 7/11/66

7. Star Sensor Test

Star Sensor Test Fixture Voltage: .45

Star Sensor Output Voltage:

Signal	Voltage
QUAD 1	1.5
QUAD 2	1.27
QUAD 3	0.94
QUAD 4	1.03
BRIGHTNESS	4.25

Performed by: G. Barrett Date: 7/11/66

ATTACHMENT II

FAILURE REPORTS

APOLLO FAILURE REPORT

Date of Failure: Month 7 | Day 26 | Year 66

FR- Q1

FAILURE DETECTED DURING:

Inspection _____ Functional Check _____ Acceptance _____ System Qualification Test

FAILED EQUIPMENT:

Electronics X Experiment X Data handling _____ Comp A _____ GSE _____

Lab unit _____ Qualification unit X Flight unit _____ Flight spare _____

FAILED ITEM:

	Name	AS&E P/N	AS&E S/N	Mfgr. P/N	Manufacturer
XXXXX	High Voltage	104-701-701 P-1	4		AS&E
Subassembly	Distribution				
XXXXXXX	Assy				
XX					

DESCRIPTION OF FAILURE: High voltage dropped from +2500 to approximately +700V under 156° Temp. test conditions of procedure AS&E 1333, page 8.

EFFECT OF FAILURE: Performance Degraded _____ Equipment not Functioning X

ACCUM TIME TO FAILURE: 24 Hrs 0 Min

DISPOSITION OF FAILED ITEM: Assembly removed and tested. Tests indicated Mil Associates converter SA-24-1-05-25, S/N 508026 failed. Removed converter for shipment to Mil Associates for further tests and subsequent repair and/or replacement.

ORIGINATOR: William Fait QA-3

REPAIR ACTION:

PART REPLACEMENT

Adjustment	Part	P/N	S/N	Mfgr

FAILED PART DISPOSITION: Repair _____ Scrap _____ Return to Vendor _____

REPAIR:

Performed By _____ Accepted by _____

CAUSE OF FAILURE:

See attached

CORRECTIVE ACTION:

See attached

APPROVED Andrew Castellano II-2 Supr.

APOLLO FAILURE REPORT

Date of Failure: Month 7 | Day 26 | Year 66

FR- Q2

FAILURE DETECTED DURING:

Inspection _____ Functional Check _____ Acceptance _____ System Qualification Test

FAILED EQUIPMENT:

Electronics X Experiment X Data handling _____ Comp A _____ GSE _____

Lab unit _____ Qualification unit X Flight unit _____ Flight spare _____

FAILED ITEM:

	Name	AS&E P/N	AS&E S/N	Mfgr. P/N	Manufacturer
Assembly	High Voltage	104-701-701-P-1	5		AS&E
Subassembly	Distribution				
Circuit board	Assy				
Part					

DESCRIPTION OF FAILURE: High voltage dropped from +2500 to approximately +700V under 156° Temp. test conditions of procedure AS&E 1333, page 8.

EFFECT OF FAILURE:

Performance Degraded _____ Equipment not Functioning X

ACCUM TIME TO FAILURE: 24 Hrs 0 Min

DISPOSITION OF FAILED ITEM: Assembly removed and tested. Tests indicated Mil Associates converter SA-24-1-05-25, S/N 508027 failed. Removed converter for shipment to Mil Associates for further tests and subsequent repair and/or replacement.

ORIGINATOR: William Fait QA-3

REPAIR ACTION:

PART REPLACEMENT

Adjustment	Part	P/N	S/N	Mfgr

FAILED PART DISPOSITION: Repair _____ Scrap _____ Return to Vendor _____

REPAIR:

Performed By _____ Accepted by _____

CAUSE OF FAILURE:

See Attached

CORRECTIVE ACTION:

See Attached

APPROVED: [signature] II-3

AMERICAN SCIENCE AND ENGINEERING, INC.

FAILURE REPORT

Product: High Voltage Power Supplies

1. Description of Failure

The Experiment Sensor Unit contains two (2) high voltage power supplies purchased from Mil Associates, Nashua, New Hampshire. These have 2500 volt output. They are assembled into a five outlet distribution box and fully potted.

Two of these units (#508-027, 508-026) failed after the sensor unit was tested at 70°C. Two others (#512-015, 508-030) failed when tested in an oven before assembly. The failure was either a low voltage (1500v) or no output voltage.

Other units (508-025, 508-032, 508-028) have undergone extensive thermal cycling and testing and have not failed.

2. Cause of Failure

These power supplies contain a high voltage capacitor made up of seven ceramic capacitors fused into a monolithic block. Each small capacitor is about 0.01 μf and 0.4 square inches in size.

Mil Associates purchased the individual capacitors from Vitramon Corp. and assembled the composite unit. They had obtained 3 good batches of 1000 units but then received 2 bad batches. They rejected about 800 of the first batch but used the accepted units to fabricate the components in the supplies in question.

On dissecting one of the failed units, a crack was found in the substrate material of one of the capacitors. This crack shorted out the capacitor and caused the supply to fail. This crack is a typical failure mode for faulty substrate material. From the appearance of the crack it is evident that it was present before the assembly of the monolithic capacitor block.

3. Other Failures

Mil Associates have had a similar power supply fail for the same reason. This was supplied to Hughes, Inc. for the ATS program.

4. Corrective Action

Mil Associates now obtains their capacitors from American Lava whose quality control is better. Results to date have been excellent with no failures.

The power supplies will be rebuilt incorporating a new capacitor and fully tested. The test schedule will include the following:

2.5	hours test at	55°C
5	hours	71°C
1	hour	20°C
2.5	hours	0°C
5	hours	-55°C
1	hour	20°C

with monitoring of all inputs and outputs and variation from load to no load. AS&E will send personnel to monitor these tests.

5. Proposed Course of Action

Since AS&E has successfully completed high and low temperature testing of the Experiment using two Mil Associates high voltage power supplies, it is evident that the failure was due to poor quality control by the vendor of the capacitors. The corrective action taken by Mil Associates has eliminated this problem.

AS&E proposes to accept the power supplies after the above tests, and assemble them into the distribution box.

After assembly and potting, the complete power supplies will be requalified through the following test which duplicates the qualification test cycle:

a. Cool to -51°C in one hour and maintain for 2 hours.
b. Turn on power supplies and verify correct operation for 4 hours at -51°C.
c. Return to 20°C and verify correct operation.
d. Raise to 70°C in one hour.
e. Turn on power supplies and operate for 20 hours. Verify correct operation.
f. Return to 20°C and verify correct operation.

The units will then be assembled into the flight units. No re-qualification of the Experiment will be performed.

6. Schedule Impact

The failure of the power supplies has caused a delay of approximately 10 days in the qualification testing program. This is now expected to be completed about 5 September 1966.

Approved: A. Castellano / J. R. Waters

A. Castellano
Mgr. Quality Assurance

J. R. Waters
Project Director

MEETING MINUTES

Subject: NASA/AS&E Program Review Meeting

Date: 16 August 1966, American Science and Engineering, Cambridge, Massachusetts

Attendees:

NASA	AS&E
Brandenburg, W.	Brackett, N.
Eaton, W.	Burke, R.
Foster, N.	Gaull, R.
Grace, T.	Waters, J. R.
	Zucker, P.

Agenda:

1. Contract Changes
   a. ASE-1272, dated 12 May, "DHS Automatic Shutoff"
   b. ASE-1298, dated 6 June, "Electronic Box Redesign"
   c. ASE-1320, dated 22 June, "Compartment A Rewiring"
   d. ASE-1361, dated 10 August, "Compartment A Logic Change"
   e. ASE-1341, dated 12 July, "Additional Scientific Support"
2. Qualification Test
   a. Review Status
   b. Resolve failutes/remedial action
   c. Schedule
3. Schedule
   a. NAA
   b. KSC
   c. Delivery
4. Mission Requirements
   a. DEP review -- ASE-1351, Rev. 1
   b. Fuel/Scientific requirements
5. Documentation
6. Additional Funding Request

A Program Review Meeting was held at AS&E on 16 August with the above people in attendance. The agenda shown above was discussed with the following results:

1. Contract Changes

T. Grace requested that AS&E justify its manpower estimates for several of the changes. Several discussions ensued on the necessity for drawings, the use of engineers to ensure that shop personnel correctly wire intricate and rapid changes, and relative estimates made for each change. The negotiations were settled when AS&E accepted the NASA offer. The negotiated settlement was $36,000 for the first four modifications and $74,000 for the scientific support (excluding fee).

2. Qualification Test

J. Waters presented the Qual Test schedule as follows:

Experiment -- high and low temperature, acceleration, and random vibration are complete. Thermal vacuum to begin on 17 August.

Data Handling System -- high and low temperature complete. Thermal vacuum to begin on 17 August.

Compartment A -- high and low temperature, over pressure test complete. Thermal vacuum to begin on 17 August.

The Qual Test failures were then discussed and a mechanism for reporting and receiving concurrence on remedial action and go-ahead was approved. AS&E will continue to inform NASA of failures within 48 hours by TWX. A second TWX will then be sent to NASA when the cause of failure and remedial action have been assessed and a conference call will be set up to mutually discuss the course of action. The agreed to action will then be verified by TWX. At the present time, there are five failures for which NASA

has been notified, action has been taken, and reports have been generated. NASA accepted an action item to review these failures and courses of action, and notify AS&E of their acceptability by 22 August. The failures are as follows:

a. High Voltage Power Supplies (Failure Report Q1 and Q2)-- high temperature -- vendor corrected component fault -- successfully requalified separately.

b. Accelerometer -- low temperature -- one of three faulty -- returned to vendor for Q.C. inspection -- testing continuing with two units.

c. PCM Encoder -- low temperature -- thermal path corrected and heater added -- successfully requalified.

d. Tape Recorder

e. Oscillator -- high temperature chamber runaway -- prototype units subjected to normal qual environment and worked acceptably -- qual unit oscillator replaced with prototype unit -- qual unit tape recorder left as is since one track is operating -- testing continuing.

T. Grace stated that AS&E should continue testing as presently planned and that NASA would notify AS&E shortly if there are any requalifications necessary on the above failures. Copies of all Failure Reports were given to T. Grace.

3. Schedule

The NAA, KSC and AS&E contract delivery schedules were discussed. A call from NAA indicated that OCP 0129 had slipped to the week of 29 August. In view of the slippage in the spacecraft delivery to KSC, it was agreed that AS&E could have additional time to perform extensive scientific testing on the experiment and conduct considerably more system testing. The delivery date for the flight units and GSE was tentatively set at 6 September, but could slip slightly as long as the units arrived at KSC one week before the spacecraft. The delivery for the flight spare units was

set at 21 October. These units have been supporting the NAA S/C Integration since April and will require checkout and calibration. NASA stated they would establish these new delivery dates in the contract change modification.

NASA indicated a possible launch date slippage and asked AS&E how the slippage would affect the present AS&E launch assumption of 15 January. AS&E stated that if a firm launch date could be given at an early date, AS&E would spread its efforts accordingly, however the present AS&E plan calls for launch support up until 15 January 1967.

4. Mission Requirements

a. The revised DEP (ASE-1351) was shown in draft form since it is presently being printed. It is expected to be transmitted to NASA by 24 August 1966.

b. Discussion concerning the RCS fuel requirements for S-17 showed that NASA requires a firmer definition from AS&E on the experimental requirements and operational procedures. J. Waters agreed to provide the best information available at this time by 1 September 1966. It was emphasized that these requirements are subject to changes due to the continuing progress in X-ray astronomy and modification of experiment objectives.

5. Documentation

AS&E stated all documentation requirements had been on time and the only outstanding document was the final Qualification Test Report.

6. Overrun Request

Mssrs. W. Brandenburg, N. Brackett and R. Burke discussed the ASE-1363, "Additional Funding Request" in a separate meeting. The discussion centered around the AS&E method of establishing overhead pools and reasons for the overhead increases. NASA stated it would fund the

$36,000 and requested that AS&E provide a more rigidly defined work statement for the scientific support modification.

APOLLO FAILURE REPORT

Date of Failure: Month 8 | Day 17 | Year 66

FR- Q-7

FAILURE DETECTED DURING:

Inspection _____ Functional Check _____ Acceptance _____ Qualification X

FAILED EQUIPMENT:

Electronics _____ Experiment X Data handling _____ Comp A _____ GSE _____

Lab unit _____ Qualification unit X Flight unit _____ Flight spare _____

FAILED ITEM:

	Name	AS&E P/N	AS&E S/N	Mfgr. P/N	Manufacturer
XXXXX	X-ray Detector	104-610-302			AS&E
Subassembly	Pre-Amp				
XXXXXXX					
XX					

DESCRIPTION OF FAILURE:

The malfunctioning pre-amp caused spurious pulses to be fed into the electronics. These pulses fed back through a common high voltage supply to other channels.

EFFECT OF FAILURE:

Performance Degraded X Equipment not Functioning _____

ACCUM TIME TO FAILURE:

35 Hrs _____ Min

DISPOSITION OF FAILED ITEM:

The unit was removed and replaced.

ORIGINATOR: **J. Boczenowski**

REPAIR ACTION:

PART REPLACEMENT

Adjustment	Part	P/N	S/N	Mfgr

FAILED PART DISPOSITION: Repair _____ Scrap _____ Return to Vendor _____

REPAIR:

Performed By _____ Accepted by _____

CAUSE OF FAILURE:

The failure was traced to an air bubble in the potted section of the unit which caused the unit to fail in a vacuum.

CORRECTIVE ACTION:

The faulty pre-amp was replaced and the system's operation verified by Quality Control. The Qualification program was then resumed.

APPROVED _____ 11-11

TO: MR. THOMAS GRACE
NASA, MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

8/22/66
ASE-JRW-385

VIA: DATA FAX

S-17 PRELIMINARY FAILURE REPORT

ITEM DURING THE INITIAL PUMPING DOWN TO VACUUM OF THE S-17 EXPERIMENTAL HARDWARE FOR THE TEMPERATURE-ALTITUDE CYCLE OF THE QUALIFICATION TEST PROGRAM, ONE OF THE X-RAY DETECTORS MALFUNCTIONED.

DESCRIPTION OF MALFUNCTION THE DETECTOR INJECTED A LARGE NUMBER OF SPURIOUS PULSES INTO THE ELECTRONICS PARTICULARLY THE GUARD CHANNEL. THESE PULSES FED BACK THROUGH A COMMON HIGH VOLTAGE POWER SUPPLY TO OTHER CHANNELS.

ACTION TAKEN THIS TYPE OF FAILURE IS SOMETIMES EVIDENCE OF A LEAK THROUGH THE WINDOWS OF THE DETECTOR. IF SO, PROLONGED HIGH VACUUM WILL PUMP OUT THE DETECTOR AND IT WILL CEASE TO PRODUCE SPURIOUS PULSES. ACCORDINGLY, THE TEST CYCLE WAS CONTINUED. HOWEVER, THE SPURIOUS PULSES PERSISTED THROUGHOUT THE TEST DURATION. CLOSER INVESTIGATION WILL BE REQUIRED TO DETERMINE THE EXACT CAUSE OF FAILURE.

ON COMPLETION OF THE TEST CYCLE, THE FAULTY COUNTER WAS REMOVED FROM THE CIRCUIT AND A NEW UNIT CONNECTED. THE EQUIPMENT WAS REEVACUATED TO 10^{-6} PSIA AND PERFORMED NORMALLY.

DISCUSSION OF FAILURE THIS DETECTOR WAS ONE UNIT OF EIGHT IN THE EQUIPMENT. DURING PREINSTALLATION TESTING EACH DETECTOR IS SUBJECTED TO THREE VACUUM CYCLES, ONE OF WHICH IS OF 100 HOUR DURATION, WHICH NORMALLY SERVES TO REJECT FAULTY UNITS. HOWEVER, DUE TO THE DELICATE NATURE OF THE DETECTORS CAUSED BY THE TWO MIL BERYLLIUM WINDOWS, ADDITIONAL RANDOM FAILURES CAN OCCUR. THE FACT THAT REPLACEMENT OF THE FAULTY UNIT BY A NEW ONE CAUSED NORMAL OPERATION TO BE RESUMED SHOWS THAT SUCH A FAILURE OCCURRED.

PROPOSED ACTION AS&E PROPOSES TO REPLACE THE FAULTY COUNTER WITH THE NEW ONE WHICH UNDERWENT THE VACUUM TEST DESCRIBED ABOVE AND TO PROCEED WITH THE QUALIFICATION TEST PROGRAM. SINCE THE UNAFFECTED HALF OF THE EXPERIMENTAL UNIT BEHAVED NORMALLY DURING THE THERMAL CYCLING AND SINCE A MAXIMUM TEMPERATURE EXCURSION OF ONLY 5°F WAS OBSERVED BY THE INTERNAL TEMPERATURE MONITORS, WE BELIEVE THAT THE CRITICAL PART OF THIS TEST, AS FAR AS THE COUNTERS ARE CONCERNED, IS THE ADDITIONAL VACUUM CYCLE.

IT SHOULD BE NOTED THAT THE COUNTERS ARE TESTED FOR PROLONGED PERIODS AT -60°F AND $+160^{\circ}$F AS PART OF THEIR INITIAL ACCEPTANCE TESTING. ACCORDINGLY, AFTER PERMANENT INSTALLATION OF THE COUNTER, WE INTEND TO PROCEED WITH VIBRATION TESTING.

YOUR CONCURRENCE WITH THIS PROPOSAL IS URGENTLY REQUIRED TO OBVIATE POSSIBLE SCHEDULE IMPACT.

J. R. WATERS, PROJECT DIRECTOR

FAILURE REPORT (Q7)

X-ray Detector and Preamplifier Serial No. 2019A

Description of Failure

This Unit was installed in the Experiment Sensor Qualification Unit. Prior to commencement of the Temperature-Altitude test, after pumping down to 10^{-6} psia, a large number of spurious pulses were observed. This condition persisted throughout the duration of the test. It was observed that the Count Rate Meter output of the +Y channel was very high.

Cause of Failure

This type of failure is typical of high voltage breakdown. The counter was removed from the Qualification Unit and the preamp. cover taken off to enable the contents to be observed. It was placed in a small vacuum chamber and slowly pumped down with the high voltage (+2500 V) on. As the pressure decreased an internal blue arc could be observed from the high voltage terminal to ground. The potting material was cut open to observe the path of the discharge. A small air bubble in the potting material was found adjacent to the high voltage terminal. It was also observed that both transistors in the preamplifier were shorted out due to the prolonged sparking that had taken place.

Other Failures

Failures of other counter assemblies have been observed but these have been detected during assembly and checkout. The most common mode of counter failure is a failure of the beryllium windows but these are detected during the ATP.

Corrective Action

Potting procedures have been reviewed in order to try to eliminate trapped air bubbles. These procedures already include degassing of the potting compound and vacuum outgassing of the unit when poured full. Due to the very compact design, significant improvements are hard to achieve without the possibility of causing an air trapping situation in another area.

Proposal Action

Detector units are routinely tested under vacuum for corona after complete assembly and potting. However, as a new procedure, the complete X-ray sensor packages will now be vacuum tested before going

into acceptance testing. It should be noted that it is desirable to limit the number of vacuum cycles that the counters undergo since these can lead to failures of the delicate two mil beryllium windows.

Schedule Impact

The counter was replaced with a spare unit and the Qualification Unit retested satisfactorily. The additional vacuum testing of the Flight Units will require one day extra.

Approved: A. Castellano

A. Castellano
Manager, Quality Assurance

J. R. Waters
Project Director

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NASA

cc: FG
JTW
FJK
10/10/66

BT

UNCLAS EX42/T129-66/

FOR DR JOHN WATERS

SUBJECT/ AS&E FAILURE REPORT Q-7.

THE SUBJECT FAILURE REPORT HAS BEEN REVIEWED BY THE EXPERIMENTS PROGRAM OFFICE AND THE FOLLOWING DIRECTIONS ARE SUBMITTED/

PROCEED AS YOU DESCRIPED BY/

A. DEGASSING THE POTTING COMPOUND AND VACUUM OUTGASSING THE COUNTER UNITS WHEN POURED FULL.

B. VACUUM TEST THE COMPLETE X-RAY SENSOR PACKAGE BEFORE GOING INTO ACCEPTANCE TESTING.

SGD NORMAN G FOSTER MGR TEST AND OPERATIONS

BT

RECEIVED
OCT 10 1966
AMERICAN SCIENCE & ENGINEERING, INC.

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ATTACHMENT III

FUNCTIONAL TEST DATA

ATTACHMENT III

"REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR"

AS&E APOLLO X-RAY ASTRONOMY EXPERIMENT
ENVIRONMENTAL TEST DATA SHEET

Type of Test: HIGH TEMPERATURE - ATTEMPT NO. 1

Test Start-Time: 1200 Date: 25 JUL 66 Test Complete-Time: 0400 Date: 26 JUL 66

GSE Clock Reading-Start: _____ Complete: _____

Environmental Test Equipment:

Manuf.: AM. RES. CORP Model No.: ARC-2 Serial No.: AF-186

Cal Date: 7-66 Other Data: SYSTEM 82

Functional Test Data:

Digital Test:	Pre-Environment	Post Environment
	Pass ✓ Fail _____	Pass _____ Fail _____

Power Cons.:	Pre-Environment	Post Environment
Current	1.25 a	_____
Voltage	27.5 v	_____

"REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR"

Calibration:

Pre-Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.	
X CRC	60 Sec	186	2598	2566	2576	2464	2604	126	2567	
	30 Sec	-	651	634	634	602	624	-	629	
Y CRC	60 Sec	552	2432	2328	2284	2366	2412	542	2365	
	30 Sec	-	105	88	88	102	116	-	100	
PHA 1	60 Sec	160	1576	1578	1446	1400	1680	136	1536	
	30 Sec	-	420	436	390	396	518	-	432	
PHA 2	60 Sec	94	426	378	256	556	442	80	412	
	30 Sec	-	14	26	16	18	16	-	18	
PHA 3	60 Sec	96	466	444	318	576	482	82	457	
	30 Sec	-	23	22	18	20	20	-	21	
PHA 4	60 Sec	94	736	718	756	700	738	82	730	
	30 Sec	-	20	22	16	18	16	-	18	
PHA 5	60 Sec	98	426	378	240	546	436	86	405	
	30 Sec	-	20	26	22	18	20	-	21	
PHA 6	60 Sec	94	410	368	236	540	410	82	393	
	30 Sec	-	14	24	18	18	16	-	18	
PHA 7	60 Sec	14	18	10	14	14	14	18	14	
	30 Sec	-	18	16	18	12	18	-	16	
PHA 8	60 Sec	464	490	466	336	622	554	410	494	
	30 Sec	-	60	58	64	58	66	-	61	
X_o CRM	30 Sec	.03	.13	.11	.14	.14	.11	.03		
	60 Sec	-	.35	.35	.34	.30	.34	-		
X+ CRM		.08	-	-	-	-	-	.09		
X- CRM		1.1	-	-	-	-	-	1.1		
Y_o CRM	30 Sec	.05	.04	.04	.04	.04	.04	.45		
	60 Sec	-	.40	.41	.40	.38	.42	-		
Y+ CRM		.09	-	-	-	-	-	.10		
Y- CRM		.60	-	-	-	-	-	.57		
B_x CRM		.08	-	-	-	-	-	.06		
B_y CRM		.04	-	-	-	-	-	.04		
DURATION		100	50.8	50	50	50.2	50.2	100.5		

TEMP. 73°F

"REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR"

Calibration:

Post Environment

Channel	Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.	
X CRC 60 Sec									
30 Sec									
Y CRC 60 Sec									
30 Sec									
PHA 1 60 Sec									
30 Sec									
PHA 2 60 Sec									
30 Sec									
PHA 3 60 Sec									
30 Sec									
PHA 4 60 Sec									
30 Sec									
PHA 5 60 Sec									
30 Sec									
PHA 6 60 Sec									
30 Sec									
PHA 7 60 Sec									
30 Sec									
PHA 8 60 Sec									
30 Sec									
X_o CRM 30 Sec									
60 Sec									
X+ CRM									
X- CRM									
Y_o CRM 30 Sec									
60 Sec									
Y+ CRM									
Y- CRM									
B_x CRM									
B_y CRM									

"REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR"

Star Sensor: Signal	Pre-Environment Voltage	Post-Environment Voltage
QUAD 1	1.21	
QUAD 2	1.15	
QUAD 3	1.18	
QUAD 4	1.20	
X AXIS	0.40	
Y AXIS	0.25	
BRIGHT	3.64	
LAMP	0.45	

Post Test Inspection Results: AFTER 20 HR SOAK AT 160°F (EXPERIMENT OPERATING) NO COUNTS WERE OBTAINED DURING THE CALIBRATION TEST THE DIGITAL TEST WORKED SUCCESSFULLY. MONITORS INDICATED NO OUTPUT FROM EITHER HIGH VOLTAGE POWER SUPPLY. POWER SUPPLIES WERE THUS REMOVED FOR ANALYSIS.

Failure Data: BOTH HIGH VOLTAGE SUPPLIES FAILED AS NOTED IN TH ATTACHED FAILURE ANALYSIS REPORT. CORRECTIVE ACTION IS AS NOTED THEREIN. SUPPLIES WERE REPLACED AND TESTING RESUMED ON 1 AUG 66

Test Performed by:

AVCO: – AS&E K Gaillardetz

AS&E QC: J. Bogdanowski

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

(2A/2)

AS&E APOLLO X-RAY ASTRONOMY EXPERIMENT
ENVIRONMENTAL TEST DATA SHEET

Type of Test: LOW TEMPERATURE

Test Start-Time: 2015 Date: 1 AUG 66 Test Complete-Time: 0700 Date: 2 AUG 66

GSE Clock Reading-Start: 2013 Complete: 212

Environmental Test Equipment:

Manuf.: CONRAD Model No.: 10×10×10 Serial No.: AF 397

Cal Date: 4·66 Other Data: —

Functional Test Data:

Digital Test:	Pre-Environment	Post Environment	DURING ENV
	Pass ✓ Fail ____	Pass ✓ Fail ____	✓ ____

Power Cons.:	Pre-Environment	Post Environment	DURING ENV.
Current	1.28 a	1.28 a	1.28 a
Voltage	27.5 v	27.5 v	27.5 v

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Pre-Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC	60 Sec	236	2064	1104	1914	1920	1865	200	1922
	30 Sec	–	515	276	478	480	466	–	480
Y CRC	60 Sec	1386	2174	2240	2074	2240	2220	1928	2090
	30 Sec	–	611	558	520	592	555	–	535
PHA 1	60 Sec	106	908	948	956	965	952	120	951
	30 Sec	–	645	614	532	552	642	–	611
PHA 2	60 Sec	40	116	92	78	122	94	26	93
	30 Sec	–	8	8	8	14	14	–	12
PHA 3	60 Sec	28	76	72	72	78	74	18	74
	30 Sec	–	16	8	8	16	12	–	16
PHA 4	60 Sec	82	652	652	668	624	678	76	655
	30 Sec	–	16	18	16	16	20	–	15
PHA 5	60 Sec	45	188	146	168	218	178	38	179
	30 Sec	–	16	8	12	16	12	–	12
PHA 6	60 Sec	30	112	110	106	128	110	20	113
	30 Sec	–	12	8	10	10	12	–	10
PHA 7	60 Sec	14	14	14	12	16	12	14	14
	30 Sec	–	18	10	14	12	12	–	13
PHA 8	60 Sec	402	192	200	178	184	176	398	186
	30 Sec	–	56	52	64	44	48	–	53
X_o CRM	30 Sec	.03	.14	.11	.14	.11	.15	.04	
	60 Sec	–	.20	.21	.22	.20	.23	–	
X+ CRM		–	.01	–	–	–	.01	–	
X- CRM		–	1.03	–	–	–	.95	–	
Y_o CRM	30 Sec	.09	.14	.13	.13	.11	.10	.10	
	60 Sec	–	.30	.30	.27	.31	.30	–	
Y+ CRM		–	.03	–	–	–	.03	–	
Y- CRM		–	.47	–	–	–	.47	–	
B_x CRM		–	.03	–	–	–	.03	–	
B_y CRM		–	.02	–	–	–	.02	–	
DURATION		100	50.8	51.5	50.2	49.8	49.8	100	

TEMP : 92° F

"REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR"

Calibration:

Pre-Environment

Channel	Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC 60 Sec	206	1734	1686	1676	1725	1715	231	1763
30 Sec	-	646	633	626	615	621	-	624
Y CRC 60 Sec	1467	2012	1987	1918	1850	1857	1154	1921
30 Sec	-	454	496	360	351	4[illegible]	-	446
PHA 1 60 Sec	162	758	764	746	760	751	167	756
30 Sec	-	432	438	462	428	445	-	439
PHA 2 60 Sec	37	112	108	120	118	121	35	116
30 Sec	-	12	13	4	2	6	-	7
PHA 3 60 Sec	28	98	100	96	100	96	29	98
30 Sec	-	12	11	4	2	4	-	7
PHA 4 60 Sec	76	706	666	692	732	735	83	706
30 Sec	-	30	24	10	8	16	-	18
PHA 5 60 Sec	43	150	156	152	126	142	39	145
30 Sec	-	12	12	8	8	8	-	10
PHA 6 60 Sec	32	102	110	104	114	114	30	109
30 Sec	-	14	10	4	2	2	-	6
PHA 7 60 Sec	14	12	18	16	10	18	16	15
30 Sec	-	12	10	4	2	6	-	7
PHA 8 60 Sec	357	170	168	202	184	180	384	181
30 Sec	-	44	43	50	46	45	-	46
X_o CRM 30 Sec	.03	.14	.13	.14	.15	.15	.04	
60 Sec	-	.21	.21	.22	.22	.22	-	
X+ CRM	.01	-	-	-	-	-	.02	
X- CRM	.98	-	-	-	-	-	.9	
Y_o CRM 30 Sec	.07	.11	.10	.10	.10	.09	.07	
60 Sec	-	.27	.28	.28	.32	.31	-	
Y+ CRM	.03	-	-	-	-	-	.03	
Y- CRM	.44	-	-	-	-	-	.45	
B_x CRM	.02	-	-	-	-	-	.02	
B_y CRM	.02	-	-	-	-	-	.02	
DURATION	100	51.5	51	50.8	51.2	51.2	100	

TEMP : -60° F

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Post Environment

Channel	Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC 60 Sec	146	1852	1764	1676	1772	1742	112	1731
30 Sec	-	660	632	678	634	624	-	637
Y CRC 60 Sec	1046	1966	1856	1844	1862	1796	1108	1873
30 Sec	-	344	358	352	402	344	-	365
PHA 1 60 Sec	116	740	770	712	760	706	128	738
30 Sec	-	434	452	464	464	396	-	436
PHA 2 60 Sec	18	162	152	172	140	158	42	145
30 Sec	-	2	6	2	4	4	-	3
PHA 3 60 Sec	16	88	128	152	130	142	42	128
30 Sec	-	0	4	2	4	4	-	3
PHA 4 60 Sec	48	722	764	701	720	770	42	715
30 Sec	-	1	12	16	6	14	-	10
PHA 5 60 Sec	22	136	158	188	164	176	54	163
30 Sec	-	2	2	4	4	6	-	4
PHA 6 60 Sec	16	100	136	156	144	196	42	136
30 Sec	-	2	4	4	6	4	-	4
PHA 7 60 Sec	18	18	16	18	14	14	14	15
30 Sec	-	6	4	8	6	6	-	5
PHA 8 60 Sec	350	170	208	216	196	224	336	203
30 Sec	-	56	40	28	40	42	-	41
X_o CRM 30 Sec	.04	.13	.13	.13	.14	.13	.04	
60 Sec	-	.18	.20	.22	.23	.22	-	
X+ CRM	.1	-	-	-	-	-	.07	
X- CRM	.95	-	-	-	-	-	.95	
Y_o CRM 30 Sec	.08	.10	.10	.10	.11	.09	.09	
60 Sec	-	.32	.30	.28	.30	.30	-	
Y+ CRM	.05	-	-	-	-	-	.04	
Y- CRM	.47	-	-	-	-	-	.46	
B_x CRM	.03	-	-	-	-	-	.03	
B_y CRM	.01	-	-	-	-	-	.01	
DURATION	100	51	50.5	50	50.5	50.2	100	

TEMP : 90° F

"REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR"

Star Sensor: Signal	Pre-Environment Voltage	Post-Environment Voltage	DURING VOLT
QUAD 1	1.25	1.26	1.29
QUAD 2	1.08	1.06	1.10
QUAD 3	0.93	0.92	0.93
QUAD 4	0.96	0.95	0.97
X AXIS	0.43	0.47	0.49
Y AXIS	0.24	0.23	0.27
BRIGHT	3.97	3.93	3.47
LAMP	0.45	0.45	0.452

Post Test Inspection Results: NO VISIBLE DAMAGE - NO PROBLEMS

Failure Data: NO FAILURES

Test Performed by:

AVCO: —

AS&E R J aillardetz

AS&E QC: J. Szymanski

NOTE: STAR SENSOR WAS QUALIFIED SEPARATELY AT AS&E

ATTACHMENT III

QA 2

AS&E APOLLO X-RAY ASTRONOMY EXPERIMENT
ENVIRONMENTAL TEST DATA SHEET

Type of Test: HIGH TEMPERATURE - ATTEMPT NO. 2

Test Start-Time: 1800 Date: 2 AUG 66 Test Complete-Time: 0700 Date: 4 AUG 66

GSE Clock Reading-Start: 212 Complete: 237.6

Environmental Test Equipment;

Manuf.: CONRAD Model No.: 10 x 10 x 10 Serial No.: AF 377

Cal Date: 4-66 Other Data: —

Functional Test Data:

Digital Test:	Pre-Environment	Post Environment	DURING ENV
	Pass ✓ Fail ____	Pass ✓ Fail ____	✓ ____

Power Cons.:	Pre-Environment	Post Environment	DURING ENV
Current	1.3 a	1.3 a	1.3 a
Voltage	27.5 v	27.5 v	27.5 v

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Pre-Environment NOTE : SAME AS POST - LOW TEMP DATA

Channel	Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC 60 Sec	146	1752	1714	1676	1772	1742	112	1731
30 Sec	-	660	632	615	654	620	-	637
Y CRC 60 Sec	1666	1966	1826	1844	1962	1790	1669	1833
30 Sec	-	344	398	352	462	344	-	368
PHA 1 60 Sec	116	740	770	772	760	706	128	738
30 Sec	-	434	452	424	464	396	-	430
PHA 2 60 Sec	18	102	152	172	140	158	42	145
30 Sec	-	0	6	2	4	4	-	3
PHA 3 60 Sec	16	88	128	152	130	142	42	128
30 Sec	-	0	4	2	4	4	-	3
PHA 4 60 Sec	48	722	704	700	720	730	42	715
30 Sec	-	0	12	16	6	14	-	10
PHA 5 60 Sec	22	130	158	188	164	176	54	163
30 Sec	-	2	2	4	4	6	-	4
PHA 6 60 Sec	16	100	136	156	144	148	42	136
30 Sec	-	2	4	4	6	4	-	4
PHA 7 60 Sec	18	18	10	18	14	14	14	15
30 Sec	-	0	4	8	6	6	-	5
PHA 8 60 Sec	350	170	208	216	196	224	336	203
30 Sec	-	56	46	28	46	42	-	41
X_o CRM 30 Sec	.04	.13	.13	.13	.14	.13	.04	
60 Sec	-	.18	.20	.22	.23	.22	-	
X+ CRM	.1	-	-	-	-	-	.07	
X- CRM	.55	-	-	-	-	-	.55	
Y_o CRM 30 Sec	.08	.10	.10	.10	.11	.09	.09	
60 Sec	-	.32	.30	.28	.30	.30	-	
Y+ CRM	.05	-	-	-	-	-	.04	
Y- CRM	.47	-	-	-	-	-	.46	
B_x CRM	.03	-	-	-	-	-	.03	
B_y CRM	.01	-	-	-	-	-	.01	
DURATION	100	51	50.5	50	50.5	50.2	100	

TEMP : 90° F

Taken at conclusion of 2a Run while still at test temperature

(2A)

Calibration:

Post Environment

NOTE : RELATIVE HUMIDITY IS 10%

Channel	Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC 60 Sec	114	1710	1624	1622	1610	1702	158	1614
30 Sec	-	604	611	555	574	631	-	554
Y CRC 60 Sec	1148	1902	1930	1860	1904	1814	1176	1886
30 Sec	-	284	264	284	244	254	-	266
PHA 1 60 Sec	44	782	682	536	626	708	94	689
30 Sec	-	498	596	552	464	585	-	526
PHA 2 60 Sec	8	40	46	44	38	52	4	44
30 Sec	-	2	0	0	2	0	-	1
PHA 3 60 Sec	4	120	128	116	104	130	2	126
30 Sec	-	2	2	4	0	4	-	2
PHA 4 60 Sec	20	606	600	590	588	588	22	594
30 Sec	-	2	0	10	6	2	-	4
PHA 5 60 Sec	14	80	86	96	90	92	14	89
30 Sec	-	6	2	2	6	4	-	4
PHA 6 60 Sec	2	24	12	12	12	24	0	17
30 Sec	-	0	2	0	0	0	-	0
PHA 7 60 Sec	8	4	2	4	8	2	6	4
30 Sec	-	2	0	2	4	2	-	2
PHA 8 60 Sec	300	120	118	106	114	120	328	116
30 Sec	-	30	42	32	30	40	-	35
X_o CRM 30 Sec	.04	.13	.13	.12	.12	.13	.04	
60 Sec	-	.20	.23	.22	.20	.24	-	
X+ CRM	.02	-	-	-	-	-	.02	
X- CRM	.94	-	-	-	-	-	.87	
Y_o CRM 30 Sec	.09	.09	.09	.09	.08	.10	.09	
60 Sec	-	.28	.32	.33	.31	.30	-	
Y+ CRM	.05	-	-	-	-	-	.05	
Y- CRM	.30	-	-	-	-	-	.31	
B_x CRM	.03	-	-	-	-	-	.03	
B_y CRM	.02	-	-	-	-	-	.02	
DURATION	100	51.5	50.6	50.6	50.6	50.6	100	

TEMP : 160° F

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

QA .2

Calibration:

Post Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC	60 Sec	114	1726	1694	1788	1760	1648	122	1727
	30 Sec	-	6[illegible]	6[illegible]	6[illegible]	5[illegible]	5[illegible]	-	59[illegible]
Y CRC	60 Sec	1052	1800	1824	1870	1874	1696	910	1827
	30 Sec	-	3[illegible]	324	3[illegible]	292	254	-	31[illegible]
PHA 1	60 Sec	56	772	772	744	756	740	56	757
	30 Sec	-	5[illegible]2	482	46[illegible]	442	424	-	462
PHA 2	60 Sec	2	40	40	36	40	38	4	39
	30 Sec	-	0	0	0	0	0	-	0
PHA 3	60 Sec	8	122	110	134	126	110	10	118
	30 Sec	-	0	0	2	0	2	-	1
PHA 4	60 Sec	38	652	666	688	662	652	24	664
	30 Sec	-	2	8	4	0	6	-	4
PHA 5	60 Sec	18	48	44	44	48	44	8	46
	30 Sec	-	2	4	4	0	0	-	2
PHA 6	60 Sec	2	26	16	24	16	18	4	20
	30 Sec	-	1	0	0	0	0	-	0
PHA 7	60 Sec	16	4	4	10	2	8	10	6
	30 Sec	-	2	4	6	2	4	-	4
PHA 8	60 Sec	316	104	134	128	122	128	322	123
	30 Sec	-	40	32	46	38	38	-	39
X_o CRM	30 Sec	.04	.14	.12	.14	.13	.13	.04	
	60 Sec	-	.22	.20	.22	.21	.20	-	
X+ CRM		.14	-	-	-	-	-	.13	
X- CRM		.9	-	-	-	-	-	.9	
Y_o CRM	30 Sec	.08	.07	.08	.09	.08	.09	.08	
	60 Sec	-	.27	.30	.28	.30	.28	-	
Y+ CRM		.03	-	-	-	-	-	.03	
Y- CRM		.48	-	-	-	-	-	.45	
B_x CRM		.03	-	-	-	-	-	.03	
B_y CRM		.02	-	-	-	-	-	.02	
DURATION		100	50.8	50.5	50.2	50.2	49.3	100	

TEMP: 80° F

"REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR"

Star Sensor:	Pre-Environment	Post Environment	DURING
Signal	Voltage	Voltage	VOLT
QUAD 1	1.26	1.23	1.04
QUAD 2	1.06	1.08	1.03
QUAD 3	0.92	0.94	1.20
QUAD 4	0.95	1.00	1.46
X AXIS	0.47	0.40	0.45
Y AXIS	0.23	0.22	0.15
BRIGHT	3.93	3.70	2.50
LAMP	0.45	0.45	0.451

Post Test Inspection Results:

No visible damage - no problems

Failure Data: No failures

Test Performed by:

Avco: _____ AS&E R Gaillardetz

AS&E QC: John Sorrentino

NOTE: Star Sensor was qualified separately at AS&E

ATTACHMENT III

QA

AS&E APOLLO X-RAY ASTRONOMY EXPERIMENT
ENVIRONMENTAL TEST DATA SHEET

Type of Test: ACCELERATION

Test Start-Time: 1200 Date: 9 Aug 66 Test Complete-Time: 1700 Date: 10 Aug 66

GSE Clock Reading-Start: 237.6 Complete: 239.8

Environmental Test Equipment;

Manuf.: GENISCO Model No.: E-195 Serial No.: 8

Cal Date: _____ Other Data: —

Functional Test Data:

Digital Test;	Pre-Environment	Post Environment
	Pass ✓ Fail _____	Pass ✓ Fail _____

Power Cons.:	Pre-Environment	Post Environment
Current	1.3 a	1.28 a
Voltage	27.5 v	27.5 v

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Pre-Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC	60 Sec	152	1736	1754	1776	1748	1760	154	1753
	30 Sec	-	766	684	670	658	672	-	682
Y CRC	60 Sec	1138	2172	2014	2128	2070	2048	1312	2096
	30 Sec	-	596	592	588	564	548	-	576
PHA 1	60 Sec	84	862	850	902	820	876	156	862
	30 Sec	-	540	566	526	524	542	-	546
PHA 2	60 Sec	14	74	118	72	96	120	12	96
	30 Sec	-	0	8	4	2	4	-	4
PHA 3	60 Sec	16	66	100	64	68	100	10	80
	30 Sec	-	6	6	4	2	2	-	3
PHA 4	60 Sec	46	720	712	706	696	734	42	714
	30 Sec	-	2	12	10	4	12	-	8
PHA 5	60 Sec	22	118	136	124	120	148	12	129
	30 Sec	-	4	8	8	4	10	-	7
PHA 6	60 Sec	10	96	118	78	82	116	14	98
	30 Sec	-	2	6	6	4	4	-	4
PHA 7	60 Sec	18	16	16	14	14	16	14	15
	30 Sec	-	6	10	4	6	16	-	7
PHA 8	60 Sec	346	156	188	146	142	180	344	162
	30 Sec	-	44	42	36	34	42	-	40
X_o CRM	30 Sec	.03	.13	.15	.13	.14	.15	.03	
	60 Sec	-	.21	.22	.24	.22	.21	-	
X+ CRM		.18	-	-	-	-	-	.20	
X- CRM		.95	-	-	-	-	-	.95	
Y_o CRM	30 Sec	.09	.13	.13	.12	.12	.12	.08	
	60 Sec	-	.30	.26	.30	.30	.28	-	
Y+ CRM		.03	-	-	-	-	-	.04	
Y- CRM		.50	-	-	-	-	-	.48	
B_x CRM		.03	-	-	-	-	-	.03	
B_y CRM		.02	-	-	-	-	-	.03	
DURATION		100	50.5	-	49.9	50.2	49.9	100	

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR;

Calibration:

Post Environment

Channel	Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC 60 Sec	162	1766	1734	1694	1784	1714	174	1737
30 Sec	-	880	864	842	824	832	-	836
Y CRC 60 Sec	1432	2035	2018	2018	2100	2152	1374	2075
30 Sec	-	515	515	515	485	525	-	519
PHA 1 60 Sec	94	856	832	810	866	774	132	838
30 Sec	-	502	498	476	516	428	-	484
PHA 2 60 Sec	10	144	154	140	158	160	22	151
30 Sec	-	8	2	2	4	10	-	5
PHA 3 60 Sec	10	128	142	120	138	142	16	134
30 Sec	-	4	2	2	0	4	-	2
PHA 4 60 Sec	42	700	658	694	708	690	50	678
30 Sec	-	10	8	8	8	4	-	8
PHA 5 60 Sec	16	162	186	136	156	180	22	164
30 Sec	-	12	8	4	4	4	-	6
PHA 6 60 Sec	12	144	154	126	148	146	18	144
30 Sec	-	4	4	2	4	0	-	3
PHA 7 60 Sec	16	10	12	14	12	10	14	12
30 Sec	-	6	4	6	2	4	-	4
PHA 8 60 Sec	390	230	266	210	260	256	418	244
30 Sec	-	54	44	38	52	52	-	48
X_o CRM 30 Sec	.03	.13	.15	.13	.13	.13	.04	
60 Sec	-	.19	.23	.21	.22	.20	-	
X+ CRM	.19	-	-	-	-	-	.20	
X- CRM	1.0	-	-	-	-	-	1.0	
Y_o CRM 30 Sec	.09	.12	.13	.10	.13	.12	.09	
60 Sec	-	.28	.28	.30	.30	.30	-	
Y+ CRM	.04	-	-	-	-	-	.04	
Y- CRM	.50	-	-	-	-	-	.50	
B_x CRM	.04	-	-	-	-	-	.04	
B_y CRM	.04	-	-	-	-	-	.04	
DURATION	100	51	49.2	50	50.2	50	100	

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Star Sensor:	Pre-Environment	Post Environment
Signal	Voltage	Voltage
QUAD 1	1.40	1.40
QUAD 2	1.25	1.25
QUAD 3	1.05	1.05
QUAD 4	1.10	1.05
X AXIS	0.60	0.70
Y AXIS	0.25	0.25
BRIGHT	3.67	3.60
LAMP	0.455	0.455

Post Test Inspection Results: no damage - Everything secure

Failure Data: no failures

Test Performed by:

TVCO: _____ AS&E R Gaillardetz

AS&E QC: John Cosgrowski QA

AS&E APOLLO X-RAY ASTRONOMY EXPERIMENT
ENVIRONMENTAL TEST DATA SHEET

Type of Test: RANDOM VIBRATION

Test Start-Time: 1400 Date: 12 Aug 66 Test Complete-Time: 1200 Date: 15 Aug 66

GSE Clock Reading-Start: 240 Complete: _____

Environmental Test Equipment:

Manuf.: LING Model No.: 15000 g-16 Serial No.: C41

Cal Date: - Other Data: CLUSTER CONTROLS

Functional Test Data:

Digital Test:	Pre-Environment	Post Environment
	Pass ✓ Fail _____	Pass ✓ Fail _____

Power Cons.:	Pre-Environment	Post Environment
Current	1.3 a	1.28 a
Voltage	27.5 v	27.5 v

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

QA 2

Calibration:

Pre-Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.	
X CRC	60 Sec	162	1760	1734	1674	1784	1714	174	1737	
	30 Sec	–	680	604	612	624	632	–	630	
Y CRC	60 Sec	1432	2038	2068	2018	2100	2152	1814	2015	
	30 Sec	–	515	515	515	485	525	–	519	
PHA 1	60 Sec	94	856	832	860	866	774	132	838	
	30 Sec	–	502	498	476	516	478	–	484	
PHA 2	60 Sec	10	144	154	140	158	160	22	151	
	30 Sec	–	8	2	2	4	10	–	5	
PHA 3	60 Sec	10	128	142	120	138	142	16	134	
	30 Sec	–	4	2	2	0	0	–	2	
PHA 4	60 Sec	42	700	698	694	708	690	50	698	
	30 Sec	–	10	8	8	8	4	–	8	
PHA 5	60 Sec	16	162	186	136	156	180	22	164	
	30 Sec	–	12	8	4	4	4	–	6	
PHA 6	60 Sec	12	144	154	126	148	146	18	144	
	30 Sec	–	4	4	2	4	0	–	3	
PHA 7	60 Sec	16	10	12	14	12	10	14	12	
	30 Sec	–	6	4	6	2	4	–	4	
PHA 8	60 Sec	390	230	266	210	260	256	418	244	
	30 Sec	–	54	44	38	52	52	–	48	
X_o CRM	30 Sec	.03	.13	.15	.13	.13	.13	.04		
	60 Sec	–	.19	.23	.21	.22	.20	–		
X+ CRM		.19	–	–	–	–	–	.20		
X- CRM		1.0	–	–	–	–	–	1.0		
Y_o CRM	30 Sec	.09	.12	.13	.10	.13	.12	.09		
	60 Sec	–	.28	.28	.30	.30	.30	–		
Y+ CRM		.04	–	–	–	–	–	.04		
Y- CRM		.50	–	–	–	–	–	.50		
B_x CRM		.04	–	–	–	–	–	.04		
B_y CRM		.04	–	–	–	–	–	.04		
DURATION		100	51	49.2	50	50.2	50	100		

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Post Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC	60 Sec	166	1912	1910	1944	1834	1806	190	1881
	30 Sec	-	784	778	826	724	750	-	772
Y CRC	60 Sec	1458	2132	2226	2222	2088	2088	1444	2151
	30 Sec	-	585	620	600	540	600	-	589
PHA 1	60 Sec	98	1110	952	1048	914	944	112	994
	30 Sec	-	786	594	708	588	646	-	665
PHA 2	60 Sec	12	56	64	82	54	42	26	60
	30 Sec	-	4	4	6	4	2	-	4
PHA 3	60 Sec	12	42	48	62	42	36	22	46
	30 Sec	-	2	2	4	4	2	-	3
PHA 4	60 Sec	64	604	650	618	606	568	72	609
	30 Sec	-	10	6	12	10	12	-	10
PHA 5	60 Sec	26	154	130	156	162	152	36	151
	30 Sec	-	4	6	8	6	6	-	6
PHA 6	60 Sec	14	112	116	100	108	106	28	108
	30 Sec	-	6	2	4	6	2	-	4
PHA 7	60 Sec	12	18	14	16	18	12	18	16
	30 Sec	-	4	4	6	6	6	-	5
PHA 8	60 Sec	420	194	156	188	208	148	426	179
	30 Sec	-	70	44	58	58	52	-	56
X_o CRM	30 Sec	.03	.16	.16	.16	.15	.15	.03	
	60 Sec	-	.21	.22	.24	.21	.20	-	
X+ CRM		.21	-	-	-	-	-	.21	
X- CRM		1.03	-	-	-	-	-	1.00	
Y_o CRM	30 Sec	.09	.13	.14	.14	.12	.13	.09	
	60 Sec	-	.27	.30	.30	.30	.28	-	
Y+ CRM		.17	-	-	-	-	-	.15	
Y- CRM		.50	-	-	-	-	-	.50	
B_x CRM		.04	-	-	-	-	-	.05	
B_y CRM		.04	-	-	-	-	-	.04	
DURATION		100	50.8	50.5	50.1	50	50	100	

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Star Sensor: Signal	Pre-Environment Voltage	Post-Environment Voltage
QUAD 1	1.40	1.41
QUAD 2	1.25	1.32
QUAD 3	1.05	1.10
QUAD 4	1.05	1.10
X AXIS	0.70	0.55
Y AXIS	0.25	0.20
BRIGHT	3.60	3.91
LAMP	0.455	0.454

Post Test Inspection Results: UNIT OK ALL TESTS PERFORMED

Failure Data: NO FAILURES

Test Performed by:

AVCO: – AS&E R J aillardetz

AS&E QC: J. Bozenowski

AS&E APOLLO X-RAY ASTRONOMY EXPERIMENT
ENVIRONMENTAL TEST DATA SHEET

Type of Test: TEMPERATURE - ALTITUDE

Test Start-Time: 1400 Date: 17 AUG 66 Test Complete-Time: 1145 Date: 26 AUG 66

GSE Clock Reading-Start: 247.4 Complete: 305.0

Environmental Test Equipment;

Manuf.: AVCO Model No.: 10' Serial No.: _____

Cal Date: _____ Other Data: _____

Functional Test Data;

Digital Test;	Pre-Environment	Post Environment
	Pass ✓ Fail _____	Pass ✓ Fail _____

Power Cons.:	Pre-Environment	Post Environment
Current	1.28 a	1.3 a
Voltage	27.5 v	27.5 v

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Pre-Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.		
X CRC	60 Sec	70	1876	1852	1776	1808	1812	66	1825		
	30 Sec	-	740	778	728	760	746	-	750		
Y CRC	60 Sec	242	1818	1818	1744	1762	1758	252	1780		
	30 Sec	-	460	440	340	380	350	-	394		
PHA 1	60 Sec	42	914	902	820	802	856	22	859		
	30 Sec	-	574	590	520	524	574	-	556		
PHA 2	60 Sec	4	62	64	54	54	44	2	56		
	30 Sec	-	0	4	2	4	2	-	2		
PHA 3	60 Sec	2	44	48	38	36	34	2	40		
	30 Sec	-	0	2	2	2	2	-	2		
PHA 4	60 Sec	12	616	584	568	598	586	20	590		
	30 Sec	-	4	8	2	8	6	-	6		
PHA 5	60 Sec	4	182	144	180	150	172	12	166		
	30 Sec	-	0	4	4	6	2	-	3		
PHA 6	60 Sec	4	112	120	98	90	98	2	104		
	30 Sec	-	0	2	4	2	2	-	2		
PHA 7	60 Sec	4	16	16	20	14	18	4	17		
	30 Sec	-	2	2	2	6	4	-	3		
PHA 8	60 Sec	236	136	112	116	116	118	256	120		
	30 Sec	-	36	24	34	36	28	-	32		
X_o CRM	30 Sec	.03	.14 ~~36~~	.16	.16	.14	.15	.04			
	60 Sec	-	.21	.21	.21	.20	.23	-			
X+ CRM		.19	-	-	-	-	-	.18			
X- CRM		1.00	-	-	-	-	-	.95			
Y_o CRM	30 Sec	.04	.10	.11	.10	.09	.10	.03			
	60 Sec	-	.26	.23	.26	.28	.26	-			
Y+ CRM		.04	-	-	-	-	-	.04			
Y- CRM		0	-	-	-	-	-	.01			
B_x CRM		.02	-	-	-	-	-	.02			
B_y CRM		.02	-	-	-	-	-	.02			
DURATION		100	49.7	50.0	49.8	50.0	49.5	100			

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Post Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.	
X CRC	60 Sec	108	1956	1822	1766	1720	1806	116	1816	
	30 Sec	-	802	726	704	682	714	-	726	
Y CRC	60 Sec	506	2078	1950	1982	2120	2062	480	2038	
	30 Sec	-	580	554	480	560	514	-	538	
PHA 1	60 Sec	34	712	644	606	580	650	38	638	
	30 Sec	-	494	454	400	378	450	-	435	
PHA 2	60 Sec	12	22	20	18	24	26	6	22	
	30 Sec	-	2	0	0	2	4	-	2	
PHA 3	60 Sec	22	42	70	52	44	62	16	54	
	30 Sec	-	4	2	8	2	6	-	4	
PHA 4	60 Sec	44	672	674	656	614	656	38	654	
	30 Sec	-	10	6	8	10	8	-	8	
PHA 5	60 Sec	8	116	90	82	84	82	6	91	
	30 Sec	-	2	2	4	4	4	-	3	
PHA 6	60 Sec	16	96	96	~~100~~ 120	100	116	16	106	
	30 Sec	-	4	0	~~8~~ 4	8	8	-	5	
PHA 7	60 Sec	6	2	6	2	4	6	6	4	
	30 Sec	-	2	0	0	2	2	-	1	
PHA 8	60 Sec	272	136	112	106	124	94	266	114	
	30 Sec	-	2	32	44	28	30	-	27	
X_o CRM	30 Sec	.03	.16	.15	.15	.13	.13	.03		
	60 Sec	-	.22	.23	.20	.20	.20	-		
X+ CRM		.4	-	-	-	-	-	.42		
X- CRM		.95	-	-	-	-	-	1.00		
Y_o CRM	30 Sec	.05	.13	.13	.13	.12	.12	.05		
	60 Sec	-	.28	.28	.27	.27	.28	-		
Y+ CRM		1.2	-	-	-	-	-	1.2		
Y- CRM		0	-	-	-	-	-	0		
B_x CRM		-	-	-	-	-	-	-		
B_y CRM		-	-	-	-	-	-	-		

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Star Sensor:	Pre-Environment	Post-Environment
Signal	Voltage	Voltage
QUAD 1	1.40	1.42
QUAD 2	1.25	1.25
QUAD 3	1.05	1.05
QUAD 4	1.10	1.05
X AXIS	0.50	0.55
Y AXIS	0.25	0.20
BRIGHT	3.85	3.50
LAMP	0.45	0.45

Post Test Inspection Results: FUNCTIONAL TEST INDICATED MALFUNCTIONING DETECTOR / PRE-AMP DURING THERMAL-VACUUM TEST. POST-TEST INVESTIGATION REVEALED TY CHANNEL COUNTER WAS AT FAULT. WHEN DISCONNECTED ALL OTHER CHANNELS BEHAVED NORMALLY. NEW DETECTOR / PRE-AMP WAS SUBSTITUTED AND UNIT OPERATED AT VACUUM FOR FIVE HOURS. OPERATION WAS NORMAL WITH DATA AS ABOVE

Failure Data: FAILURE ANALYSIS INDICATED HIGH VOLTAGE BREAKDOWN IN THE PRE-AMP. DETAILS AND RECOMMENDED ACTION ARE CONTAINED IN FAILURE REPORT Q7.

Test Performed by:

AVCO: _____ AS&E R. Gaillardetz

AS&E QC: J. Bozenowski

AS&E APOLLO X-RAY ASTRONOMY EXPERIMENT
ENVIRONMENTAL TEST DATA SHEET

Type of Test: SHOCK

Test Start-Time: 1200 Date: 8·26·66 Test Complete-Time: 1600 Date: 8·27·66

GSE Clock Reading-Start: 305.0 Complete: 306.2

Environmental Test Equipment;

Manuf.: AVCO Model No.: S00 L8 Serial No.: -

Cal Date: - Other Data: ENDEVCO ACCEL 22/K S/N JA04

Functional Test Data:

Digital Test;	Pre-Environment	Post Environment
	Pass ✓ Fail	Pass ✓ Fail

Power Cons.:	Pre-Environment	Post Environment
Current	1.3 a	1.3 a
Voltage	27.5 v	27.5 v

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Pre-Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC	60 Sec	108	1856	1922	1716	1720	1806	116	1816
	30 Sec	-	902	972	904	882	914	-	926
Y CRC	60 Sec	506	2078	1952	1982	2120	2062	480	2038
	30 Sec	-	586	554	480	560	514	-	538
PHA 1	60 Sec	34	712	644	606	580	650	38	638
	30 Sec	-	494	454	400	378	450	-	435
PHA 2	60 Sec	12	22	20	18	24	26	6	22
	30 Sec	-	2	0	0	2	4	-	2
PHA 3	60 Sec	22	42	70	52	44	62	16	54
	30 Sec	-	4	2	8	2	6	-	4
PHA 4	60 Sec	44	672	674	656	614	656	38	654
	30 Sec	-	10	6	8	10	8	-	8
PHA 5	60 Sec	8	116	90	82	84	82	6	91
	30 Sec	-	2	2	4	4	4	-	3
PHA 6	60 Sec	16	96	96	120	100	116	16	111
	30 Sec	-	4	0	4	8	8	-	5
PHA 7	60 Sec	6	2	6	2	4	6	6	4
	30 Sec	-	2	0	0	2	2	-	1
PHA 8	60 Sec	272	136	112	106	124	94	266	114
	30 Sec	-	2	32	44	28	30	-	27
X_o CRM	30 Sec	.03	.16	.15	.15	.13	.13	.03	
	60 Sec	-	.22	.23	.20	.20	.20	-	
X+ CRM		.4	-	-	-	-	-	.42	
X- CRM		.95	-	-	-	-	-	1.0	
Y_o CRM	30 Sec	.05	.13	.13	.13	.12	.12	.05	
	60 Sec	-	.28	.29	.27	.27	.28	-	
Y+ CRM		1.2	-	-	-	-	-	1.2	
Y- CRM		0	-	-	-	-	-	0	
B_x CRM		—	-	-	-	-	-	-	
B_y CRM		—	-	-	-	-	-	-	
DURATION		100	50.6	49.7	50.3	49.7	50.0	100	

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Post Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC	60 Sec	142	1784	1886	1916	1866	1866	141	1864
	30 Sec	–	700	810	784	762	752	–	762
Y CRC	60 Sec	842	2160	21[illegible]	2132	2022	2196	727	2128
	30 Sec	–	628	576	564	500	608	–	575
PHA 1	60 Sec	58	722	76[illegible]	754	664	734	42	727
	30 Sec	–	524	59[illegible]	532	478	532	–	536
PHA 2	60 Sec	6	30	[illegible]0	34	44	24	8	32
	30 Sec	–	0	[illegible]	6	12	0	–	4
PHA 3	60 Sec	12	34	[illegible]	58	48	50	14	48
	30 Sec	–	2	[illegible]	4	10	4	–	4
PHA 4	60 Sec	26	562	5[illegible]6	584	624	604	36	588
	30 Sec	–	0	[illegible]	2	12	2	–	4
PHA 5	60 Sec	10	146	1[illegible]	120	114	110	20	125
	30 Sec	–	0	[illegible]	2	12	0	–	3
PHA 6	60 Sec	8	200	[illegible]4	184	192	192	22	194
	30 Sec	–	4	[illegible]	4	16	0	–	6
PHA 7	60 Sec	2	4	[illegible]	6	16	2	6	7
	30 Sec	–	0	0	2	8	0	–	2
PHA 8	60 Sec	326	120	[illegible]24	128	128	140	306	128
	30 Sec	–	32	[illegible]36	36	40	52	–	39
X_0 CRM	30 Sec	.03	.13	.15	.16	.15	.15	.03	
	60 Sec	–	.21	.22	.23	.21	.23	–	
X+ CRM		.5	–	–	–	–	–	.48	
X- CRM		1.05	–	–	–	–	–	1.02	
Y_0 CRM	30 Sec	.08	.1[illegible]	.13	.13	.12	.13	.06	
	60 Sec	–	.2[illegible]	.26	.26	.28	.29	–	
Y+ CRM		1.25	–	–	–	–	–	1.25	
Y- CRM		0	–	–	–	–	–	0	
B_x CRM		–	–	–	–	–	–	–	–
B_y CRM		–	–	–	–	–	–	–	–
DURATION		100	50.5	50	50	49.9	50.4	100	

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Star Sensor:	Pre-Environment	Post Environment
Signal	Voltage	Voltage
QUAD 1	1.42	1.40
QUAD 2	1.25	1.25
QUAD 3	1.05	1.05
QUAD 4	1.05	1.10
X AXIS	0.55	0.6
Y AXIS	0.20	0.25
BRIGHT	3.50	3.95
LAMP	0.450	0.451

Post Test Inspection Results: no damage evidenced

Failure Data: no failures noted

Test Performed by:

Avco: _____ AS&E R Gaillardetz

AS&E QC: J. Sorgenowski

ATTACHMENT I II

AS&E APOLLO X-RAY ASTRONOMY EXPERIMENT
ENVIRONMENTAL TEST DATA SHEET

Type of Test: SINUSOIDAL VIBRATION

Test Start-Time: _____ Date: 8·29·66 Test Complete-Time: 2000 Date: 8·31·66

GSE Clock Reading-Start: 306.2 Complete: 323

Environmental Test Equipment;

Manuf.: CALIDYNG Model No.: 15000 J-14 Serial No.: C-41

Cal Date: - Other Data: CENTER CONTROLS

Functional Test Data:

Digital Test;	Pre-Environment	Post Environment
	Pass ✓ Fail _____	Pass ✓ Fail _____

Power Cons.:	Pre-Environment	Post Environment
Current	1.3 a	1.3 a
Voltage	27.5 v	27.5 v

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Pre-Environment

Channel	Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC 60 Sec	142	1784	1886	1916	1866	1946	141	1864
30 Sec	-	700	810	784	762	752	-	762
Y CRC 60 Sec	842	2160	2130	2132	2022	2196	727	2128
30 Sec	-	628	576	564	520	608	-	575
PHA 1 60 Sec	58	722	762	754	664	734	42	727
30 Sec	-	524	584	532	478	532	-	530
PHA 2 60 Sec	6	30	30	34	44	24	8	32
30 Sec	-	0	0	6	12	0	-	4
PHA 3 60 Sec	12	34	52	58	48	50	14	48
30 Sec	-	2	2	4	10	4	-	4
PHA 4 60 Sec	26	562	566	584	624	604	36	588
30 Sec	-	0	6	2	12	2	-	4
PHA 5 60 Sec	10	146	136	120	114	110	20	125
30 Sec	-	0	2	2	12	0	-	3
PHA 6 60 Sec	8	200	204	184	192	192	22	194
30 Sec	-	4	4	4	16	0	-	6
PHA 7 60 Sec	2	4	6	6	16	2	6	7
30 Sec	-	0	0	2	8	0	-	2
PHA 8 60 Sec	326	120	124	128	128	140	306	128
30 Sec	-	32	36	36	40	52	-	39
X_o CRM 30 Sec	.03	.13	.15	.16	.15	.15	.03	
60 Sec	-	.21	.22	.23	.24	.23	-	
X+ CRM	.5	-	-	-	-	-	.48	
X- CRM	1.05	-	-	-	-	-	1.02	
Y_o CRM 30 Sec	.08	.13	.13	.13	.12	.13	.06	
60 Sec	-	.26	.26	.26	.28	.29	-	
Y+ CRM	1.25	-	-	-	-	-	1.25	
Y- CRM	0	-	-	-	-	-	0	
B_x CRM	-	-	-	-	-	-	-	
B_y CRM	-	-	-	-	-	-	-	
DURATION	100	50.5	50	50	49.9	50.4	100	

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Post Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC	60 Sec	106	1674	1648	1634	1786	1780	120	1625
	30 Sec	-	810	868	740	720	742	-	772
Y CRC	60 Sec	624	2202	2186	2158	2038	2002	602	2113
	30 Sec	-	617	636	614	606	538	-	602
PHA 1	60 Sec	42	754	698	688	696	718	44	711
	30 Sec	-	582	568	478	568	526	-	524
PHA 2	60 Sec	4	30	34	36	34	24	0	32
	30 Sec	-	2	0	0	2	2	-	1
PHA 3	60 Sec	12	42	38	44	36	42	4	40
	30 Sec	-	4	2	4	6	6	-	4
PHA 4	60 Sec	14	556	550	582	562	546	26	559
	30 Sec	-	6	0	4	16	2	-	6
PHA 5	60 Sec	12	152	140	144	134	132	6	140
	30 Sec	-	4	4	4	4	2	-	4
PHA 6	60 Sec	2	130	108	104	104	104	2	110
	30 Sec	-	2	2	0	4	2	-	2
PHA 7	60 Sec	0	10	8	8	4	6	0	7
	30 Sec	-	2	0	0	2	2	-	1
PHA 8	60 Sec	278	134	128	120	100	106	260	118
	30 Sec	-	36	48	40	38	36	-	40
X_o CRM	30 Sec	.02	.16	.14	.14	.13	.13	.03	
	60 Sec	-	.19	.21	.21	.20	.20	-	
X+ CRM		.40	-	-	-	-	-	.40	
X- CRM		.95	-	-	-	-	-	1.0	
Y_o CRM	30 Sec	.04	.13	.11	.11	.10	.13	.04	
	60 Sec	-	.27	.28	.28	.26	.28	-	
Y+ CRM		1.2	-	-	-	-	-	1.2	
Y- CRM		0	-	-	-	-	-	0	
B_x CRM		-	-	-	-	-	-	-	
B_y CRM		-	-	-	-	-	-	-	

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Star Sensor:	Pre-Environment	Post Environment
Signal	Voltage	Voltage
QUAD 1	1.40	1.40
QUAD 2	1.25	1.25
QUAD 3	1.05	1.05
QUAD 4	1.11	1.05
X AXIS	0.60	0.60
Y AXIS	0.25	0.25
BRIGHT	3.95	2.78
LAMP	0.451	0.451

Post Test Inspection Results: NO VISIBLE DAMAGE

Failure Data: NO FAILURES

Test Performed by:

Avco: _____ AS&E E. Fiddendetty

AS&E QC: J. Bazemore

ATTACHMENT III

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

AS&E APOLLO X-RAY ASTRONOMY EXPERIMENT
ENVIRONMENTAL TEST DATA SHEET

Type of Test: ACOUSTICS

Test Start-Time: 0900 Date: 7 Oct Test Complete-Time: 1200 Date: 19 Oct

GSE Clock Reading-Start: - Complete: -

Environmental Test Equipment;

Manuf.: BRUEL & KJAER Model No.: - Serial No.: -

Cal Date: Other Data: GULTON 1/2 in. XTAL MIKE

Functional Test Data:

Digital Test:	Pre-Environment	Post Environment
	Pass ✓ Fail	Pass ✓ Fail

Power Cons.:	Pre-Environment	Post Environment
Current	1.3 A	1.3 A
Voltage	27.5 V	27.5 V

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Calibration:

Pre-Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC	60 Sec	122	1862	1886	1850	1872	1884	130	1875
	30 Sec	-	700	751	732	726	728	-	727
Y CRC	60 Sec	589	2084	2056	2102	2094	2058	602	2079
	30 Sec	-	621	680	650	646	674	-	654
PHA 1	60 Sec	51	720	711	736	695	721	54	717
	30 Sec	-	536	524	528	514	525	-	525
PHA 2	60 Sec	4	25	28	22	34	30	6	28
	30 Sec	-	4	4	2	6	6	-	4
PHA 3	60 Sec	10	35	28	30	28	26	8	29
	30 Sec	-	2	4	2	0	2	-	2
PHA 4	60 Sec	14	550	559	520	532	542	12	541
	30 Sec	-	8	10	6	10	12	-	9
PHA 5	60 Sec	12	152	146	140	148	152	12	148
	30 Sec	-	4	4	2	4	6	-	4
PHA 6	60 Sec	3	128	124	120	124	130	2	125
	30 Sec	-	4	4	4	2	4	-	4
PHA 7	60 Sec	0	10	12	10	8	10	0	10
	30 Sec	-	2	0	0	0	2	-	1
PHA 8	60 Sec	274	120	124	130	130	118	258	124
	30 Sec	-	26	24	28	22	19	-	24
X_o CRM	30 Sec	.03	.13	.12	.12	.13	.11	.03	
	60 Sec	-	.19	.18	.21	.22	.20	-	
X+ CRM		.45	-	-	-	-	-	.45	
X- CRM		1.0	-	-	-	-	-	.95	
Y_o CRM	30 Sec	.04	.13	.13	.11	.12	.13	.04	
	60 Sec	-	.26	.26	.25	.27	.25	-	
Y+ CRM		1.2	-	-	-	-	-	1.2	
Y- CRM		0	-	-	-	-	-	0	
B_x CRM		-	-	-	-	-	-	-	
B_y CRM		-	-	-	-	-	-	-	

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Calibration:

Post Environment

Channel		Bkg.	Cal1	Cal2	Cal3	Cal4	Cal5	Bkg.	Ave.
X CRC	60 Sec	118	1861	1848	1803	1850	1796	136	1831
	30 Sec	–	749	804	798	788	757	–	779
Y CRC	60 Sec	670	2176	2186	2004	1938	2040	702	2049
	30 Sec	–	722	710	718	594	633	–	676
PHA 1	60 Sec	38	802	776	706	692	704	43	736
	30 Sec	–	634	594	574	532	524	–	568
PHA 2	60 Sec	6	22	26	24	22	22	6	23
	30 Sec	–	2	4	0	4	0	–	2
PHA 3	60 Sec	12	34	26	26	40	20	12	29
	30 Sec	–	2	6	0	8	0	–	3
PHA 4	60 Sec	12	496	514	574	550	554	14	538
	30 Sec	–	0	4	22	10	0	–	7
PHA 5	60 Sec	14	190	168	148	152	144	14	160
	30 Sec	–	2	8	6	4	4	–	5
PHA 6	60 Sec	4	124	118	122	126	115	6	121
	30 Sec	–	3	0	2	2	0	–	1
PHA 7	60 Sec	0	4	6	4	6	2	2	4
	30 Sec	–	0	4	0	4	0	–	2
PHA 8	60 Sec	312	78	112	86	96	110	278	96
	30 Sec	~~312~~	30	48	30	34	38	–	36
X_0 CRM	30 Sec	.03	.12	.13	.12	.11	.11	.04	
	60 Sec	–	.20	.21	.19	.20	.20	–	
X+ CRM		.43	–	–	–	–	–	.45	
X- CRM		.95	–	–	–	–	–	.95	
Y_0 CRM	30 Sec	.04	.13	.11	.10	.12	.13	.04	
	60 Sec	–	.27	.25	.25	.28	.27	–	
Y+ CRM		1.1	–	–	–	–	–	1.0	
Y- CRM		0	–	–	–	–	–	0	
B_x CRM		–	–	–	–	–	–	–	
B_y CRM		–	–	–	–	–	–	–	

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Star Sensor:	Pre-Environment	Post Environment
Signal	Voltage	Voltage
QUAD 1	1.41	1.40
QUAD 2	1.25	1.25
QUAD 3	1.07	1.05
QUAD 4	1.1	1.05
X AXIS	0.5	0.6
Y AXIS	0.3	0.25
BRIGHT	4.1	4.2
LAMP	0.45	0.45

Post Test Inspection Results: No damage evident

Failure Data: no failures

Test Performed by:

Avco: _____ AS&E L Gaillardetz

AS&E QC: J. Gazenowski

ATTACHMENT IV

EMI WAIVER

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

Telefax WESTERN UNION Telefax

WESTERN UNION TELEX SERVICE

TLX216

GOVT TELTEX PD WSHINGTON DC 17 NOV 66 337P EST

DR JOHN WATERS AMERICAN SCIENCE AND ENGINEERING INC

11 CARLETON ST CAMBRIDGE MASS

SUBJECT CLN REQUEST FOR WAIVER ON EMI TEST

THE DATA YOU SUBMITTED FROM THE SO17 EMI QUALIFICATION TEST HAVE BEEN REVIEWED BY MSC AND APPROPRIATE SYSTEMS SPECIALIST AND NAA PEOPLE. IT WAS CONCLUDED THAT THE AMOUNT BY WHICH THE LIMITS WERE EXCEEDED WOULD NOT INDANGER THE EXPERIMENT OR SPACECRAFT SYSTEMS. CONSEQUENTLY, YOUR WAIVER REQUEST IS GRANTED. YOU SHOULD BE PREPARED CMA HOWEVER CMA TO VALIDATE THAT THERE ARE NO HARMFUL

cc: K G JRW HSR

NOV 7 AM 3 59

11/7/66

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Telefax WESTERN UNION Telefax

WESTERN UNION TELEX SERVICE

EFFECTS TO THE SPACECRAFT OR EXPERIMENT DURING INTEGRATED RFI TEST AT KSC.

SED NORMAN G FOSTER MANAGER TEST AND OPERATIONS EXPERIMENTS PROGRAM OFC NASA MSC HOUSTON TEX

WU TELTEX CAMB

NASA WSH

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