Bendix

Aerospace Systems Division

Qualification Status List

ALSEP Array E Configuration

DATE 25 Sept. 1972

This Qualification Status List (QSL) has been prepared in compliance with the requirements of NASA contract NAS 9-5829, for incorporation in the ALSEP Array E Acceptance Data Packages (ADP).

As of the date of publication the information herein reflects the status of Array E qualification following completion of the systems level testing on the qualification hardware. There are no outstanding Failure Reports from previous ALSEP Arrays affecting the qualification status. The open Array E Failure Investigation Action Reports (FIAR's) which may possibly constrain the close out of this report are discussed in paragraph 3.3 below.

Only ALSEP Sub-Packages No. 1 and No. 2 are covered in this QSL. The fuel cask assembly, including support structure, thermal shields, ..., has been previously qualified and the minor differences which have arisen are discussed in revision B of ATM 780. The LSPE explosive package assemblies which are carried in the LM Quad III are being qualified separately and a separate ATM will be written for their qualification status.

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CONTENTS

	Cover Sheet		i
	Contents Sheet		ii
1.0	INTRODUCTION		1
2.0	HARDWARE DESCRIPTION		2
3.0	ARRAY E QUALIFICATION		9
	3.1	Test Requirements	9
	3.2	Qual Test Summary	12
	3.3	FIAR Summary	18
	3.4	QSL Summary	24
4.0	QUAL/FLIGHT DIFFERENCES		25
5.0	CONCLUSION		32

Appendicies

A -- Vibration/Shock requirements

B -- FIAR Listing

C -- QSL Forms

1.0 INTRODUCTION

In order to verify that flight hardware is qualified at the time of CARR and factory shipment, Reliability Engineering prepares a Qualification Status List (QSL) which provides a comparison of qualification requirements versus test results for end item assemblies. These data are prepared for inclusion as section 3.0 of the end item Acceptance Data Packages.

Since Array E represents a major redesign of the ALSEP system and includes several new experiments, the system has been requalified. There are, however, a few selected components and one experiment (HFE) which have been carried over from previous arrays. In paragraph 2.0 below, the major components and sub-assemblies, including structural thermal items, are identified by part and serial numbers and the qualification level and array for which each item was qualified is presented.

The qualification program was conducted to demonstrate that the flight configuration system design is inherently capable of meeting the established performance requirements during and following exposure to stress levels exceeding the maximum expected flight levels. The Array E program, including test requirements, failure reports, and qualification status are presented and discussed in paragraph 3.0.

Differences between the deliverable flight hardware and the equivalent configuration qualified, which have arisen during the Array E test program, are identified with qualification rationale in paragraph 4.0.

Appendicies A and B contain the vibration and shock environmental spectra and QSL forms for each experiment and the major components and sub-assemblies which constitute the Array E ALSEP.

Only ALSEP Sub-Packages No. 1 and No. 2 are covered in this QSL. However, the remaining hardware items are identified in paragraph 2.0 and the FIAR's associated with the LSPE/LM Quad III hardware are identified in paragraph 3.3 for the sake of completeness.

2.0 HARDWARE DESCRIPTION

The Array E Flight system consists of two subpackages which are stowed aboard the LM for transit to the lunar surface, the LSP explosive packages which are stowed in the LM Quad III, and the nuclear fuel capsule for the Radioisotope Thermal Generator (RTG) which is carried in the fuel cask assembly external to the LM.

Sub-Package No. 1 consists of the structural/thermal subsystem, the central station including the data and power subsystems, the S-Band antenna, and three of the experiments. In the central station, five of the electronic components have been redesigned to enhance system reliability and improve performance. The Command Decoder (CD) Data Processor (DDP/ADP), Power Conditioning Unit (PCU), Power Distribution Unit (PDU) and the S-band Transmitter (XMTR) are new components. The redundant command receiver (RCVR), diplexer filter and diplexer switch are the same type units as flown in Array D.

Subpackage No. 2 contains the generator assembly for the RTG, the shorting plug assembly, antenna aiming mechanism, ALSEP deployment tools, and two experiments.

The experiments subsystem for Array E consists of five experiments, four new and the Heat Flow Experiment (HFE) which has flown previously on Apollo 15 and 16. The new experiments are the 1) Lunar Seismic Profiling experiment (LSP), 2) the Lunar Mass Spectrometer (LMS), 3) the Lunar Surface Gravimeter (LSG) and 4) the Lunar Ejecta and Meteorite experiment (LEAM).

Table 2-1 below identifies the major Array E components and sub-assemblies by part and serial number for both qualification and flight hardware and the qualification level and array for which each item was qualified. Significant configuration differences are discussed in paragraph 4.0 and the rationale for qualification of the flight configuration given.

TABLE 2-1

Array E Configuration Description

HARDWARE DESCRIPTION	QUALIFIED FOR	QUAL PART NUMBER	FLIGHT PART NUMBER
Sub-Package No. 1	QSE (qualified at the sub-pack. level)	2348700-502 S/N 23	2348700-501 S/N 24
Structual/Thermal subsystem	QSE	--	--
primary structure	(qualified at the sub-pack level)	2348620 S/N 17	2348620-101 S/N 18
thermal plate		2362851 S/N 13	2362851 S/N 12
thermal bag		2330333 S/N 11	2330333 S/N 12
sunshield assembly		2348650 S/N 18	2348650 S/N 19
thermal curtain L		2348647 S/N 10	2348647 S/N 11
thermal curtain R		2348646 S/N 10	2348646 S/N 11
Central Station assembly	QSE	2362900-501 S/N 10	2362900-502 S/N 11
wiring harness	QSE (qualified at system level)	2362852 S/N 14	2362852 S/N 15
switch actuator	QSE (qualified at system level)	2348801 S/N 12	2348801 S/N 13
diplexer filter	Qual A, QSE (qualified at the component level and verified at the system level)	2330525 S/N 5 (QSA) S/N 12 (QSE)	2330525 S/N 13
diplexer switch	Qual A, QSE (qualified at the component level and verified at the system level)	2330526 S/N 5 (QSA) S/N 12 (QSE)	2330526 S/N 13

TABLE 2-1

Array E Configuration Description

(CONT.)

HARDWARE DESCRIPTION	QUALIFICATION	QUAL PART NUMBER	FLIGHT PART NUMBER
Central Station assembly (cont.)			
redundant command receiver	Qual D, QSE (qualified at the component level and verified at the system level)	2345147 S/N 14 (Qual D) S/N 17 (QSE)	2345147 S/N 15
command decoder	QSE (qualified partially at component level and patially at system level)	2367600-503 S/N 11	2367600-502 S/N 12
da ta processor (DDP/ADP)	QSE (qualified partially at component level and partially at system level)	2349400-502 S/N 14	2349400-503 S/N 15
transmitter(s)	Qual E, QSE (qualified at the component level and verified at the system level)	2362877 S/N 41 (Qual E) S/N 42 } QSE S/N 43 }	2362877 S/N 44 S/N 45
power conditioning unit	QSE (qualified partially at the component level and partially at system level)	2368101-503 S/N 11	2368101-503 S/N 12
power distribution unit	QSE (qualified partially at the component level and partially at system level)	2362200-502 S/N 13	2362200-503 S/N 14
LSP central electronics	QSE (qualified partially at the component level and partially at the system level)	2347800 S/N 2	2347800 S/N 3

TABLE 2-1

Array E Configuration Description

(CONT.)

HARDWARE DESCRIPTION	QUALIFICATION	QUAL PART NUMBER	FLIGHT PART NUMBER
S/P No. 1 Experiments		-	-
LSG experiment	Qual E, QSE (qualified partially at the experiment level and partially at the system level)	2345875 S/N 2	2345856 S/N 3
LMS experiment	Qual E, QSE (qualified partially at the experiment level and partially at the system level)	2347400 S/N 5	2347400-103 S/N 7
LSP geophone module	QSE (qualified at the system level)	2348321 S/N 2	2348321-101 S/N 3
S/P No. 1 Miscellaneous		-	-
S-band antenna	QSA, QSE (qualified for array A and verified with array E at system level)	2330307 S/N 4 (QSA) S/N 13 (QSE)	2330307 S/N 14
power dissipation module	QSE (qualified at the system level)	2348636-502 S/N 10	2348636-503 S/N 11
Sub-Package No. 2	QSA, QSB QSD, QSE.	2348800-502 S/N 20	2348800-501 S/N 21
Structural subsystem			
pallet assembly	QSB, QSD, QSE (qualified for array B, minor modifications for arrays D and E qualified by similarity)	239101 S/N 2 (QSD) 2364060-2 S/N 11 (QSE)	2364060-1 S/N 13

TABLE 2-1

Array E Configuration Description

(CONT.)

HARDWARE DESCRIPTION	QUALIFICATION	QUAL PART NUMBER	FLIGHT PART NUMBER
Structural subsystem (continued			
carrier subpallet	QSE (qualified at sub-pack level)	2364050 S/N 5	2364050 S/N 6
HFE subpallet	QSD (qualified for array D, and verified at array E sub-pack level)	2339130 S/N 2 2348880 S/N 2	2364071 S/N 8
S/P No. 2 Experiments		-	-
LEAM experiment	Qual E, QSE (qualified partially at the experiment level and partially at the system level)	2347700 S/N 2	2347700 S/N 3
HFE experiment	Qual D, QSE (qualified for array D, and verified at array E system level)	2345430 S/N 2 (Qual D, QSE)	2345430-102 S/N 7
HFE probe package	Qual D, QSE (qualified partially at the experiment level and partially at the system level)	2333127 S/N SQ2B (Qual D, QSE)	2333127 S/N F4B
Radio-isotope Thermal Generator, etc.		-	-
generator assembly (GFE)	Qual A, QSA (GFE qualified for array A and interface verified at array A system level)	47E300779 S/N 6320005 (QSE) S/N 6320008 (QSA)	47E300779 S/N 6320014

TABLE 2-1

Array E Configuration Description

(CONT.)

HARDWARE DESCRIPTION	QUALIFICATION	QUAL PART NUMBER	FLIGHT PART NUMBER
RTG (cont.)			
flight handling tool (GFE)	Qual SA (GFE qualified for array A)	47E300452 S/N 6331011 (simulator)	47E300452 S/N 6331012
fuel transfer tool	Qual SA, SB, SE (qualified originally for array A, minor changes made for arrays B, E; qualified by simularity	2338089 S/N 2 (QSA, QSB) 2364070-101 (mass simulator used for S/P mech. tests)	2364053 S/N 9
shorting plug assembly	Qual E, QSE (verified at the component level and qualified at the system level)	2364057 S/N 11	2364057-501 S/N 13
cask dome removal tool	Qual A, B, QSE (qualified for array A, minor changes made for arrays B, E; qualified by simularity)	2338002 S/N 2 (QSB) 2348890 S/N 3 (QSE) (simulator)	2364055 S/N 4
S/P No. 2, Miscellaneous			
S-B and antenna aiming mechanism	Qual E, QSE (qualified partially at component and partially at sub -pack level)	2367400 S/N 12	2367400 S/N 13
carry bar assembly	Qual E, QSE (qualified partially at component and partially at sub-pack level)	2364000 S/N 2	2364000-101 S/N 3

TABLE 2-1

Array E Configuration Description

HARDWARE DESCRIPTION	QUALIFICATION	QUAL PART NUMBER	FLIGHT PART NUMBER
S/P No. 2, Miscellaneous (cont.)			
universal handling tool (2)	Qual A, QSE (qualified for array A and stowed interface verified in array E mech. tests)	2348891 S/N 23, 24 (simulator)	2364054 S/N 25, 26
HFE emplanting tool	Qual D, QSE (qualified for array D and stowed interface verified in array E mech. tests)	ADL 3711 S/N SQST	ADL 3711 S/N F4T
RTG Fuel Cask Assembly (carried external to LM)			
fuel capsule (GFE)	GFE qualified for array A.	-	47D300400G1
fuel cask (GFE	GFE qualified for array A.	-	47E301134 S/N 6406007
fuel cask structure assembly	Qual A (qualified for array A at component level)	2338660 S/N 4	238660 S/N 11
astronaut guard	Qual A (qualified for array A at component level)	2338675 S/N 4	2338675 S/N 11
LSPE, LM Quad III			
explosive packages (8)	Qual E, QSE (qualified at component level and if compatibility verified at system level)	2348550-501... 508	2348550-501... 508
transport frame (2)	Qual E (qualified at the component level)	2348500 S/N 7, 8, 9	2348500 S/N 10, 11

Note: A separate QSL will be prepared for the LSP QAR, which will be held separately for the Array E QAR.

3.0 ARRAY E QUALIFICATION

The ALSEP system design has been requalified to demonstrate that the flight configuration for Array E is inherently capable of meeting the established performance requirements during and following exposure to design lumit stress levels exceeding the worst case expected flight levels.

The qualification hardware was built with essentially the same parts, materials, and processes as the flight. Significant differences between the qual and flight hardware are identified, with qualification rationale, in paragraph 4.0.

3.1 Test Requirements

The Array E Statement of Work (Exhibit A of contract NAS 9-5829, CCP273) specifies that certain technical requirements be verified during the qualification test program to assure adequate performance and survival of the system under the specified mission environments. Table 3.1-1 identifies these requirements, references the source paragraph, and correlates them with the qualification tests verifying compliance.

TABLE 3.1-1

ALSEP TEST VERIFICATION REQUIREMENTS

FUNCTION	EXHIBIT B TECHNICAL SPEC REFERENCE	EXHIBIT A TEST IDENTIFICATION
Automatic Power Mgmt Res Pwr & Thermal Control	3.2.2.1.2	Power Dissipation Integ Sys Test & Thermal Vac Test
Electrical System Interface	3.2.2.2.2.1 3.2.2.2.2.2 3.2.2.2.2.2.1	PCU PIA Test C/S Verification Expr Integration (EIT)
ALSEP Control Timing and Data Signals	3.2.2.2.2.2.2	Integ Sys Test EIT
Data Subsystem Analog to Digital Conversion	3.2.2.2.2.2.3	Integ Sys Test EIT
Data Subsystem Structural Thermal Interface	3.2.2.2.3	Thermal Vac Test C/S Verification

TABLE 3.1-1

ALSEP TEST VERIFICATION REQUIREMENTS

(CONT.)

FUNCTION	EXHIBIT B TECHNICAL SPEC REFERENCE	EXHIBIT A TEST IDENTIFICATION
Experiment Telemetry Performance	3.2.2.5.1 (HFE) 3.2.2.12.1 (LEAM) 3.2.2.13.1 (LSP) 3.2.2.14.1 (LMS) Not specified for LSG	Integ Sys Test EIT
Experiment and Subsystem Pwr Consumption	3.2.2.5.6 (HFE) 3.2.2.12.6 (LEAM) 3.2.2.13.6 (LSP) 3.2.2.14.6 (LMS) 3.2.2.15.4 (LSG) 3.4.2.2.1 (data subsystem)	Thermal Vac Test PIA C/S Power Dissipation
Experiment Synchronization Pulses from the Data Subsystem	3.2.2.12.1.1 (LEAM) 3.2.2.5.1.1 (HFE) 3.2.2.13.8 (LSP) 3.2.2.14.1.1. (LMS) Not specified for LSG	Integ Sys Test EIT
Experiment Earth Commands via the Data Subsystem	3.2.2.13.9 (LSP) 3.2.2.14.1.2 (LMS) 3.2.2.15.1 (LSG) Not specified for LEAM 3.2.5.1.2 (HFE)	Iteg Sys Test EIT
System Electromagnetic Interference	3.3.9	C/S EMI Integ Sys EMI
Experiment Operational Characteristics	3.4.6.1 - 3.4.6.1.22 (HFE) 3.4.16.4 - 3.4.16.4.2 (LEAM) 3.4.17.1 - 3.4.17.1.9 (LSP) 3.4.18.1.1 - 3.4.18.4 (LMS) 3.4.19.1.3 - 3.4.19.2.3 (LSG)	Experiment Subsystem Tests EIT Integ Sys Tests Thermal Vac Tests

TABLE 3.1-1

ALSEP TEST VERIFICATION REQUIREMENTS

FUNCTION	EXHIBIT B TECHNICAL SPEC REFERENCE	EXHIBIT A TEST IDENTIFICATION
Data Subsystem Performance	3.4.2.1 - 3.4.2.1.6	Antenna Aiming Mech PIA Integ Sys Test Deployment Tests
Experiment Thermal Control	3.2.2.5.3 (HFE) 3.2.2.12.3 (LEAM) 3.2.2.13.3 (LSP) 3.2.2.14.3 (LMS) 3.2.2.15 (LSG)	Thermal Vac Test
PCU Control of RTG Output and RTG/PCU Output Characteristics	3.4.1.1.1 and 3.4.1.1.1.1	Integ Sys Test Thermal Vac PCU PIA Test
Structural/Thermal Control System Maintenance of Thermal Integrity	3.4.3	Thermal Vac Test
Array E Mass Properties	LIS-360-22103 GAC IC LID 360-22811 3.2.2.5.4 - 3.2.2.5.5 (HFE) 3.2.2.12.4 - 3.2.2.12.5 (LEAM) 3.2.2.13.4 - 3.2.2.13.5 (LSP) 3.2.2.14.4 - 3.2.2.14.5 (LMS) 3.2.2.15.2 - 3.2.2.15.3 (LSG)	Mass Properties Test
ALSEP System Environmental Requirements:		
Vibration	Appendix A	Accept/Qual Tests
Shock	Appendix A	Qual Test
Temperature (on moon)	LED-520-IF	Thermal Vac Test
Solar Radiation (on moon)	LED-520-IF	Thermal Vac Test
Pressure	LED-520-IF	Thermal Vac Test

3.2 Qualification Test Summary

The Array E qualification test program consisted of a series of design limit qualification tests preceded by a series of pre-acceptance and acceptance tests. The pre-design limit tests are essentially the same as those performed on the flight hardware and are intended to verify the integrity of the manufacturing processes and assembly, as well as compliance with the system performance requirements.

In this test sequence, the most significant functional and environmental tests are Experiments Integration, (EIT) Central Station Verification and Calibration, and the Integrated System Test (IST) with IPU at the pre-acceptance level, system Electro-Magnetic Interferences (EMI) at the acceptance level and system Thermal Vacuum (T/V), shock, vibration and LSP/Central Station RFI Immunity at the design limit level. A brief synopsis of these tests follows:

(1) EIT - The experiments were individually integrated with the central station at the thermal plate assembly level.

(2) Central Station Verification and Calibration - This test verifies proper operation of the data and power subsystems and calibrates individual circuits in the central station which have not been previously checked.

(3) IST - Following assembly of the thermal plate electronics with the thermal bag and structure, system operation was verified for the central station and all experiments. The IPU (the generator assembly with an electric fuel capsule simulator) provided ALSEP system power during this test.

(4) EMI - Compatibility of all subsystem functions operating together was demonstrated during system EMI testing.

(5) T/V (design limit) - Proper operation of the integrated system was verified with Array E deployed in Bendix' 20' x 27' Space Simulation chamber. During this test the hardware was exposed to simulated lunar morning, lunar noon, and lunar nite worst case environments.

(6) Shock - Subpackages 1 and 2 were seperately exposed to mechanical impulses to verify capability to withstand shock pulses greater than expected during a normal lunar landing.

(7) Vibration - Subpackages 1 and 2 were separately subjected to vibration tests simulating both launch and boost, as well as lunar descent levels. These levels are in excess of the anticipated flight levels and demonstrate the margin of safety inherent in the Array E design.

(8) LSP/Central Station RFI Immunity - The ALSEP central station and one explosive package (with an inert detonator) were deployed and it was verified that the explosive package was immune to ALSEP central station radiation and that it could be activated by ALSEP command.

Summarized in tables below are the tests that make up the Array E qualification test program. These tables identify the tests by procedure number and the ALSEP Test Reports (ATR's) documenting the results. Specifically, they identify the following tests:

Table	Test Description
3.2-1	Experiment Pre-Integration Acceptance Tests
3.2-2	Component Pre-Integration Acceptance Tests
3.2-3	System Pre-Acceptance Tests
3.2-4	System Acceptance Tests
3.2-5	System Design Limit Tests

TABLE 3.2-1

EXPERIMENT

PRE-INTEGRATION ACCEPTANCE TESTS

TEST NOMENCLATURE	TEST PROCEDURE	ATR
LEAM		
PIA	2365512	334
Mass Properties	2365513	334
(Operating Vibration (Op-Vib) (acceptance and design limit)	2365514	334
LMS - Qual		
PIA	2365500	335
Mass Properties	2365507	335
Op-Vib (acceptance)	2365503	335
Op-Vib (design limit)	2365507	335
LMS - Proto with multimode board		
PIA	2368972	336
Op-Vib (acceptance)	2368970	336
Op-Vib (design limit)	2368971	336
Shock	2365506	336
EMI	2368982	336
T/V	2365527	336
LSG - Heater Box/Electronics		
Functional test	2347889	337
Op-Vib (acceptance)	2365518	337
Op-Vib (design limit)	2365526	337
LSG - Electronics Package		
Functional test	2365536	338
Op-Vib (acceptance)	2365519	338
Op-Vig (design limit)	2347888	338
Noise test	2365541	338
LSG		
PIA	2365520	339
Mass Properties	2365521	339
Acceptance Vibration (non-operating)	2365530	339
LSP		
Central Electronics (CE) PIA	2365363	340
CE Op-Vib (acceptance)	2365585	340
CE Op-Vib (design limit)	2365580	340
Geophone Module - Mass Properties	2365383	340
HFE		
PIA	2333069	-
Mass Properties	2334365	-

TABLE 3.2-2

COMPONENT

PRE-INTEGRATION ACCEPTANCE TESTS

TEST NOMENCLATURE	TEST PROCEDURE	ATR
Central Station Components		
Command Receiver - PIA	2368943	-
Transmitter - PIA	2368912	-
Diplexer Flight - PIA	2368925	-
Diplexer Switch - PIA	2368925	-
Command Decoder		
PIA	2349306	-
Op-Vib	2365314	-
Noise	2368944	-
Data Processor		
PIA	2349202	-
Op-Vib	2365320	-
Power Conditioning Unit		
PIA	2349002	-
Op-Vib	2365323	-
Power Distribution Unit		
PIA	2349103	-
Op-Vib	2365323	-
Central Station Harness	2365550	-
RTG		
Shorting Plug - PIA	2365563	310
Generator Assembly - PIA	2333057	-
Generator Assembly - Leak Tect	2338631	323
Antenna - VSWR	2338612	323
Antenna Aiming Mechanism		
Environmental	2365561	-
Functional	2365562	309/323
Power Dissipation Module	2365304	-

TABLE 3.2-3

SYSTEM

PRE-ACCEPTANCE TESTS

TEST NOMENCLATURE	TEST PROCEDURE	ATR
Central Station Functional	2365551	-
Central Station Verification and Calibration	2365552	-
Experiment Integration Test (EIT)		
LEAM/CS EIT	2365556	-
LMS/CS EIT	2365555	-
LSG/CS EIT	2365558	-
LSP/CS EIT	2365557	-
HFE/CS EIT	2365559	-
Integrated System Test (IST)	2365564	-

TABLE 3.2-4

SYSTEM

ACCEPTANCE TESTS

TEST NOMENCLATURE	TEST PROCEDURE	ATR
System EMI	2365565	316
Sub-Package No. 1		
Mass Properties	2365566	317
Sine Vibration	2365568	318
Tumble	2365570	319
Fastener Verification	2365571	320
Modified IST	2365573	321
Sub-Package No. 2		
Mass Properties	2365567	311
Sine Vibration	2365569	312
Tumble	2365570	313
Fastener Verification	2365572	314

TABLE 3.2-5

SYSTEM

DESIGN LIMIT TESTS

TEST NOMENCLATURE	TEST PROCEDURE	ATR
System Thermal Vacuum (acceptance levels followed by design limit levels in same test set-up)	2365581, 2365582	322
Sub-Package No. 1		
Shock	2365579	325
Vibration	2365577	326
Fastener Verification	2365571	327
MIST	2368969	328/324
Antenna Radiated Power	2368969	328
Sub-Package No. 2		
Shock	2365580	330
Vibration	2365578	329
Fastener Verification	2365572	332
LEAM PIA	2 365512	331
LSG PIA	2365520	331
LMS PIA	2365500	331
Shorting Plug PIA	2365563	331
Fit Checks	2368961	331
LSP/EP RFI Immunity	2365395	333

3.3 FIAR Summary

For the Array E program, a failure is defined "... as the inability of an item at any assembly level to perform one or more of its specified functions..."; this includes out-of-tolerance conditions. Failure reporting commenced at the acceptance testing level of major components designated as qual, flight, or flight spare hardware.

ALSEP Reliability personnel have reviewed all DR's initiated on ALSEP hardware to determine whether or not a reportable failure had occurred. When a failure report was required, the cognizant Reliability P.E. initiated a Failure Investigation Action Report (FIAR) and followed it up by participating in all trouble shooting and failure analysis activities, including determination of corrective action for both the affected and similar hardware. All FIAR's written for array E hardware are summarized in Appendix B below.

All Array E FIAR's that had not been closed out by MSC as of 8 September 1972 are identified below; the status indicated reflects the post-CARR status as of 25 September 1972. *

(1) FIAR AA-EH-00E27, LMS S/N5, Qual

During pumpdown/backfill on the LMS Qual model, the experiment could not obtain the required backfill pressure. Analysis and examination of the cover assembly revealed radial cracks in the ceramic of the breakseal and poor braze joints and application of GE-VAC sealant. The Qual cover assembly was replaced. The flight breakseal also exhibited a leak under test at Langley, but has been repaired with GE-VAC. UTD has changed the storage protection mode which relaxes the leak-rate requirement.

*Revision A reflects the post-CARR status of these FIAR's; one remains open.

(1) FIAR AA-EH-00E27, LMS S/N5, Qual (cont.)

Status: Closed

Action: (1) TWX and FIAR issued 5/17/72

(2) Interim FIAR issued 7/25/72

(3) Final FIAR issued 9/14/72

(4) Closed by MSC signoff 9/19/72

(2) FIAR AA-EH-00E39, Command Receiver S/N 18, Flight

During the lunar morning IST in the flight system thermal vacuum test, no command verification word was received for octal command 135. The fault has been isolated to an apparent 6db loss in the UPLINK signal strength caused by a thermally intermittent rf ground in the front end of the receiver. A similar problem appeared in the S/N17 unit in the Qual central station (see FIAR E61.) S/N15 (flight spare) has been tested to verify that this problem is not present and has been integrated in the Flight central station.

Status: Closed

Action: (1) TWX and FIAR issued 7/5/72

(2) Interim FIAR issued 7/28/72

(3) Final FIAR issued 9/1/72

(4) Closed by MSC signoff 9/14/72

(3) FIAR AA-EH-00E41, LEAM S/N2, Qual

During pre-integration acceptance testing, there was no continuity from pin 3 to pins 10, 22, 24 and 27 on P90 of the astromate connector. The open was caused by an open power line inside the experiment electronics package which was not adequately stress relieved.

Status: Closed

Action: (1) TWX and FIAR issued 7/7/72

(2) Final FIAR issued 7/17/72

(3) Closed by MSC signoff 9/14/72

(4) FIAR AA-EH-00E42, LMS, Proto (Qual MMECB)

Following the prototype vibration test, the filament power supply HK read low. Analysis at UTD has shown that excessive noise present in the reference circuit will cause oscillation in the cyclic mode when filament leads are trimmed from 24" to 6" during final assembly. Adding a capacitor on the order of 1 microfarad successfully eliminated the noise problem in the proto unit. The flight unit has not exhibited this problem.

Status: Closed

Action: (1) TWX and FIAR issued 7/14/72

(2) Final FIAR issued 9/14/72

(3) Closed by MSC signoff 9/19/72

(5) FIAR AA-EH-00E43, S/P 1 Sunshield, Qual

During the sub-pack 1 design limit vibration test, the sunshield honeycomb core to insert bond apparently failed near the LSG mounting inserts. The sunshield has been evaluated and determined to be structually sound, although monor bonding separations are present. The subpackage was reassembled and the vibration testing has been completed; a waiver is being submitted for x-axis sine vibration between 50 and 100 Hz per BxA-MSC agreement.

Status: Open

Action: (1) TWX and FIAR issued 7/21/72

(2) Final FIAR issued 9/15/72

(3) BxA awaiting LSPO closeout.

(6) FIAR AA-EH-00E48, LSPE Geophones, Flight

The Flight geophones were examined for cracked standoffs after special engineering tests which were run on ASE spare geophones at Geotech, showed that the transducer standoffs could be cracked with an exposure to cold temperatures (-125°F). Two of the four standoffs were severly cracked; these were replaced.

Status: Closed

Action: (1) TWX and final FIAR issued 8/7/72

(2) Closed per MSC signoff 9/14/72

(7) FIAR AA-EH-00E49, Data Processor S/N 14, Qual

During the post design limit vibration MIST, central station housekeeping data indicated that DDP Y was on, whereas DDP X should have been on. Trouble-shooting isolated the fault to a short on the +5V line to DDP X; visual examination revealed that the +5V line inside the data processor was pinched and shorted to the ground plane of the motherboard.

Status: Closed

Action: (1) TWX and FIAR issued 8/9/72

(2) Final FIAR issued 9/15/72

(3) Closed by MSC signoff 9/19/72

(8) FIAR AA-EH-00E61, Command Receiver S/N17, Qual

During Central station verification testing following hardware repairs required in FIAR AA-EH-00E49, command verification words were being lost and the telemetry data indicated an apparent signal strength loss of 7 db. The receiver has been returned to Motorola, G.E.D. for fault isolation and repair. (Ref: FIAR E39 for similar discrepancy)

Status: Closed

Action: (1) TWX and FIAR issued 8/17/72

(2) Interim FIAR issued 9/1/72

(3) Final FIAR issued 9/15/72

(4) Closed by MSC signoff 9/19/72

(9) FIAR AA-EH-00E65, Data Processor S/N 15, Flight

During the retest of the data processor following incorporation of CRN 70114, 12HK channels appeared faulty. The problem was isolated to chips 17 on the sequencer board. Another problem appeared, every twelfth channel was erratic. This problem was isolated to a faulty chip, U20; U20 has an apparent short to the substate. The sequencer board from the spare data processor has been put in the flight unit and the faulty board is being reworked.

Status: Closed

Action: (1) Interim FIAR issued 9/3/72

(2) Final FIAR issued 9/15/72

(3) Closed by MSC signoff 9/19/72

3.4 QSL Summary

The qualification status of Array E has been prepared and is contained in Appendix B. These QSL sheets provide a comparison of the qualification requirements versus the test results for ALSEP assemblies and major components. The status has been established via qualification testing by Bendix Aerospace Systems and its subcontractors. The QSL sheets identify the appropriate test procedure, test reports, and remarks relative to each requirement.

Several components have been qualified for previous arrays. The qualification status for these arrays are documented in:

Array A - ATM 765
Array B - ATM 825
Array C - ATM 859
Array A2 - ATM 986
Array D - ATM 1052

However, the qualification status sheets for previously qualified components has been included herein.

4.0 QUAL/FLIGHT DIFFERENCE

When qualification and flight hardware are fabricated, assembled, and tested in a serial, yet nearly parallel fashion, it is inevitable that some configuration differences between the deliverable flight hardware and the configuration qualified will arise. These differences result from:

1. lack of timely receipt of EEE parts, which may dictate that parts having lessor screening requirements be used in qualification hardware, or

2. MRB repair disposition of minor hardware deficiencies, or

3. flight design modifications arising out of qualification test results, or

4. performance requirement changes late in the program such as the multi-mode emission capability for the LMS experiment.

Each difference which arises must be evaluated for its effect on system performance as it affects the qualification status of the flight hardware, and the cost/schedule impacts of incorporating changes for the sake of hardware uniformity.

Configuration differences which have arisen during the array E program have been reviewed and evaluated for impact on the qualification status of the deliverable flight hardware. Each difference has been identified and documented by ALSEP Reliability in ATM 1054. This ATM was first published in September of 1971 and has been periodically reviewed and revised to reflect the current hardware status.

The intent here is to identify only the most significant qual/flight differences and to provide the qualification rationale for the flight configuration. Differences having no structural or functional significance, for example the screening level of EEE parts, have been ignored; the remaining differences are summarized below in Table 4-1.

TABLE 4-1

QUAL/FLIGHT CONFIGURATION DIFFERENCES

HARDWARE DESCRIPTION	DIFFERENCE	QUALIFICATION RATIONALE
Sub Package No. 1 Structual/Thermal Subsystem		
thermistors (2)	two thermistors were omitted on Qual primary structure.	Flight qualified by simularity with previous arrays and the other two thermistors on the primary structure.
Central Station Assembly wiring harness	Flight has microdot connectors J23, J24, J26, J27 potted per FTRR chit #700.	Flight has added design margin over configuration qualified; potting has be tested per AER 543.
switch actuator	no differences exist	-
diplexer filter	no differences exist	-
diplexer switch	no differences exist	-
redundant command receiver	no differences exist	-
transmitter	EEE parts screening levels	qual by similarity
command decoder	Qual has jumper wires in the data demod board; Flight has new board with corrected art work. (Ref: deviation DA 0017)	qual by similarity
	EEE parts screening levels	qual by similarity
data processor (DDP/ADP)	Qual has jumper wires in the sequencer board; Flight has new board with corrected artwork. (Ref: deviation DA0016)	qual by similarity

TABLE 4-1

QUAL/FLIGHT CONFIGURATION DIFFERENCES

HARDWARE DESCRIPTION	DIFFERENCE	QUALIFICATION RATIONALE
data processor (DDP/ADP)	Flight has H-film tape over sharp edge of motherboard to prevent cutting insulation of wiring from interface connector to motherboard. (Ref. FIAR E-49)	Flight has added design margin over configuration qualified; tape has negligible mass.
	Qual has one hardwire to correct board deficiency. (A/D)	qual by similarity
	Qual motherboard has clock lines tied together, Flight has new board with artwork modified to eliminate a potential system single point failure source.	qual by similarity
	EEE parts screening levels	qual by similarity
power conditioning unit	Flight has counter -bored mounting holes for modules in housing to accept tapered washers; Qual has mounting holes drilled to line up with modules.	Flight design eases multiple interface alignment problems and reduces undesireable stresses at module/motherboard interfaces. The mounting interfaces are mechanically equivalent; no affect on qualification
	Flight has added damper pad in strain relief clamp inside unit. (Ref. FIAR E-49)	Flight has added design margin over configuration qualified; pad has negligible mass.
power distribution unit	Qual +5V delay module has two-sided PWB #1 without 15 plated-thru holes and with solder added on one critical hole; Flight has similar board with all plated -thru holes.	Flight has NASA preferred design; Boards are functionally identical; no affect on qualification.

TABLE 4-1

QUAL/FLIGHT CONFIGURATION DIFFERENCES

HARDWARE DESCRIPTION	DIFFERENCE	QUALIFICATION RATIONALE
power distribution unit	Flight has added damper pad in strain relief clamp inside unit. (Ref. FIAR E-49)	Flight has added design margin over configuration qualified; pad has negligi mass.
LSP central electonics	no differences exist	-
S/P 1 Experiments		
LSG	EEE parts screening levels	qual by similarity
	Flight has a shim spacer on top of heater box to give added clearance between pre-amp and mounting screw; Qual does not.	Designs are mechanically equivalent; no affect on qualification.
	Flight has a helicoil insert repair for tapped hole	qual by similarity with other ALSEP applications.
	Flight has strain relief mod kit added for flat conductor cable.	Flight has added safety margin over configuration qualified; additional rationale contained in BxA response to Action Item #761.
NOTE: LSG mass simulator used for S/P 1 acceptance vibration testing, LSG qual model used for design limit testing.		
LMS	EEE parts screening levels	qual by similarity
	Flight has a multi-mode emission control; qual has a single level emission.	design change was qualified in a test sequence performed on the proto model LMS.
	Flight has strain relief mod kit added for flat conductor cable.	Flight had added safety margin over configuration qualified; additional rationale contained in BxA response to Action Item #761.
	Flight has radiator area increased to 40 square inches. Qual had 34 square inches.	This reduced the nominal temperature swing by approximately 10^{o}F; qual by similarity.

TABLE 4-1

QUAL/FLIGHT CONFIGURATION DIFFERENCES

(CONT.)

HARDWARE DESCRIPTION	DIFFERENCE	QUALIFICATION RATIONALE
LMS (cont.)		
	Flight has a diode added in the housekeeping mux to eliminate a -8V spurious bias voltage which appears when turning the ion pump off.	design change was qualified in the proto model during the multi-mode emission control board qualification
	Flight and Qual Electron Multiplier tubes are identical in design and materials. The qual model tubes were 100% tested at high temperature and random vibration which caused an apparent tube degradation, although the tubes were still within spec. Flight tubes were selected from a lot having only a sampling of tubes tested.	flight tubes are qualified by similarity. Functional characteristics are verified during environmental testing.
	Flight EM tubes have a GE -vac sealant for added leakage protection.	Flight has added design margin over configuration qualified.
LSPE Geophone Module	Flight has strain relief mod kit added.	Flight has added safety margin over configuration qualified; additional rationale contained in BxA response to Action Item #761.
S/P 1 Miscellaneous		
S-band antenna	no differences exist	-
antenna cable assembly	no differences exist	-
power dissipation module	Qual has aerospace sealant on resistor terminals; Flight has thermofit tubing.	qual by similarity to resistor on the central station thermal plate.

TABLE 4-1

QUAL/FLIGHT CONFIGURATION DIFFERENCES
(CONT.)

HARDWARE DESCRIPTION	DIFFERENCE	QUALIFICATION RATIONALE
Sub Package No. 2		
Structual subsystem		
pallet assembly	no differences exist	-
carrier and pallet	no differences exist	-
HFE sub-pallet	no differences exist	-
S/P 2 Experiments		
HFE	EEE parts screening levels	qual by similarity
	Qual and Flight have different power dissipation capability in the thermal plate to improve thermal control.	heaters are functionally and physically similar; no affect on qualification.
	Flight has ferrite beads added to pulse power supply to prevent oscillation.	Flight design is qualified by similarity with other ALSEP applications.
	Flight has middle radiation shields added in the stage 3 assembly.	Flight has added design margin; no affect on qualification.
	Flight model has a cable strain relief mod kit incorporated.	Flight has added design margin; no affect on qualification.
HFE probe package	Flight model has thermal control tape on probe cables and a wider "crows -foot" grip.	Flight has added design margin; no affect on qualification.
HFE astomate connector	Flight model has Hysol 901/91 added to connector and a cable strain relief mod kit incorporated.	Flight has added design margin; no affect on qualification.
LEAM experiment	Flight model has a cable strain relief mod kit incorporated.	Flight has added design margin; no affect on qualification.

NOTE: LEAM mass simulator used for qual S/P 2 acceptance vibration; LEAM qual model used for design limit.

TABLE 4-1

QUAL/FLIGHT CONFIGURATION DIFFERENCES
(CONT.)

HARDWARE DESCRIPTION	DIFFERENCE	QUALIFICATION RATIONALE
Radioisotope Thermal Generator, ...		
generator assembly	no differences exist	-
NOTE: RTG mass simulator used for all S/P 2 mechanical tests.		
flight handling tool	no differences exist	-
fuel transfer tool	no difference exist	-
cask dome removal tool	no differences exist	-
NOTE: tool mass simulators used for all S/P 2 mechanical tests		
shorting plug assembly	Flight has a #20 and a #18 wire from pin 2 of J22A to pin 2 of P22A; the #18 wire is tied common to SW#1. Qual has only a #24 wire from pin 2 of J22A to the common of SW #1 to pin 2 of P22A.	Flight has added design margin; no affect on qualification.
Sub Package Miscellaneous		
S-band antenna aiming mechanism	no difference exist	-
carry bar assembly	Flight has the D handles removed per crew request.	No significant mechanical difference exists; no affect on qualification.
universal handling tool	no differences exist	-
HFE emplanting tool	no differences exist	-
NOTE: tool mass simulators used during S/P 2 mechanical tests.		
RTG Fuel Cask Assembly	minor design differences exist -- ATM 780 documents these differences	qual by similarity

5.0 CONCLUSION

The Array E ALSEP design has been successfully qualified during the qualification program discussed above. This program has demonstrated that the system design is inherently capable of meeting the established performance requirements during and following exposure to stress levels exceeding the maximum expected flight levels.

The significant Qual/Flight hardware differences that exist in Array E are discussed in paragraph 4.0 above and the rationale for qualification given. These differences have no effect on the qualification status.

The open FIAR's identified in paragraph 3.3 above represent the only open items that may constrain the closeout of this report. When all of these FIAR's have been closed out by MSC - action, this report will be revised to reflect the final status.

APPENDIX A

VIBRATION AND SHOCK REQUIREMENTS

This Appendix contains the vibration and shock spectra for Array E components and sub-packages.

(1) Operating Random Vibration (Component Level)

(2) Sine Vibration (Sub-Package Level)

(3) S/P 1 X-Axis Random Vibration*

(4) S/P 2 X-Axis Random Vibration*

(5) S/P 1 and 2 Y-Axis Random Vibration*

(6) S/P 1 Z-Axis Random Vibration*

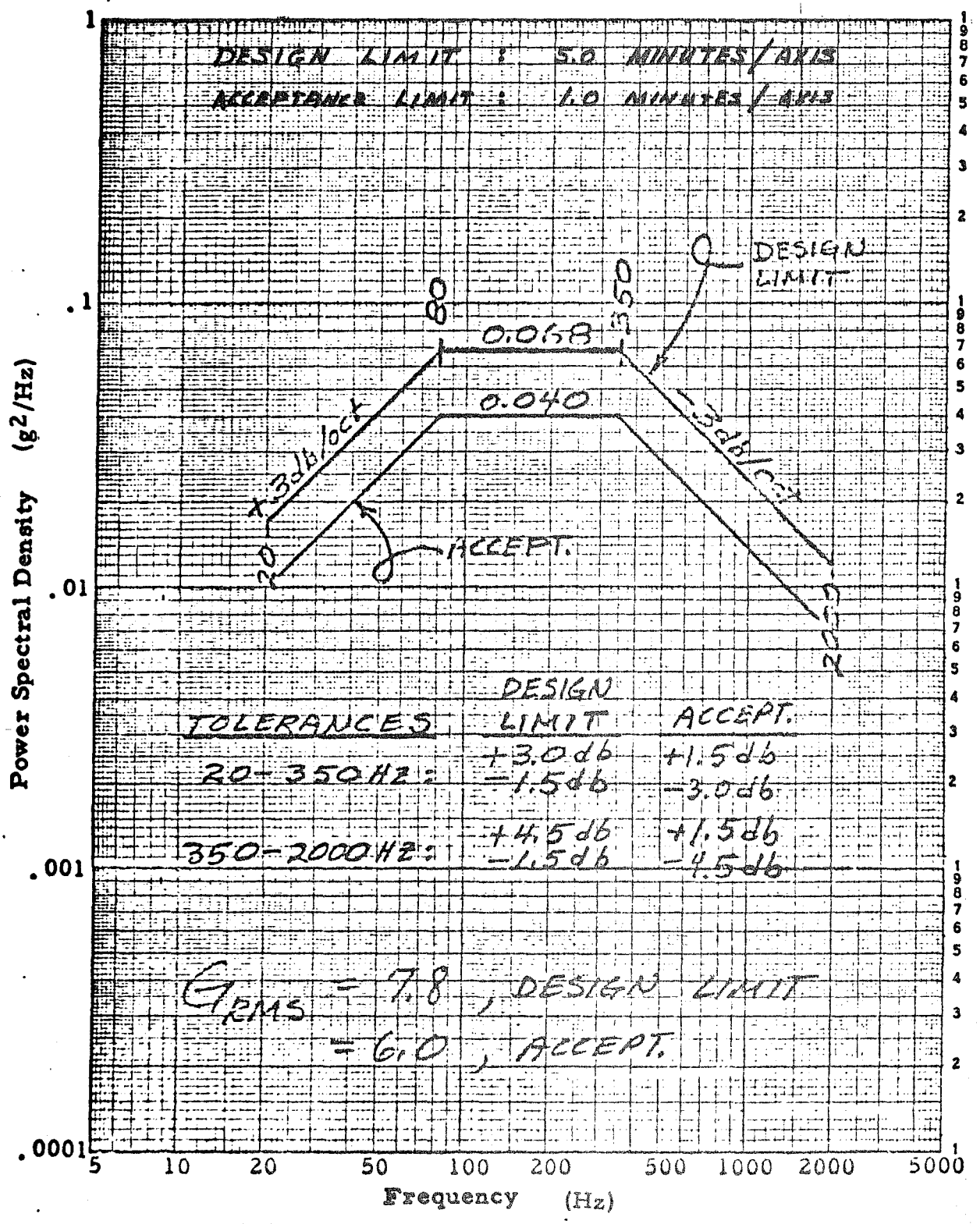
(7) S/P 2 Z-Axis Random Vibration*

(8) Lunar Descent Random Vibration
(X, Y, Z, Axes for S/P 1 and 2)

(9) Shock Pulse — S/P 1 and 2

*Launch and Boost Vibration Spectrum - Qualification Levels

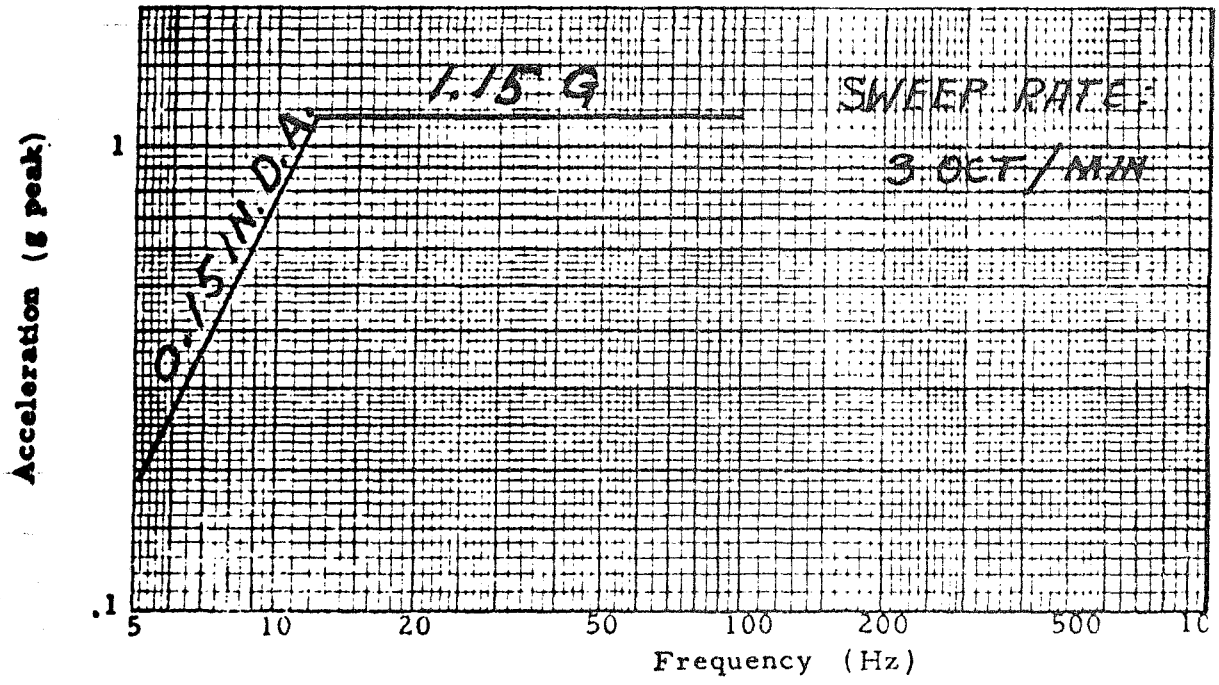
X, Y, Z AXES
OPERATING RANDOM VIBRATION
(COMPONENT LEVEL)



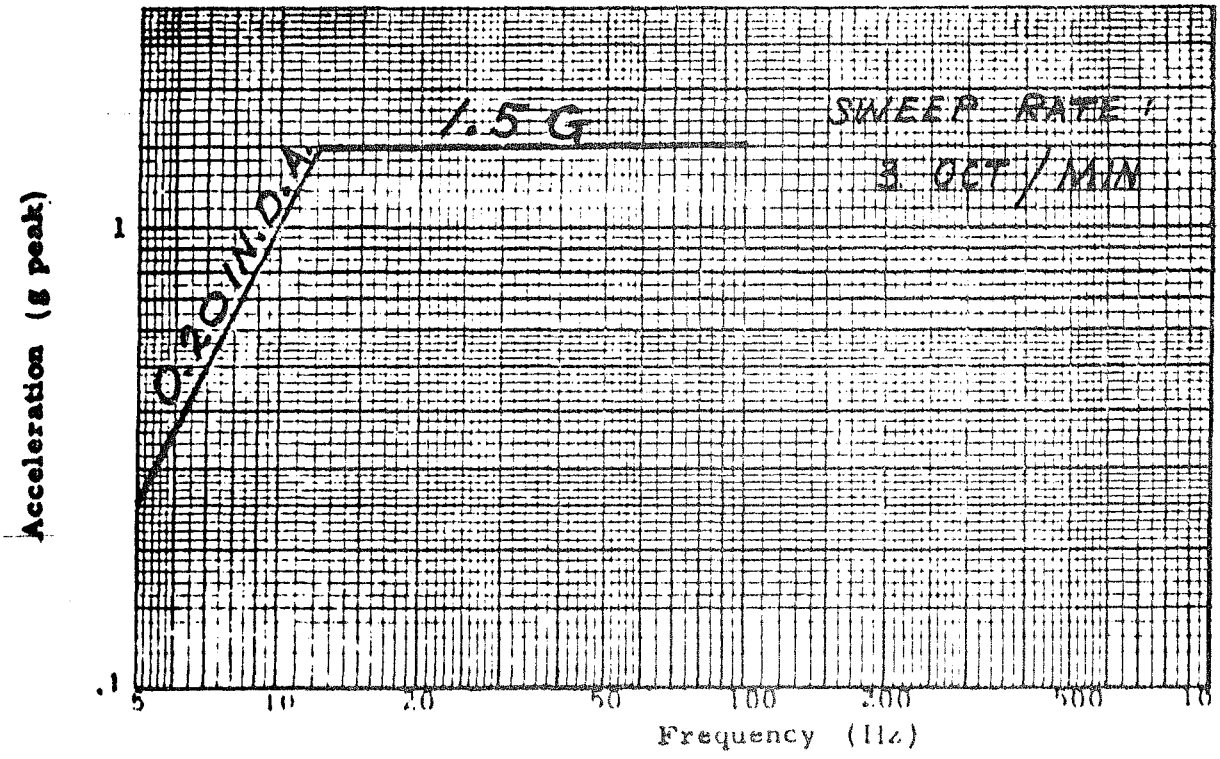
TOLERANCES	DESIGN LIMIT	ACCEPT.
20-350 Hz:	+3.0 db -1.5 db	+1.5 db -3.0 db
350-2000 Hz:	+4.5 db -1.5 db	+1.5 db -4.5 db

G_{RMS} = 7.8, DESIGN LIMIT
= 6.0, ACCEPT.

X, Y, Z AXES SINE VIBRATION

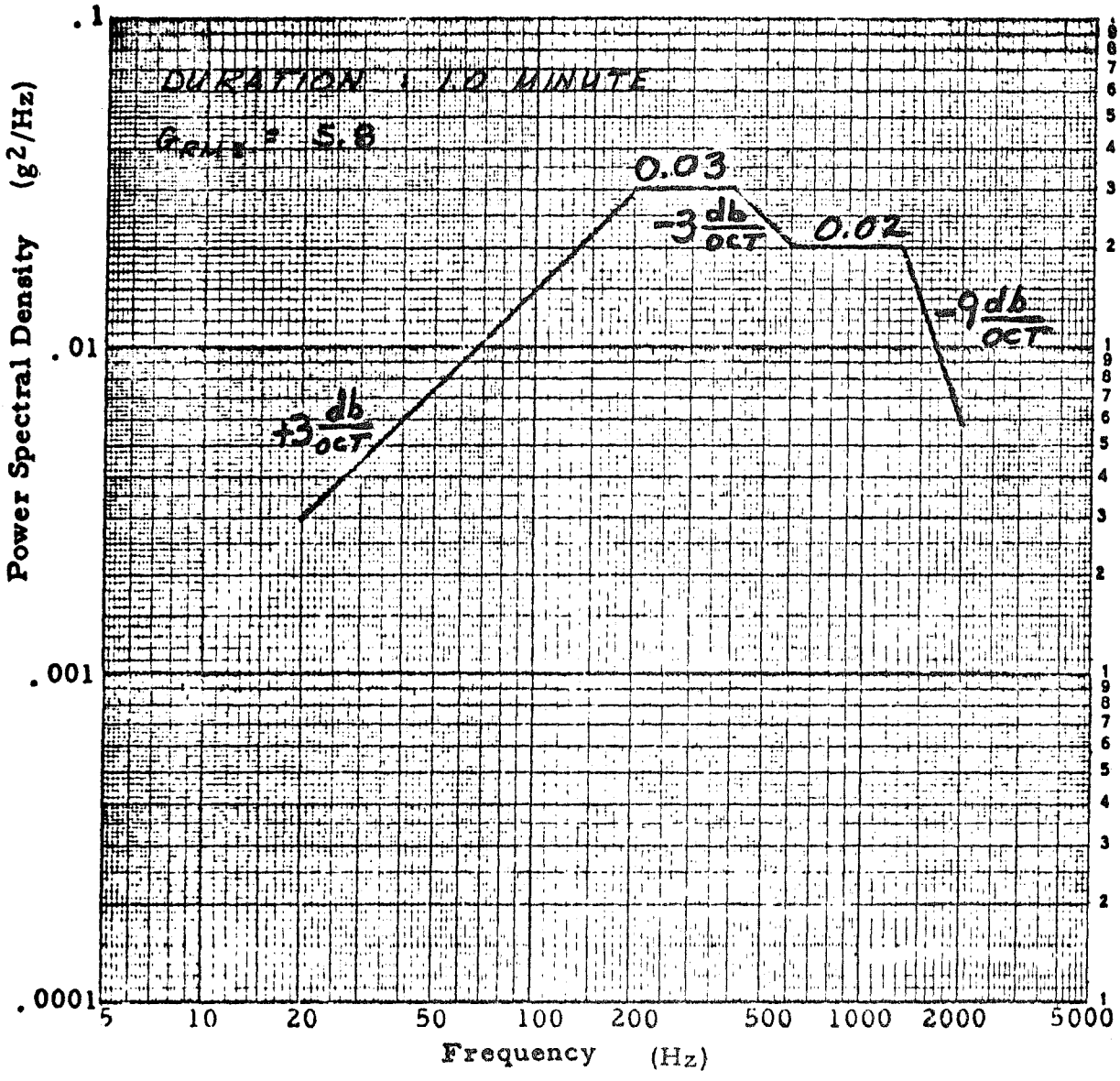


ACCEPTANCE LEVEL - SUBPACKAGES 1 AND 2

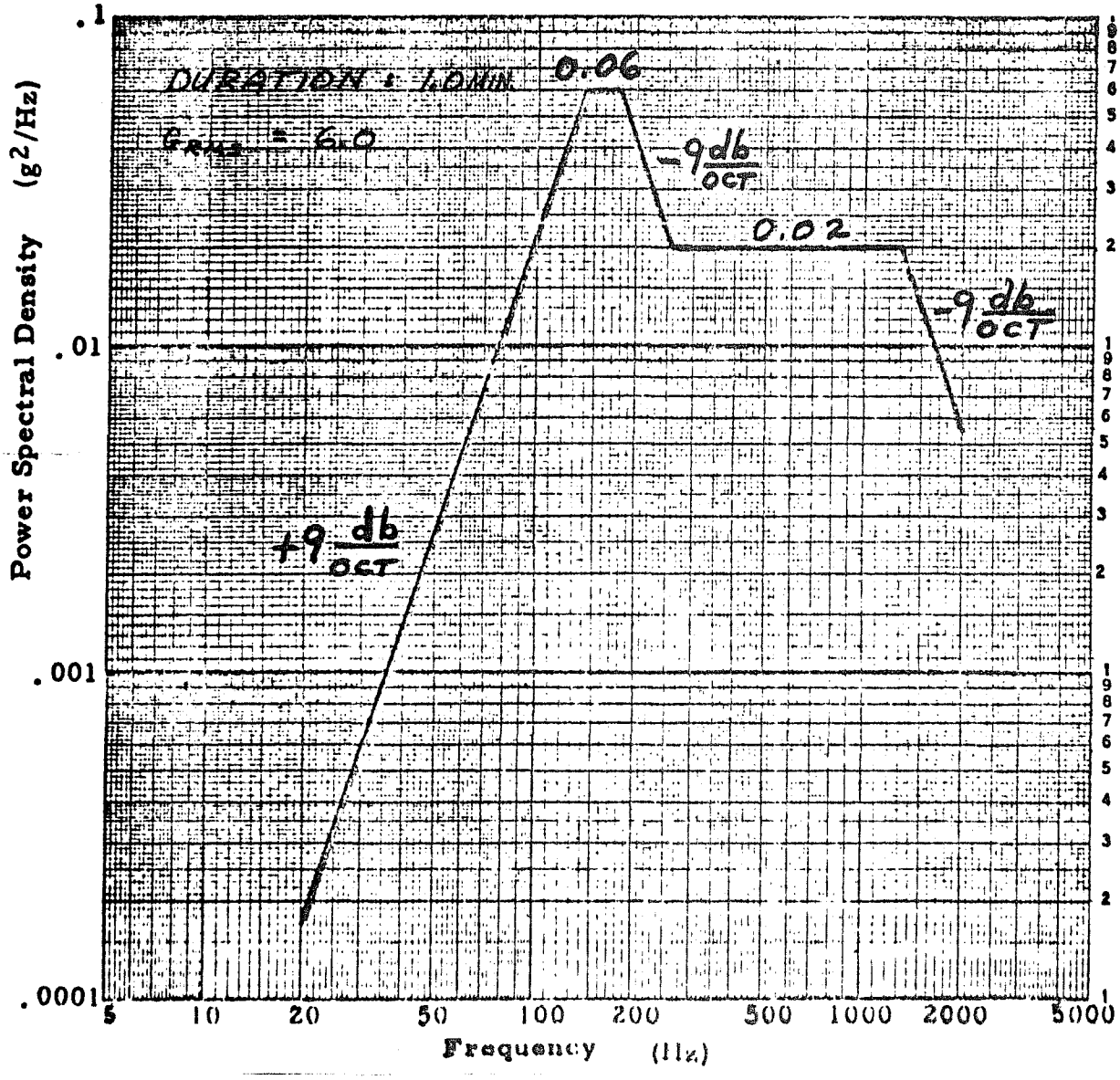


DESIGN LIMIT LEVEL - SUBPACKAGES 1 AND 2

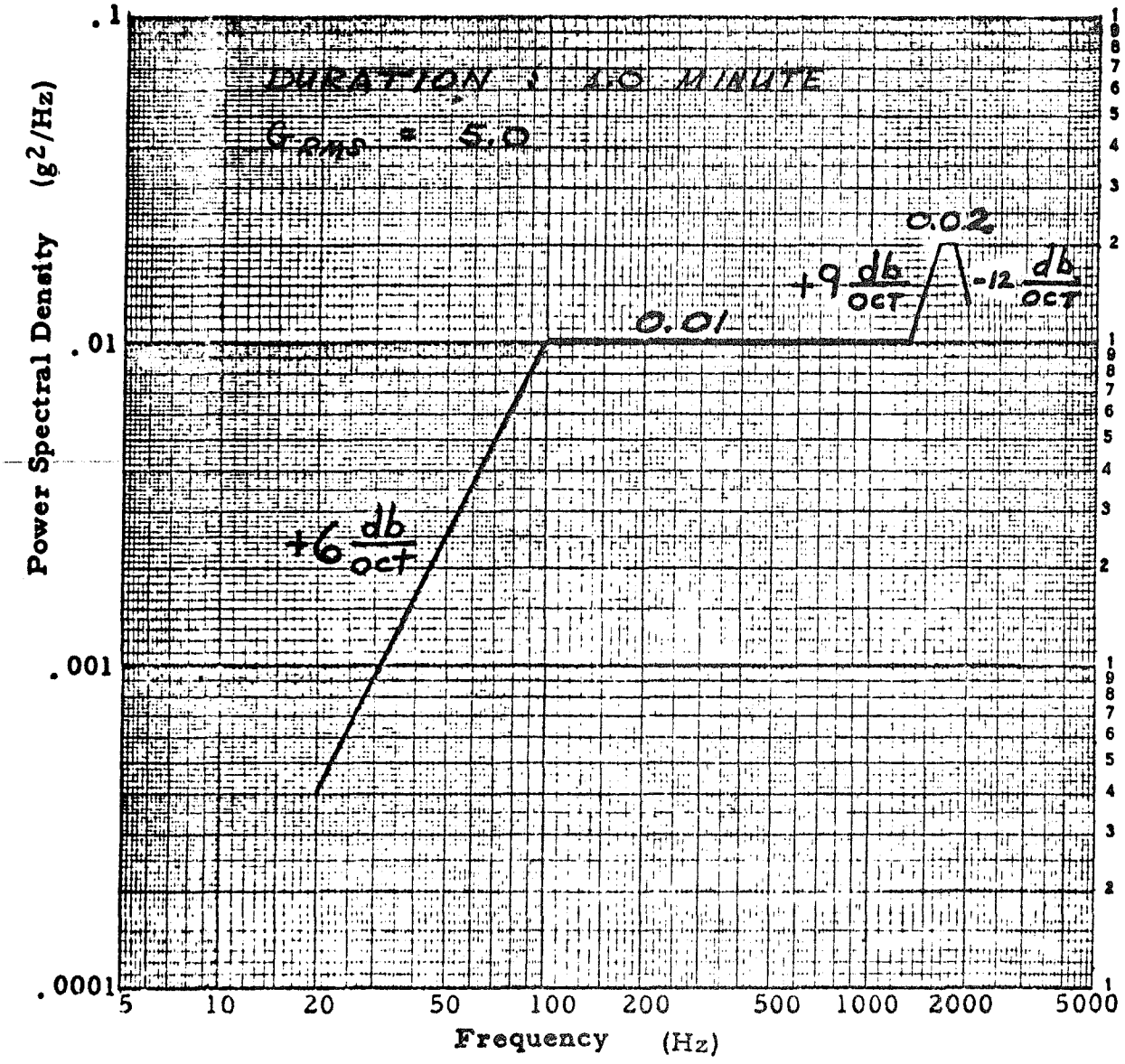
X - AXIS
RANDOM VIBRATION SPECTRUM
SUBPACKAGE 1



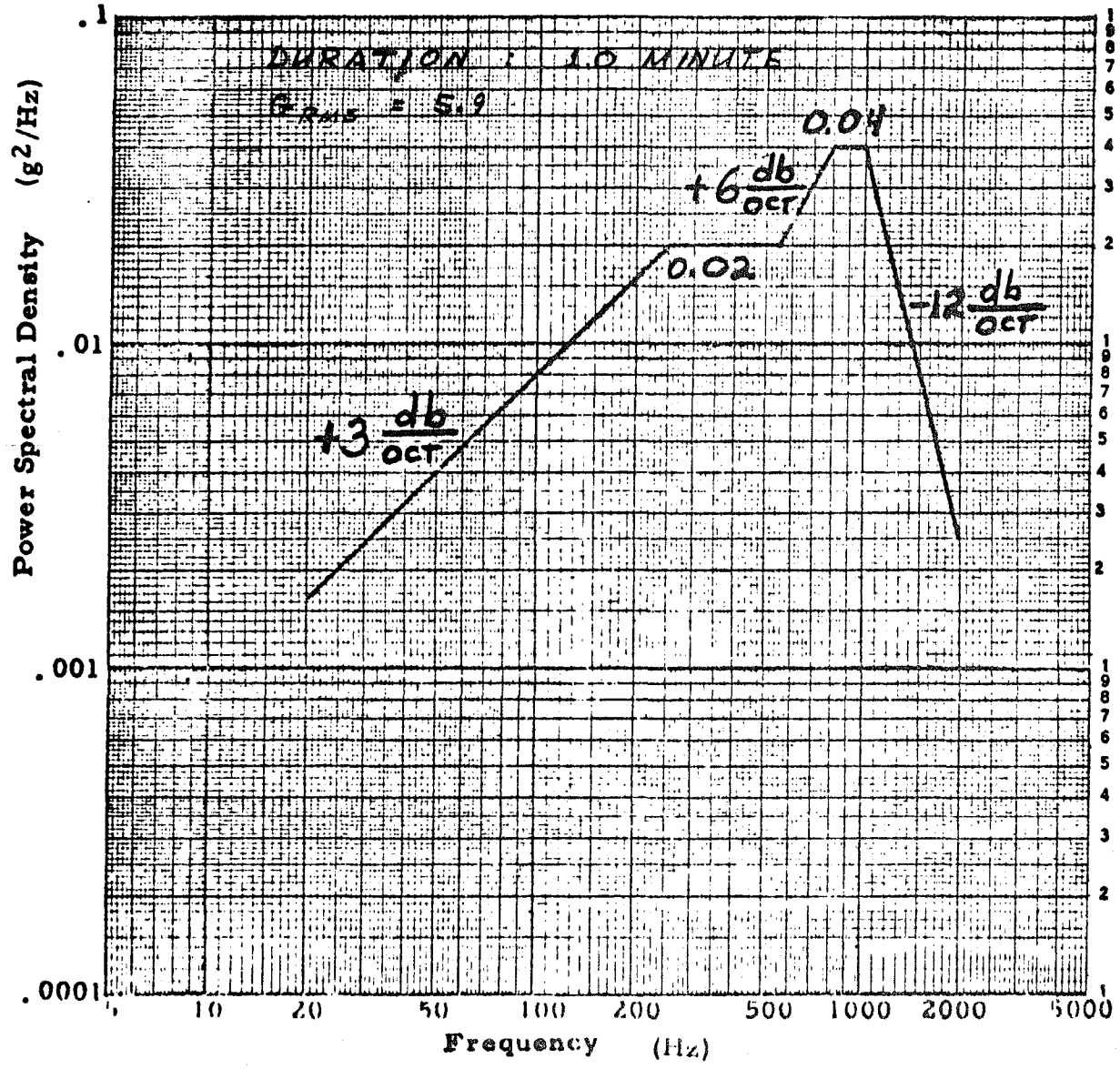
X - AXIS
RANDOM VIBRATION SPECTRUM
SUBPACKAGE 2



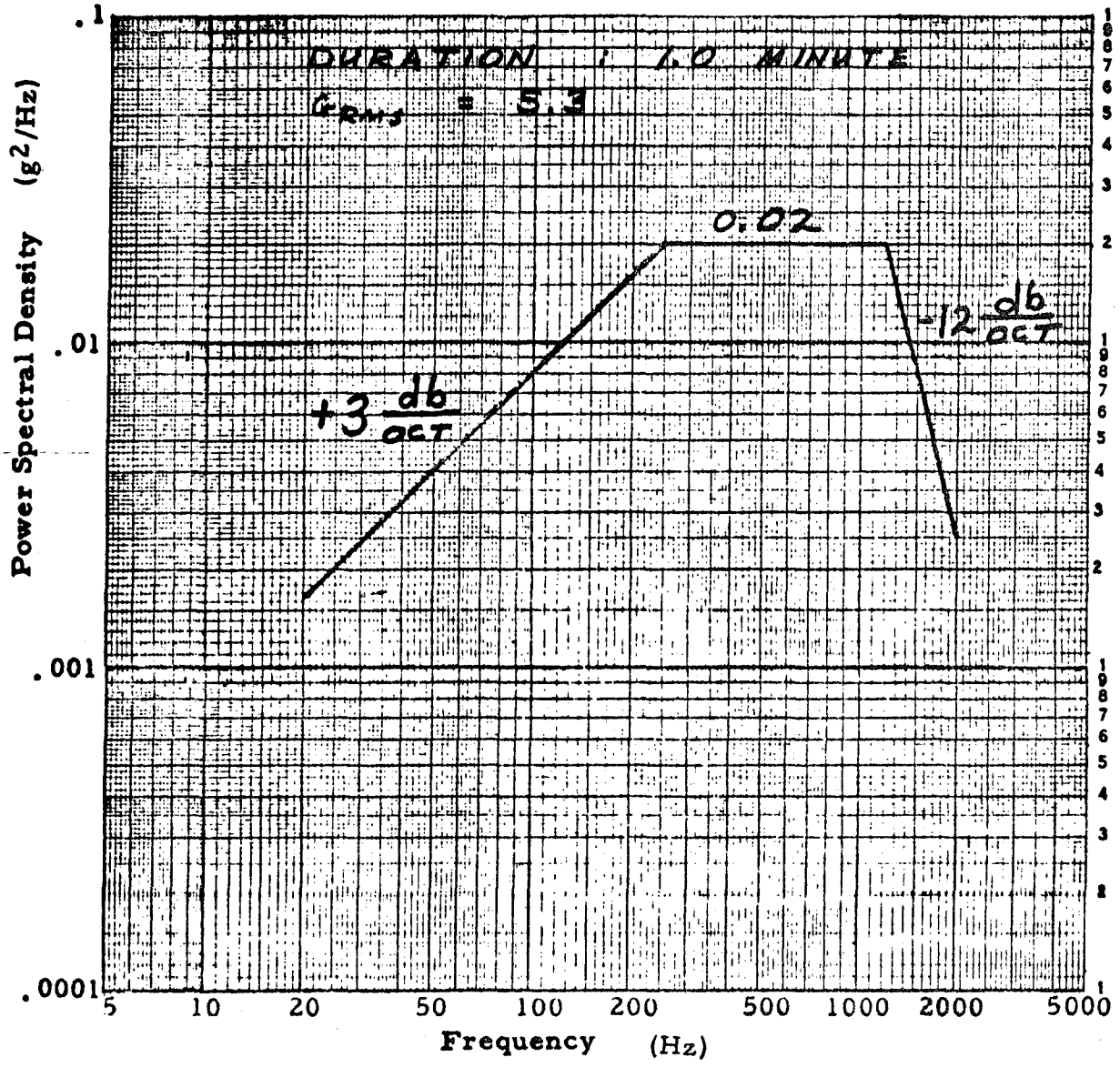
Y - AXIS
RANDOM VIBRATION SPECTRUM
SUBPACKAGES 1 AND 2



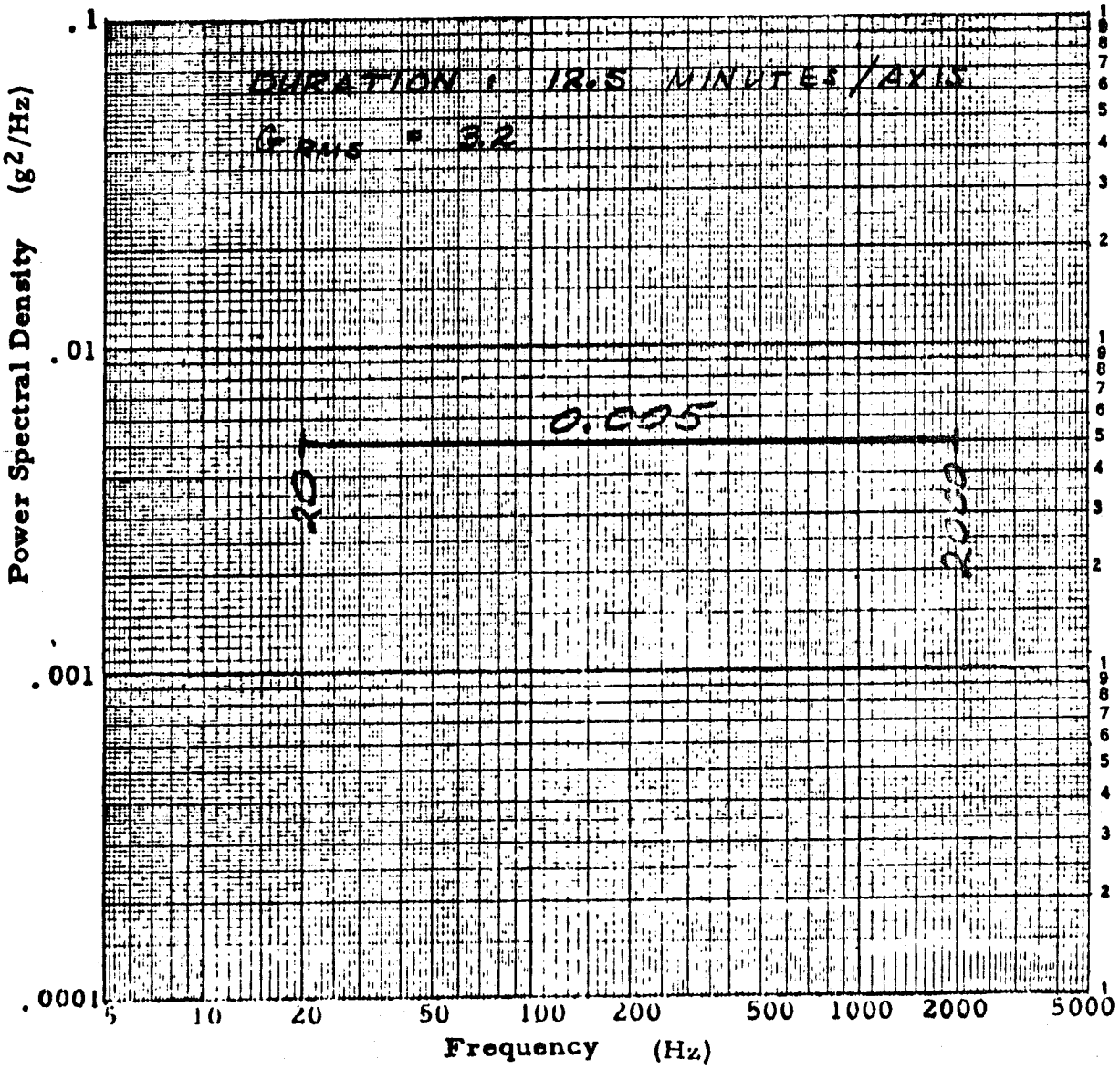
Z - AXIS
RANDOM VIBRATION SPECTRUM
SUBPACKAGE 1

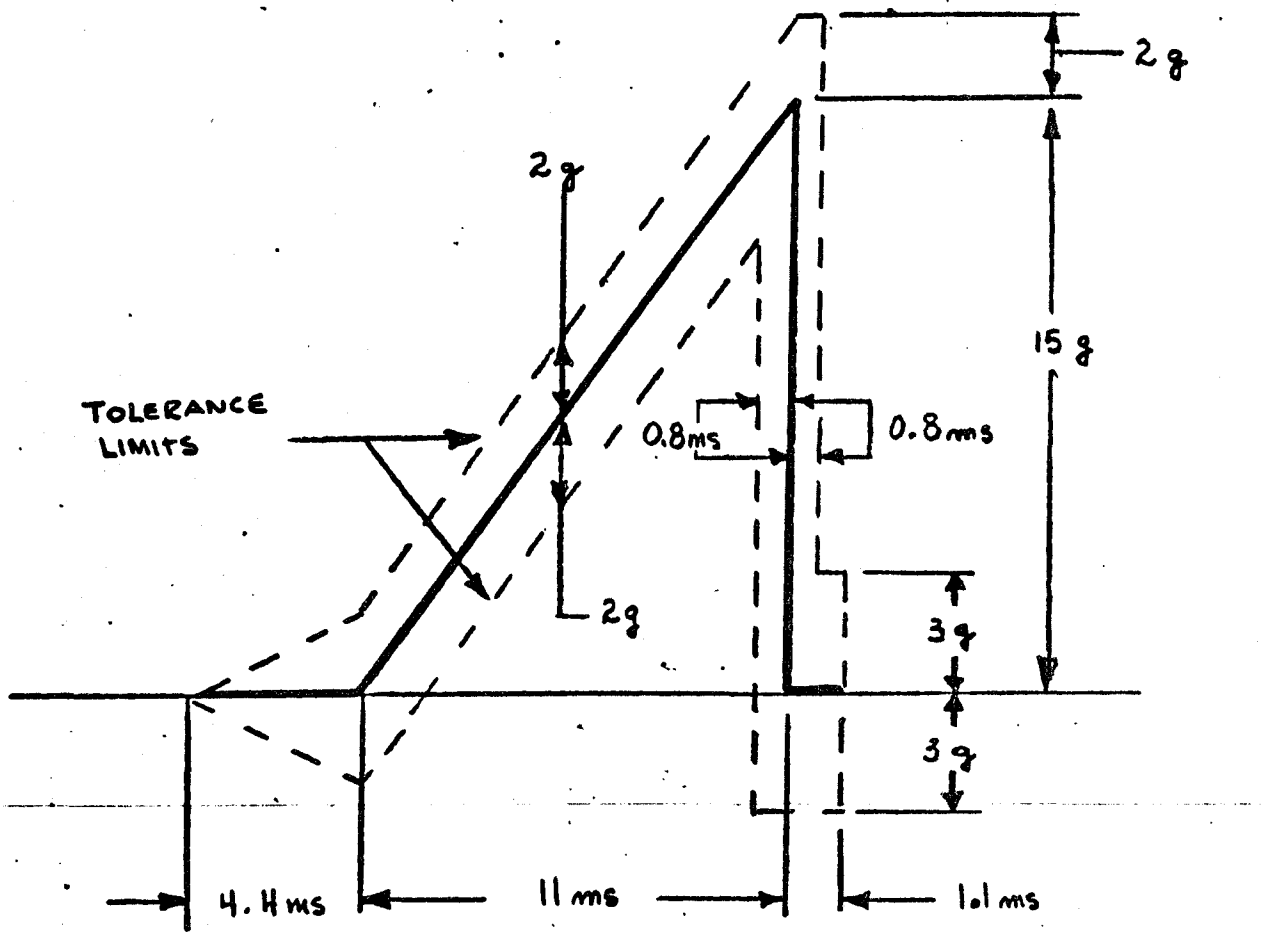


Z - AXIS
RANDOM VIBRATION SPECTRUM
SUBPACKAGE 2



X, Y, Z AXES
LUNAR DESCENT RANDOM VIBRATION
SUBPACKAGES 1 AND 2





SHOCK PULSE
SUBPACKAGES 1 AND 2

APPENDIX B

This appendix contains a complete listing of all Array E FIAR's that have been initiated prior to 22 September 1972.

The LSPE explosive packages, which contain the Bulova Watch Company (BWC) built timers, are not hardware included in the qualification status report. However, for completeness in the following summary, failures associated with the ALSEP/LM Quad III hardware are identified.

Array E FIAR Summary

FIAR	Hardware	FIAR Synopsis	Status
E-1 (Rev. B)	HFE-Astromate Flight S/N 7	Pins 34 and 35 in connector J-70 were shorted by a solder ball wedged between them. Corrective action requires functional test and X-ray of potted connector.	Closed
E-2	LSG Qual S/N 2	The sensor beam failed to null smoothly; problem was caused by contamination between the lower stop and beam. Both Qual and Flight have inspected and cleared.	Closed

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-3	RTG Qual S/N 6320005	The thermopile resistance exhibited erratic behavior, varying between 330 and 3400 ohms. This is an old generator and suspected cause is shifting of thermoelement followers during temperature cycling. Unit function normally at stable temperatures; no corrective action desired by MSC.	Closed
E-4	PDU Qual S/N 13	Open circuits appeared when the motherboard became partially lifted away from the pin header of modules A1, A2, A3, and A4. Problem was caused by handling during a repair operation of motherboard/chassis interference fit. Design change has been incorporated to eliminate interference.	Closed
E-5	LSP Geophone Flight 4 Spare/ Proto E S/N 2	An open circuit appeared in the geophone transducer coil; cause undetermined, but most probably due to vibration with the transducer mass unlocked. The mass lock clips of LSP design were weak. Flight and Qual have stiffer pressure requirement.	Closed
E-6 (Rev.C)	Central Station Qual S/N 10	Spurious commands generated by the command decoder scrambled the PDU relay status and locked out the uplink. The problem was corrected thru incorporation of a +5 V delay module in the PDU.	Closed
E-7	LMS Qual S/N 5	LMS housekeeping data OT's appeared intermittently due to poor grounding. Problem was corrected by tying the ground for the EM tubes together, shunting the normal variations in the chassis ground circuit.	Closed

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-8	LMS Qual S/N 5	A shim between a support bracket and the base on the cable spool end fractured. The material used was too soft and a design change to 302 stainless from aluminum has been made.	Closed
E-9	LMS Qual S/N 5	Experiment power was lost during operating vibration testing; the cause was a broken pad on the flat cable harness with inadequate strain relief. The broken circuit was repaired and covered with PR 1538.	Closed
E-10	LMS Qual S/N 5	Erratic science data appeared during vibration testing; the fault was isolated to a broken wire in the pre-amp discriminator module. To correct the problem, all leads will be epoxied in place at feed-thru slots to prevent motion during vibration testing.	Closed
E-11	LSG Qual S/N 2	Excessive test equipment noise caused spurious status changes during operating vibration testing. Another anomaly appeared caused by a thermally intermittent short in chip U22 in board No. 1. Since this problem occurred at a temperature not seen by the Electronics in lunar operation, it has been dispositioned, use as is.	Closed
E-12	HFE Flight S/N 7	Probe data errors indicated an open circuit at the data amplifier inputs; the constanten wire to pin 31 of TB2 was loose. The faulty connection was repaired and several others inspected with no faults found.	Closed

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-13	LEAM Qual S/N 2	A data error appeared which was caused by a leaky Harris op-amp in the collector module S/N 29. There is no failure history on this part; therefore it is considered a random failure.	Closed
E-14	LSP - EPA Proto S/N 7	Thermal battery timer B-21 failed to start at WSTF field test.	Closed
E-15	LSP - EPA Proto S/N 10	Timers B-10 and/or S-10 failed during WSTF field test.	Closed
E-16	RTG Flight Mod 24	RTD indicator R3-1 failed to open; cause has been determined to be repeated thermal cycling in an air ambient environment. No corrective action is contemplated.	Closed
E-17	HFE Flight S/N 7	Probe #1 upper gradient bridge data was in error; fault was caused by a low impedance short between the bridge output and the chassis via a test lead. The test leads have been removed.	Closed
E-18	Central Station Qual S/N 10	During a MIST, no analog output was present for LSPE geophone #1; the fault was isolated to loose crimp connections at pins 2 and 7 of connector J150 in the C/S wiring harness. A design change has been incorporated specifying a special technique for these and similar connections.	Closed

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-19	PDU Flight S/N 14	Fuse F4 appeared to be thermally intermittent; this behavior has been attributed to a poor weld bond at the fuse element/post interface--the lot was found defective. All defective fuses have been replaced with fuses from a new lot having a temperature cycling screen.	Closed
E-20	Central Station S/N 10	During a CD/DP/CS verification test an apparently spurious status change occurred; the fault was isolated to leaky output gates in the command decoder. All output gates in both qual and flight hardware have been screened for excessive leakage.	Closed
E-21	Data Processor Flight S/N 15	During op-vib testing, a sudden shift in ± 12 V current appeared; the fault was isolated to National Semi-conductor op-amp. The fault mechanism was lost, but is suspected as a "large" particle that fell out during decapping (part was inverted). This is considered a random defect.	Closed
E-22	HFE-Astromate Flight S/N 7	The locking collar of the microdot connector had been damaged during the trouble-shooting associated with FIAR E-1, but was not noticed. Additional data errors were present during retest; examination of the schjeldahl connector revealed a thin film of epoxy on some of the contacts which resulted from an improper application of connector potting. Both discrepancies have been reworked.	Closed

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-23	LMS Flight S/N 7	A wire weld broke at terminal E119 on an EM tube during assembly; the failure was caused by an insufficient tie down coupled with improper handling. The fault was repaired.	Closed
E-24	LMS Flight	Calibration data was missing from channel A during a functional test; the fault was isolated to poor solder joint and a lifted pad that broke continuity with a plated thru hole; the unit has been repaired.	Closed
E-25	---	This FIAR was canceled.	----
E-26 (Rev A)	PDM/PDU Flight	The fuse in the +29 V line to PDR #1 blew; the cause was isolated to a pinched wire in the PDM panel. The unit has been reworked, and an isolation test added to the PDM checkout after installation on the Sub-Pack.	Closed
E-27	LMS Qual S/N 5	During pumpdown/backfill, the required back pressure could not be obtained; the fault was isolated to cracks in ceramic of the break seal, poor brazing and poor application of the GE-VAC sealant. The break seal has been replaced.	Closed by MSC 9/19/72
E-28	HFE Qual S/N 2	During the transition to lunar nite in the system thermal vacuum test, all HFE data went to zero. The fault was isolated to an epoxy contaminated schjeldahl connector. This connector had been built up prior to implementing AQD-59, which has eliminated further problems in similar connectors.	Closed

Appendix B (cont' d)

FIAR	Hardware	FIAR Synopsis	Status
E-29	LEAM Flight S/N 3	During a functional test, excessive noise bits appeared on the EAST and WEST sensors; the fault was isolated to poor grounding caused by an operator error in applying epoxy to a redundant ground strip. The unit has been reworked.	Closed
E-30 (Rev A)	LSPE-XMTR Qual S/N 2	During lunar noon testing it was observed that the output power was out of spec on the low side. The test set up outside the space chamber had been altered, and an 93 Ω cable was used as opposed to the 50 Ω system, causing a mismatch. Also, the OSM connector J-155 had a loose braid. Proper operation was verified with 50 Ω cable and the loose braid was reworked.	Closed
E-31	LEAM Qual S/N 2	Following T/V testing, it was observed that a bonded joint on one leg was broken. The design was evaluated and found to be adequate; the qual fault was caused by inadequate surface preparation. The unit was reworked.	Closed
E-32	LEAM Qual S/N 2	Housekeeping data indicated that the LEAM dust covers failed to blow following command; visual observation showed they had blown. The fault was traced to a poor welded connection on a relay lead. Following replacement, the unit functioned normally.	Closed
E-33	LMS Flight S/N 7	During a MIST, LMS data went to zero; the fault was isolated to a short in the schjeldahl connector. A gold strand shorted two pins; also, excessive flux was present that caused a "hard" fit and probably induced the gold sliver. The unit has been reworked.	Closed

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-34	LSP-Geophone Qual S/N 2	The test data indicated that the geophones were picking up the AGC rf transmitter pulses. The problem was corrected thru addition of a ground strap from the geophone cables to the C/S thermal plate. Qual and Flight conform.	Closed
E-35	LSPE-Geophone Qual S/N 2	During T/V testing the geophones were exposed to temperatures outside their specifications. Geophone evaluation showed damaged support rings; qual has been reworked and flight inspected and reworked.	Closed
E-36	RTG Flight Mod 24	RTD R3-3 gave erratic readings (ref. FIAR E-16). Repeated thermal cycling and dynamic environments cause this type of anomaly; a general waiver, RTG-1 has been granted for all generators.	Closed
E-37	LEAM Flight S/N 3	LEAM exhibited excessive noise bits during the set up for EMI testing. The fault was caused by a difference in potential between the experiment signal return and chassis ground; the thermal bag and the signal ground are now tied common.	Closed
E-38	LSPE-rf Cable Qual S/N 2	The Antenna cable shield broke at the connector P-155B. The fault was traced to inadequate soldering technique; a new method has been devised (ref MP-62). Qual and Flight conform.	Closed
E-39	Command RCVR Flight S/N 18	An apparent 6 db signal strength loss caused CVW's to be lost. The fault was isolated to poor grounding in the RCVR's front end.	Closed by MSC 9/14/72

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-40	LEAM Qual S/N 2	(Ref FIAR E-37) Excessive noise bits were present caused by grounding problem. Unit has been repaired.	Closed
E-41	LEAM Qual S/N 2	An open power line inside the electronics package appeared; fault was isolated to a broken wire which was due to inadequate stress relief. Unit has been repaired.	Closed by MSC 9/14/72
E-42	LMS Proto/Qual	The filament power supply HK read low. Excessive noise in the reference circuit causes this anomaly; unit has a capacitor added to eliminate the problem. Similar behavior is not present in the Flight unit.	Closed by MSC 9/14/72
E-43	S/P 1 - Sunshield Qual S/N 23	An apparent bonding failure occurred during design limit vibration testing. Sunshield evaluation has shown the unit to be structurally sound. The sub-pack vibration testin has been successfully completed.	Open, Final FIAR submitted to MSC 9/15/72
E-44	LSP - Timer B-55	Timer failed at BWC.	Closed
E-45	LSP Timer B-59	Timer failed at BWC.	Closed
E-46	LSP Timer S-59	Timer failed at BWC.	Closed
E-47	LSP Timer B-61	Timer failed at BWX.	Closed
E-48	LSP-Geophones Flight	Geophone insulator standoffs cracked after exposure to temperatures less than -125°F. The cracked standoffs have been replaced in flight.	Closed 9/14/72

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-49	Data Processor Qual S/N 14	The +5 V line for DDP-X was shorted to the ground plane of the mother board inside the unit. A design modification has been incorporated which mechanically insulates the wiring to the DDP interface connector from the sharp edge of the mother board.	Closed by MSC 9/19/72
E-50	LSP - Timer B-54	Timer failed at BWC.	Open
E-51	LSP - Timers S-60, S-54, S-57	Timers failed at BWC.	Closed
E-52	LSP - Timers S-56, S-61	Timers failed at BWC.	Closed
E-53	LSP - Timer B-57	Timer failed at BWC.	Closed
E-54	LSP - Antenna Proto	The second grip ring pulls free before the 5th (top) section deploys. Unit has been reworked.	Closed
E-55	LSP - Timer B-58	Timer failed at BWC.	Closed
E-56	LSP - Timers S-64, S-69, S-65	Timers failed at BWC.	Closed
E-57	LSP - Timer B-55	Timer failed at BWC.	Open
E-58	LSP - Timer NOL - Qual S-56	Timer failed at BWC.	Closed
E-59	LSP - Timer S-56	Timer failed at BWC.	Closed
E-60	LSP - EPA Qual S/N 27	Timers failed at BxA.	Closed

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-61	Command RCVR Qual S/N 17	During C/S verification test an apparent signal strength loss of approximately 6 db caused CVW's losses. The problem is similar to that reported for S/N 18 in FIAR E-39. The receiver has been returned to Motorola for fault isolation.	Closed by MSC 9/19/72
E-62	LSP - Timer B-66	Timer failed at BWC.	Open
E-63	LSP - Timer S-69	Timer failed at BWC.	Closed
E-64	LSP - Timer B-57	Timer failed at BWC.	Open
E-65	Data Processor Flight S/N 15	During retest following incorporation of design fix required for FIAR E-49, 12 channels indicated an error. The fault was isolated to chip U17 on the sequencer board. In addition, a short to the substrate in U20 cause every 12th channel to be erratic. The board has been reworked.	Closed by MSC 9/19/72
E-66	LSP - Timer B-65	Timer failed at BWC.	Open
E-67	LSP - Timer S-73	Timer failed at BWC.	Open
E-68	LSP - Timer S-76	Timer failed at BWC.	Open
E-69	LSP - Timers B-72, B-67, B-69, B-78	Timers failed at BWC.	Open
E-70	LSP - Timer S-77, S-74	Timer failed at BWC.	Closed

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-71	LSP - Timer	Timer failed at BWC.	Open
E-72	LSP - Timer B-76	Timer failed at BWC.	Open
E-73	LSP - Timer S-55	Timer failed at BxA.	Open
E-74	LSP - Timer	Timer failed at BxA.	Open
E-75	LSP - Timer S-62	Timer failed at BxA in T/V test.	Open
E-76	LSP - Timer B-58, S-58	Timer failed at BxA in T/V test.	Open
E-77	LSP - Timer B-59	Timer failed at BxA in T/V test.	Open
E-78	LSP - Timer B-56	Timer failed at BxA in T/V test.	Open
E-79	LSP - Timer S-61	Timer failed at BxA in T/V test.	Open
E-80	LSP - Timer S-83	Timer failed at BWC.	Open
E-81	LSP - Timer B-77	Timer failed at BWC.	Open
E-82	LSP - Timer B-80	Timer failed at BWC.	Open
E-83	LSP - Timer B-81	Timer failed at BWC.	Open
E-84	LSP - Timer B-83	Timer failed at BWC.	Oepn

Appendix B (cont'd)

FIAR	Hardware	FIAR Synopsis	Status
E-85	LSP - Timer S-75	Timer failed at BWC.	Open
E-86	LSP - Timer B-85	Timer failed at BWC.	Open
E-87	LSP - Timer B-89	Timer failed at BWC	Open
E-88	LSP - Timer B-82	Timer failed at BWC	Open
E-89	LSP - Timer B-78	Timer failed at BWC	Open

APPENDIX C

QUALIFICATION STATUS LIST

The QSL sheets contained herein are as follows:

(1) Sub-Package No. 1
(2) S-band Antenna
(3) Diplexer Filter
(4) Diplexer Switch
(5) Command Receiver
(6) Command Decoder
(7) Data Processor
(8) Transmitter
(9) Power Conditioning Unit (PCU)
(10) Power Distribution Unit (PDU)
(11) LSPE - Central Electronics
(12) Sub-Package No. 2
(13) Radio Isotope Thermoelectric Generator
(14) Shorting Plug Assembly
(15) Antenna Aiming Mechanism
(16) ALSEP Tools
(17) LSG Experiment
(18) LMS - Qual Model
(19) LMS - Proto w/Qual Multi-Mode Emission
(20) LEAM Experiment
(21) HFE Experiment

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date	No.	Rev. No.
11 Sept 1972	ATM 1106	
Analyst	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Subpackage No. 1 Flight 6 BxA 2348700-501 S/N 24 Qual SE BxA 2348700-502 S/N 23	ENVIRONMENTAL Temperature: Operating/ Non-Operating Earth Moon	0°F to +125°F (internal) -65°F to +160°F (in-lunar flight) -300°F to +250°F	Meets Specifications	BxA	Ann Arbor	TP 2365581 2365582 ATR 322	9/1/72	System capability verified during thermal vacuum testing; designed to satisfy non-operating requirements.
	Pressure Operating Non-Operating	Sea Level to 10^{-12} Torr	Tested to 5×10^{-6} Torr	BxA	Ann Arbor	Same as above	9/1/72	Test level limited by test equipment capability
	Humidity Operating Non-Operating	15 - 100%	Designed to meet requirements	-	-	-	-	No test required
	Vibration Operating (N/A) Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets specifications	BxA	Ann Arbor	TP 2365577 2365568 ATR 326/319	9/1/72	Waiver W0058 submitted for 70 - 100 HZ upsweep and 100 - 50 HZ downsweep of SINE vibration.
	Acceleration Operating Non-Operating	LED 520-1	Designed to meet requirements	-	-	-	-	No test required
	Shock Operating (N/A) Non-Operating	See Appendix A	Meets specifications	BxA	Ann Arbor	TP 2365579 ATR 325	9/1/72	Capability demonstrated by test
	Salt Spray	N/R		-	-	-	-	
	Sand & Dust	LED 520-1	Designed	-	-	-	-	
	Fungus	per SS 10 00 00		-	-	-	-	
	Acoustical Noise	LED 520-1	to meet	-	-	-	-	No tests required
	Rain	N/R		-	-	-	-	
	Radiation	LED 520-1	Requirements	-	-	-	-	
	Explosion Proof	N/R		-	-	-	-	
	PARAMETRIC Functional Performance verified during systems testing	See Paragraph 3.1 of ATM 1106	Meets specifications	BxA	Ann Arbor	See Paragraph 3.2 of ATM 1106	9/1/72	System performance verified during thermal vacuum testing
	EMI	per AL770000	Meets specifications	BxA	Ann Arbor	TP 2365565 ATR 316	9/1/72	Compatibility and margin of compatibility demonstrated by test.

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date 11 Sept 1972	No. ATM 1106	Rev. No.
Analyst	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
S-band Antenna Flight 6 BxA 2334522 S/N 14	ENVIRONMENTAL							
	Temperature: Operating	-65°F to +160°F (in-lunar flight)	Meets specifications	BxA	Ann Arbor	TP 2334335 ATR 60/70 (Array A)	May-June 1968	Antenna qualified for Array A and verified with Array E at sub package level
	Non-Operating Earth							
	Moon	-300°F to +250°F						
Qual SA/SE BxA 2334522 S/N 4/13	Pressure Operating (N/A) Non-Operating	Sea level to 10^{-12} Torr	Tested to 5×10^{-6} Torr	BxA	Ann Arbor	Same as above		Test level limited by test equipment capability
	Humidity Operating Non-Operating	15 - 100%	Designed to meet requirements	-	-	-	-	No test required
	Vibration Operating (N/A) Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets specifications	BxA	Ann Arbor	TP 2365577 2365568 ATR 326/318	9/1/72	Capability verified during Array E subpackage No. 1 vibration testing
	Acceleration Operating (N/A) Non-Operating	See ATR 16	Meets specifications	BxA	Ann Arbor	TP 2334343 ATR 90/91	July 1968	Qualified for Array A
	Shock Operating (N/A) Non-Operating	See Appendix A	Meets specifications	BxA	Ann Arbor	TP 2365579 ATR 325	9/1/72	Capability verified during Array E SP 1 testing
	Salt Spray	N/R		-	-	-	-	
	Sand & Dust	LED-520	designed	-	-	-	-	
	Fungus	N/R		-	-	-	-	
	Acoustical Noise	N/R	to meet	-	-	-	-	No tests required
	Rain	N/R		-	-	-	-	
	Radiation	LED-520	requirements	-	-	-	-	
	Explosion Proof	N/R		-	-	-	-	
	PARAMETRIC							
	Radiated Power (effective beam width, xmit/ receive)	42.5 dbm 27° @ 11.7 db 27° @ 11.0 db	42.5 dbm 29° @ 11.7 db 31° @ 11.0 db	Bendix Research Labs	Southfield, Mich	Design Verification Report #4028	June 1967	Qualified for Array A
	Input VSWR @ Xmtr f_o @ Rcvr f_o	1.40:1 1.5:1	1.40:1 1.50:1	Bendix Research Labs	Southfield, Mich	Same as above	June 1967	Qualified for Array A
	Minimum Power Handling Capability	1.5 w cw @ Xmtr f_o	1.5 w cw @ Xmtr f_o	Bendix Research Labs	Southfield, Mich	Same as above	June 1967	Qualified for Array A

QUALIFICATION STATUS LIST-ALSEP PROGRAM — CENTRAL STATION ELECTRONICS COMPONENTS

Date 11 Sept. 72 | No. ATM 1106 | Rev. No.

Analyst Rantec | Page ____ of ____ Pages

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Referen	Date	
Filter, Diplexer BxA # 2330525 S/N 13 Flight 6 BxA # 2330525 SA Qual, S/N 12	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	 -25°F to +160°F -65°F to +160°F - - - - -	 ok per reqm ok per reqm	 Rantec Wyle Labs	 Calabasas, Calif El Segundo, Cali	 Rantec #66279-QTP	 2/19/67 2/6/67	 1. Qualification verified in SP# 1 Qual SA test
	Pressure Operating Non-Operating	 $< 10^{-12}$ Torr 30 to 1.3 Torr	 1×10^{-5} ok	Wyle Labs	El Segundo, Cali	Rantec #66279-QTP	2/20/67	(Qualified in system to 5×10^{-6} Torrs)
	Humidity Operating Non-Operating	 15 to 100% R. H.	100% RH at 160°F 100% RH at 120°F	" " "	" " " " " " "	" " " " " " "	2/8/67	NA
	Vibration Operating (N/A) Non-Operating Launch & Flight Lunar Landing	Random 15 to 150 cps, 0.2g/cps sine: 5 to 20 cps 0.4 in. D. A. 20	Ok per reqm	" " "	" " " " " " "	" " " " " " "	2/13/67	See remark 1
	Acceleration Operating Non-Operating	NA 25g's ea. axis	Ok per reqm	" " "	" " " " " " "	" " " " " " "	2/10/67	See remark 1
	Shock Operating Non-Operating	NA 20g's ea. axis	Ok per reqm	" " "	" " " " " " "	" " " " " " "	2/9/67	See remark 1
	Salt Spray	NA	NA					
	Sand & Dust	NA	NA					
	Fungus	NA	NA					
	Acoustical Noise	NA	NA					
	Rain	NA	NA					
	Radiation EMI	Radiated @ fo	57 db	Bunker Ramo	Canoga Park, Calif.	66279-QTP	2/27/67	
	Explosion Proof	NA	NA					
	PARAMETRIC VSWR	1.36:1 max all parts	1.22:1 max	Rantec	Calabasas, Calif.	66279-PTP-D	Before and after each environmental test	Qualified as part of an integrated system in the space simulation chamber during Qual S/A
	Insertion Loss	0.8 db Max	0.73 db Max	Rantec	Calabasas Calif	66279-PTP-D	1/16/67 to 2/23/67	TP 2333032 ATR-60, 70 June 1968
	Isolation between channels	50 db fn to f_{LO} 80 db f_t to fr	90 db min > 100 db min	Rantec	Calabasas Calif	66279-PTP-D 66279-PTP-D	1/16/67 to 2/23/67	

QUALIFICATION STATUS LIST-ALSEP PROGRAM

CENTRAL STATION ELECTRONICS COMPONENTS

Date 11 Sept. 72	No. ATM 1106	Rev. No.
Analyst Rantec	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Diplexer Switch BxA #2330526 S/N 13 Flight 6 SA Qual, S/N 14	ENVIRONMENTAL							
	Temperature:							
	Operating	-25°F to -160°F	Ok per reqm	Rantec	Calabasas, Calif	66279-QTP	2/19/67	1. Qualification verified in
	Non-Operating							
	Earth	-65°F to -160°F	Ok per reqm.	Wyle Labs	El Segundo, Cali		2/6/67	SP #1 Qual SA test.
	Moon							
	Pressure							
	Operating	10^{-12} Torr	1×10^{-5}	Wyle Labs	El Segundo, Calif	66279-QTP	2/20/67	Qualified in system to 5×10^{-6} Torrs
	Non-Operating	30 to 1.3 Torr	Ok					
	Humidity							
	Operating		100% RH at 160°F					
	Non-Operating	15 to 100% R.H.	100% RH at 120°F				2/8/67	
	Vibration							
	Operating (N/A)	Random: 15 to 2	Ok per reqm.					
	Non-Operating	150 cps. 0.2g /cp						
	Launch & Flight	Sine:5-20 cps 0.4					2/13/67	See remark 1
	Lunar Landing	in D.A. 20to100cp						
		8g's						
	Acceleration							
	Operating	N/A	Ok per reqm.					
	Non-Operating	25g's ea. axis					2/10/67	See remark 1
	Shock							
	Operating	N/A	Ok per reqm					
	Non-Operating	20g's ea. exis					2/9/67	See remark 1
	Salt Spray	NA	NA					
	Sand & Dust	NA	NA					
	Fungus	NA	NA					
	Acoustical Noise	NA	NA					
	Rain	NA	NA					
	Radiation	radiated at fo	50 db	Bunker Ramo	Canaga Park, Calif	66279-QTP	2/22/67	
	Explosion Proof	NA	NA					
	PARAMETRIC							
	VSWR	1.36:1 Max	1.21:1 Max	Rantec	Calabasas, Calif	66279-PTP-S	Before and after each environmental test	
	Insertion Loss	0.7 db Max	0.63 db Max	Rantec	Calabasas, Calif	66279-PTP-S	1/16/67 to 2/23/67	Qualified as part of an integrated system in the space simulation chamber during Qual SA
	Isolation between channels	20 db Min Part A to Part B or vice versa	22 db Min	Rantec	Calabasas, Calif	66279-PTP-S	1/16/67 to 2/23/67	

QUALIFICATION STATUS LIST-ALSEP PROGRAM

CENTRAL STATION ELECTRONICS COMPONENTS

Date 11 Sept. 72	No. ATM 1106	Rev. No.
Analyst T W Fox	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Command receiver BxA #2345147 S/N 15, Flight 6 S/N 17, Qual Vendor Qual S/N 14	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	-22°F to +158°F NA NA	-22°F to +158°F NA NA	Motorola GED	Scottsdale, Ariz	12-P11261B Revision B ATR294	12/1/70	
	Pressure Operating Non-Operating	1×10^{-5} mm Hg. NA	1×10^{-5} mm Hg. NA	Motorola GED	Scottsdale, Ariz	12-P11261B Revision B ATR294	12/1/70	
	Humidity Operating Non-Operating	NA 95% RH @ 158°F	NA 95% RH @ 158°F	Motorola GED	Scottsdale, Ariz	NA	NA	This is a design requirement of AL-410600, but not required to be verified by test.
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	7.9 G Rms 6 G Sine Peak 5.7 G Rms 4.3 G Rms	7.9 G Rms 6 G Sine Peak 5.7 G Rms 4.3 G Rms	Motorola GED	Scottsdale, Ariz	12-P11261B Revision B ATR294	12/1/70	
	Acceleration Operating Non-Operating	NA 14 G for 1 min.	NA 14 G for 1 min.	Motorola GED	Scottsdale, Ariz	ATR294 12-P11261B Revision B	12/1/70	
	Shock Operating Non-Operating	NA 20G/11msec	NA 20G/11msec.	Motorola GED	Scottsdale, Ariz	ATR294 12-P11261B Revision B	12/1/70	
	Salt Spray	NA	NA					
	Sand & Dust	NA	NA					
	Fungus	NA	NA					
	Acoustical Noise	NA	NA					
	Rain	NA	NA					
	Radiation	NA	NA					
	Explosion Proof	NA	NA					
	PARAMETRIC EMI	AL41600 as defined in Mil-I-26600 and NASA-ASPO-10A	AL41600 as defined in Mil-I-26600 and NASA-ASPO-10A	Motorola GED	Scottsdale, Ariz	ATR294 12-P-11261B Revision B	12/1/70	ECP 3875-9 ECP 3875-10

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date	No.	Rev. No.
11 Sept 1972	ATM 1106	
Analyst	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Command Decoder Flight 6 BxA 2367600-502 S/N 12 Qual SE BxA 2367600-503 S/N 11	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	-22°F to +158°F -65°F to +160°F (in-lunar flight)	Meets specification	BxA	Ann Arbor	TP 2349306 (comp. PIA) TP 2365581 2365582 (system)	9/1/72	PIA tests: Hot, cold, amb. & capability demonstrated during system T/V testing
	Pressure Operating Non-Operating	Sea Level to -10^{-12} torr	Tested to 5×10^{-6} torr	BxA	Ann Arbor	TP 2365521 2365582	9/1/72	Test level limited by test equipment capability
	Humidity Operating Non-Operating	95% at 70°C	Designed to meet requirements	-	-	-	-	No test required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets specifications	BxA		TP 2365314 (comp. op-vib)	9/1/72	Capability demonstrated at component level.
	Acceleration Operating Non-Operating	14 g's for 60 sec	Designed to meet requirements	-	-	-	-	No test required
	Shock Operating (N/A) Non-Operating	20 g's/11 msec (sawtooth pulse)	Designed to meet requirements	-	-	-	-	Capability demonstrated at sub-pack level
	Salt Spray	N/R						No testing required
	Sand & Dust	N/R						
	Fungus	N/R						
	Acoustical Noise	N/R						
	Rain	N/R						
	Radiation	N/R						
	Explosion Proof	N/R						
	PARAMETRIC Functional Performance	per AL 310810	Meets requirements	BxA	Ann Arbor	TP 2349306 (component PIA)	9/1/72	Capability demonstrated during system thermal vacuum test
	EMI	per AL 770000	Meets requirements	BxA	Ann Arbor	TP 2365565 ATR 316	9/1/72	Capability demonstrated at the system level

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date 9/11/72	No. ATM 1106	Rev. No.
Analyst T. Fox	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Data Processor Flight 6 BxA 2349400-503 S/N 15	ENVIRONMENTAL Temperature: Operating	-22°F to +158°F	Meets	BxA	Ann Arbor	TP 2349202 (comp. PIA) TP 2365581 2365582	9/1/72	PIA test: Hot, Cold, Amb. capability demonstrated during system T/V testing.
	Non-Operating Earth	-65°F to +160°F	Specifications					
	Moon	(cis-Lunar flight)						
	Pressure Operating	Sea Level						
	Non-Operating	to 10^{-12} torr	tested to 5×10^{-6} torr	BxA	Ann Arbor	TP 2365582 TP 2365581	9/1/72	Test level limited by test equipment capability.
Qual SE BxA 2349400-502 S/N 14	Humidity Operating Non-Operating	95% at 70°C	Designed to meet req'mnt	----	----	----	---	No test required.
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets Specifications	BxA	Ann Arbor	TP 2365320	9/1/72	Capability demonstrated by comp. level testing.
	Acceleration Operating Non-Operating	14g's for 60 sec.	Designed to meet requirements	----	----	----	---	No test required.
	Shock Operating (N/A) Non-Operating	20g's/11 msec. (sawtooth pulse)	Designed to meet requirements	----	----	----	---	Capability demonstrated at sub-pack level.
	Salt Spray	N/R						
	Sand & Dust	N/R						
	Fungus	N/R						No testing required.
	Acoustical Noise	N/R						
	Rain	N/R						
	Radiation	N/R						
	Explosion Proof	N/R						
	PARAMETRIC Functional Performance	per AL 310910	Meets requirements	BxA	Ann Arbor	TP 2344202 (component PIA)	9/1/72	Tested at the comp. level; capability demonstrated during thermal vacuum test.
	EMI	per AL 770000	Meets requirements	BxA	Ann Arbor	TP 2365565 ATR 316	9/1/72	Capability demonstrated during system level.

QUALIFICATION STATUS LIST-ALSEP PROGRAM

CENTRAL STATION ELECTRONICS COMPONENTS

Date 11 Sept. 72	No. ATM 1106	Rev. No.
Analyst	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Transmitter, PSK BxA #2362877 Qual Units, S/N 41, 42, 43 Flight 6 Flight Model S/N 44 S/N 45	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	 -22°F +158°F -65°F +200°F -65°F +200°F	 Meets (1) specification	Teledyne Telemetry	Los Angeles, Calif	Q. T. P. 2005148 Rev. D	8/31/71	
	Pressure Operating Non-Operating	Ambient to $\leq 10^{-12}$ mm Hg.	Tested to 5×10^{-6} torr					Test equipment Limitations
	Humidity Operating Non-Operating	59% Max 95% @ 158°F/cycle	(1)					
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	 $.04g^2$/Hz grms= 6.0 $.10g^2$/Hz grms= 8.8	(1)					
	Acceleration Operating (N/A) Non-Operating	14.0g's; 3 axis	(1)					
	Shock Operating (N/A) Non-Operating	20g peak/11msec	(1)					
	Salt Spray	NA						
	Sand & Dust	NA						
	Fungus	NA						
	Acoustical Noise	NA						
	Rain	NA						
	Radiation	NA						
	Explosion Proof	Min. Explo. Hay						
	PARAMETRIC Input voltage Current Output: Power	 28-30 Vdc 345 Ma. Max. 1.0 watt min.	 (1)					
	Efficiency Frequency Out	10% min. 2275.5 MHZ± 10025%	(1)					
	EMI		(1)			TTC 2005149B (Modified MSC IESD 19-3A)		

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date	No.	Rev. No.
11 Sept 1972	ATM 1106	
Analyst T. W. Fox	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Power Conditioning Unit (PCU) Flight 6 BxA 2368101-503 S/N 12	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	-22°F to +158°F -65°F to +160°F (cis - lunar flight)	Meets Specification	BxA	Ann Arbor	TP 2349002	9/1/72	DIA test: HOT, COLD, AMB. capability demonstrated during system T/V testing.
	Pressure Operating Non-Operating	Sea Level to 10^{-12} torr	Tested to 5×10^{-6} torr	BxA	Ann Arbor	TP 2365581 TP 2365582	9/1/72	Test level limited by test equipment capability
Qual SE BxA 2368101-503 S/N 11	Humidity Operating Non-Operating	95% at 70°C	Designed to meet require.	------	---------	----------	-------	No test required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets specifications	BxA	Ann Arbor	TP 2365323	9/1/72	Capability demonstrated by comp. level testing
	Acceleration Operating Non-Operating	14 g's for 60 sec	Designed to meet require.	------	---------	----------	--------	No test required
	Shock Operating (N/A) Non-Operating	20 g's/11 msec (saw tooth pulse)	Designed to meet require.	------	---------	----------	---------	Capability demonstrated at sub-pack level
	Salt Spray	N/R						No testing required
	Sand & Dust	N/R						
	Fungus	N/R						
	Acoustical Noise	N/R						
	Rain	N/R						
	Radiation	N/R						
	Explosion Proof	N/R						
	PARAMETRIC Functional Performance	Per AL 510100	Meets requirements	BxA	Ann Arbor	TP 2349002	9/1/72	Tested at the comp. level; capability demonstrated during system thermal vacuum test.
	EMI	Per AL 770000	Meets requirements	BxA	Ann Arbor	TP 2365565 ATR 316	9/1/72	Capability demonstrated at the system level

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date	No.	Rev. No.
11 Sept 1972	ATM 1106	
Analyst T.W. Fox	Page ___ of ___ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Power Distribution Unit (PDU) Flight 6 BxA 2362200-503 S/N 14 Qual SE BxA 2362200-502 S/N 13	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	-22°F to +158°F -65°F to +160°F (in lunar flight)	Meets specifications	BxA	Ann Arbor	TP 2349103	9/1/72	PIA test: HOT, COLD, AMB. capability demonstrated during system T/V testing
	Pressure Operating Non-Operating	Sea Level to 10^{-12} torr	Tested to 5×10^{-6} torr	BxA	Ann Arbor	TP 2365581 TP 2365582	9/1/72	Test level limited by test equipment capability
	Humidity Operating Non-Operating	95% at 70°C	Designed to meet require.	-----	-----	-----	-----	No test required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets specifications	BxA	Ann Arbor	TP 2349103	9/1/72	Capability demonstrated by comp. level testing
	Acceleration Operating Non-Operating	14 g's for 60 sec	Designed to meet require.	-----	-----	-----	-----	No test required
	Shock Operating (N/A) Non-Operating	20 g's/11 msec (sawtooth pulse)	Designed to meet require.	-----	-----	-----	-----	Capability demonstrated at sub-pack level
	Salt Spray	N/R						No testing required
	Sand & Dust	N/R						
	Fungus	N/R						
	Acoustical Noise	N/R						
	Rain	N/R						
	Radiation	N/R						
	Explosion Proof	N/R						
	PARAMETRIC Functional Performance	Per AL 310210	Meets requirements	BxA	Ann Arbor	TP 2349103	9/1/72	Tested at the comp. level capability demonstrated during system thermal vacuum test.
	EMI	Per AL 770000	Meets requirements	BxA	Ann Arbor	TP2365565 ATR 316	9/1/72	Capability demonstrated at the system level.

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date 9/11/72	No. ATM 1106	Rev. No.
Analyst T. Fox	Page ___ of ___ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
LSPE Central Electronics Flight 6 BxA 2347800 S/N 3	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	-22°F to +158°F -65°F to +160°F (cis-lunar flight)	Meets specifications	BxA	Ann Arbor	TP 2365359	9/1/72	In process: Hot, Cold, Amb. & capability demonstrated during system T/V testing.
Qual SE BxA 2347800 S/N 2	Pressure Operating Non-Operating	Sea Level to 10^{-12} torr	Tested to 5×10^{-6} torr	BxA	Ann Arbor	TP 2365581 2365582	9/1/72	Test level limited by test equipment capability.
	Humidity Operating Non-Operating	95% at 70°C	Designed to meet requirements	----	----	----	---	No test required.
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets specifications	BxA	Ann Arbor	TP 2365585 2365580 ATR 340	9/1/72	Capability demonstrated at component level.
Antenna Assembly Flight 6 BxA 2364769-10 S/N 3	Acceleration Operating Non-Operating	14g's for 60 sec.	Designed to meet requirements	----	----	----	---	No test required.
	Shock Operating (N/A) Non-Operating	20g's/11 msec. (sawtooth pulse)	Designed to meet requirements.	----	----	----	---	Capability demonstrated at sub-pack level.
Qual SE ** BxA 2364769 S/N 2	Salt Spray	N/R						
	Sand & Dust	N/R						
	Fungus	N/R						
	Acoustical Noise	N/R						No testing required.
	Rain	N/R						
	Radiation	N/R						
	Explosion Proof	N/R						
Geophone Module Flight 6 BxA 2348321-101 S/N 3	PARAMETRIC Functional Performance	per AL 900131	Meets requirements	BxA	Ann Arbor	TP 2365363 ATR 340	9/1/72	Tested at the S/S level; capability demonstrated during system T/V test.
Qual SE BxA 2348321-101 S/N 2	EMI	per AL 770000	Meets requirements	BxA	Ann Arbor	TP 2365565 ATR 316	9/1/72	Capability demonstrated at the system level.

970-12 **LSPE Russell Antenna Element was qualified at the component level (reference BxA Memo 9721-2909

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date 9/11/72	No. ATM 1106	Rev. No.
Analyst T. Fox	Page ___ of ___ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Sub Package No. 2 Flight 6 BxA 2348800-501 S/N 21	ENVIRONMENTAL Temperature: Operating (N/A) Non-Operating Earth Moon	-65°F to +160°F (cis-lunar flight) -300°F to 250°F	Meets specifications	BxA	Ann Arbor	TP 2365581 2365582 ATR 322	9/1/72	Capability verified during thermal vacuum testing.
	Pressure Operating (N/A) Non-Operating	Sea Level to 10-12 torr	Tested to 5 x 10^{-6} torr	BxA	Ann Arbor	Same as above	9/1/72	Test level limited by test equipment capability.
Qual SE BxA 2348800-502 S/N 20	Humidity Operating Non-Operating	15-100%	Designed to meet requirements	----	----	----	---	No test required.
	Vibration Operating (N/A) Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets specifications	BxA	Ann Arbor	TP 2365569 2365578 ATR 312/329	9/1/72	Capability demonstrated by test.
	Acceleration Operating Non-Operating	LED 520-1	Designed to meet requirements	----	----	----	---	No test required.
	Shock Operating (N/A) Non-Operating	See Appendix A	Meets requirements	BxA	Ann Arbor	TP 2365580 ATR 330	9/1/72	Capability demonstrated by test.
	Salt Spray	N/R						
	Sand & Dust	LED 520-1	Designed					
	Fungus	per 55100000						
	Acoustical Noise	LED 520-1	to meet					No tests required.
	Rain	N/R						
	Radiation	LED 520-1	requirements					
	Explosion Proof	N/R						
	PARAMETRIC N/A							

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date 9/11/72	No. ATM 1106	Rev. No.
Analyst T. Fox	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Radioisotope Thermoelectric Generator (R.T.G.) G.E. #47E300779 Mod. 24 S/N 6320014 Flight 6	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	 1000°F to 1140°F -340°F to 440°F	 1170°F 500°F	BxA	Ann Arbor, Michigan	TP 2334335 ATR-60 BSR-2387	May-June 1968	Qualification at assembly level was performed by G.E. Refer to test reports ANSQ Doc. No. 6300-281, ANSQ Doc. No. 6300-288
	Pressure Operating Non-Operating	Sea Level to 1 x 10^{-12} torr	5 x 10^{-6} torr	BxA	Ann Arbor, Michigan			Test level limited by test equipment capability.
	Humidity Operating Non-Operating	15 to 100%	Designed to meet humidity requirements.	N/A	N/A	N/A	N/A	No testing required.
Fuel Capsule, 47D000400G1, Flight 6 SA, Qual Mod. 15 SE, Qual Mod. 10 S/N 6320005	Vibration Operating (N/A) Non-Operating Launch & Flight Lunar Landing	 ATR-16 Addendum 1	 Refer to Table 1	General Electric Valley Forge Technology Center Philadelphia, Pa.	General Electric	GE Doc. #6300 Doc. #6300-288	Jan 1968	Qualified at Subpackage #2 Design limit level in the stowed configuration, Qual SA Refer to ATR-84, 85.
	Acceleration Operating (N/A) Non-Operating	ATR-16 Addendum 1	7.SG 3 to 4 min. each axis	BxA	Ann Arbor, Michigan	TP 2334330 ATR-92, 93	June 1968	Successfully Tested, Qual SA.
	Shock Operating (N/A) Non-Operating	ATR-16 Addendum 1	15 G each axis 11 msec ± 10%	BxA		TP 2334331 ATR-88, 89 BSR-2408, 2409	June 1968	Successfully Tested, Qual SA.
	Salt Spray	N/A	N/A	N/A	N/A	N/A		
	Sand & Dust	NYD	G.E.	Phil. Penn.	NYD	NYD		
	Fungus	N/A	N/A	N/A	N/A	N/A		
	Acoustical Noise	NYD	NYD	G.E.	Phil. Penn.	NYD		
	Rain	N/A	N/A	N/A	N/A	N/A		
	Radiation	NYD	NYD	G.E.	Phil. Penn.	NYD		See Line 1
	Explosion Proof	NYD	NYD	G.E.	Phil. Penn.	NYD		
	PARAMETRIC Functional	per 55100000	Meets specifications	BxA	Ann Arbor	TP 2365581 2365582	9/1/72	Performance capability verified with ALSEP interface during system T/V testing.

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date	No.	Rev. No.
11 Sept 1972	ATM 1106	
Analyst T. W. Fox	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Shorting Plug Assembly Flight 6 BxA 2364057-501 S/N 13 Qual SE BxA 2364057 S/N 11	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	-300°F to +250°F -65°F to +160°F (in lunar flight)	Meets specification	BxA	Ann Arbor	TP 2365581 2365582 ATR 322	9/1/72	capability verified during system T/V testing
	Pressure Operating Non-Operating	Sea Level to 10^{-12} torr	Tested to 5×10^{-6} torr	BxA	Ann Arbor	TP2365581 TP2365582 ATR 332	9/1/72	Test level limited by test equipment capability
	Humidity Operating Non-Operating	15-100%	Designed to meet require.	-----	-----	-----	-----	No test required
	Vibration Operating (N/A) Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets specification	BxA	Ann Arbor	TP2365569 TP2365578 ATR312/329	9/1/72	Capability verified at system level
	Acceleration Operating Non-Operating	LED-520	Designed to meet require.	-----	-----	-----	-----	No test required
	Shock Operating (N/A) Non-Operating	See Appendix	Meets specification	BxA	Ann Arbor	TP2365580 ATR 330	9/1/72	Capability demonstrated at sub-pack level.
	Salt Spray	N/R						
	Sand & Dust	N/R						
	Fungus	N/R						
	Acoustical Noise	N/R						
	Rain	N/R						
	Radiation	N/R						
	Explosion Proof	N/R						
	PARAMETRIC Functional	Per AL 230000	Meets specification	BxA	Ann Arbor	TP2365563 ATR 331	9/1/72	Tested at component level; capability verified during system T/V testing

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date	No.	Rev. No.
11 Sept. 1972	ATM 1106	
Analyst T W Fox	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
S-band Antenna Aiming Mechanism Flight 6 BxA 2367400 S/N 13 Qual SE BxA 2367400 S/N 12	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	-65°F to +160°F (in-lunar flight) -300°F to +250°F	Meets Specification	BxA	Ann Arbor	TP 2365561 and TP 2365581 2365582	9/1/72	Temperature tested at component level and verified during system thermal vacuum test.
	Pressure Operating (N/A) Non-Operating	Sea level to 10^{-12} torr	Tested to 5×10^{-6} torr	BxA	Ann Arbor	TP 2365581 2365582 ATR 322	9/1/72	Tested with system; test level limited by equipment capability.
	Humidity Operating Non-Operating	15-100%	Designed to meet reqmts.	-	-	-	-	No test required.
	Vibration Operating (N/A) Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets Specification	BxA	Ann Arbor	TP 2365569 2365578 ATR 312/329	9/1/72	Capability demonstrated at sub-pack level by test.
	Acceleration Operating Non-Operating	LED 520-1	Designed to meet reqmts.	-	-	-	-	No test required.
	Shock Operating (N/A) Non-Operating	See Appendix A	Meets Specification	BxA	Ann Arbor	TP 2365580 ATR 330	9/1/72	Capability demonstrated at sub-pack level by test.
	Salt Spray	N/R		BxA	Ann Arbor	ATR 330	9/1/72	Sub-
	Sand & Dust	LED 520-1	Designed	BxA	Ann Arbor	ATR 330	9/1/72	
	Fungus	N/R		BxA	Ann Arbor	ATR 330	9/1/72	
	Acoustical Noise	LED 520-1	to meet	BxA	Ann Arbor	ATR 330	9/1/72	No tests required.
	Rain	N/R		BxA	Ann Arbor	ATR 330	9/1/72	
	Radiation	LED 520-1	requirements	BxA	Ann Arbor	ATR 330	9/1/72	
	Explosion Proof	N/R		BxA	Ann Arbor	ATR 380	9/1/72	
	PARAMETRIC Functional	per SS 100000 (ALSEP)	Meets Specification	BxA	Ann Arbor	TP 2365561 2365562 ATR 309/323	9/1/72	Capability verified by test.

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date	No.	Rev. No.
11 Sept. 1972	ATM 1106	
Analyst T W Fox	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
ALSEP Tools Flight handling tool GE 47E300452 S/N 631012 Fuel transfer tool BxA 2364053 A/N 9 Cask dome removal tool BxA 2364055 S/N 4 Universal handling tool BxA 2364054 S/N 25, 26 HFE emplanting tool ADL 3711 S/N F4T	ENVIRONMENTAL Temperature: Operating (N/A) Non-Operating Earth Moon							See Notes below
	Pressure Operating (N/A) Non-Operating							
	Humidity Operating (N/A) Non-Operating							
	Vibration Operating (N/A) Non-Operating Launch & Flight Lunar Landing							
	Acceleration Operating (N/A) Non-Operating							
	Shock Operating (N/A) Non-Operating							
	Salt Spray							
	Sand & Dust							
	Fungus							
	Acoustical Noise							
	Rain							
	Radiation							
	Explosion Proof							
	PARAMETRIC Note 1: Mass simulators were used for all Array E sub-pack mechanical tests Note 2: All tools previously qualified for other ALSEP arrays; minor changes are considered qualified by similarity.							

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date 22 Sept. 1972	No. ATM1106	Rev. No.
Analyst Van Hoorde	Page 1 of 1 Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
LSG Quals Model 2345875 S/N 2 LSG flight Models 2345875 S/N 3	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	-300°F to +250°F (external) +50°F (nominal)	Meets requirements	BxA	Ann Arbor	2365582 2365581 ATR 322	5/15/72 5/15/72 4/30/71	Capability demonstrated at the system level.
	Pressure Operating Non-Operating	10^{-12} Torr	Tested to 5×10^{-6} torr	BxA	Ann Arbor	2365581 2365582	5/15/72	Test level limited by equipment capability
	Humidity Operating Non-Operating	N/A 15-100%	Designed to meet requirements	BxA	Ann Arbor			No test required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	See Appendix A	Tested to design limit vibrations levels indicated in appendix	BxA	Ann Arbor	2365530 2365519 E/P 2347888 2365518 H/B 2365526 2365577	9/1/72	Capability demonstrated by test.
	Acceleration Operating (N/A) Non-Operating	1.0g vertical flight L 1535022402	designed to meet requirements					No test required
	Shock Operating (NA) Non-Operating	See Appendix A		BxA	Ann Arbor	2365580	3/17/72	Capability demonstrated by test.
	Salt Spray	N/A						
	Sand & Dust	N/A						
	Fungus	N/A						
	Acoustical Noise	N/A						No test required
	Rain	N/A						
	Radiation	N/A						
	Explosion Proof	N/A						
	PARAMETRIC PIA (T/V)	Tested as part of the integrated system in space simulation chamber	Capable to start up and operation in lunar surface	BxA	Ann Arbor	2365520 2365582 2365581	7/11/72 5/15/72 5/15/72	At subpack I level
	EMI	Per AL 770000	Meet requirements	BxA	Ann Arbor	2365565	5/31/72	At subpack I level

QUALIFICATION STATUS LIST-ALSEP PROGRAM LUNAR MASS SPECTROMETER (LMS) EXPERIMENT

Date 8-10-72	No. ATM1106	Rev. No.
Analyst JEH	Page 1 of 2 Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
LMS Qual Experiment with "Old Qual Fixed Mode Emission Control"	ENVIRONMENTAL Temperature: Operating Non-Operating Earth (launch pad) Moon	 -100Fto+160°F (internal) -300°Fto+250°F	 meets specification	 BxA	 Ann Arbor	TP 2347420 TP 2365581 TP 2365582 (T/V Desn. Limit)	Jan. 1972 June 1972	In Process: hot, cold, amb. Test at SP-I level (LMS instrument analyzer in use at vacuum $\leq 10^{-6}$)
LMS PN-2347400-101 LMS SN-5	Pressure Operating and Non-Operating	Sea level to 10^{-12}TORR	5×10^{-6}TORR	BxA	Ann Arbor	TP 2365581 TP 2365582 (T/V Desn. Limit)	June 1972	Test at SP-I level (LMS instrument analyzer in use at vacuum $\leq 10^{-6}$)
MMEC Assy. 151-600 MMEC BD. 151-700	Humidity Operating Non-Operating	NA 15 to 100%	Designed to meet Humidity Req.	BxA	Ann Arbor	NA	NA	No Test Required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	See Appendix A	Meets requirements	BxA BxA	Ann Arbor Ann Arbor	TP2365503(acc.) TP2365504(D. L.) TP2365568	Feb. 1972 Aug. 1972	Oper. Test at LMS level Non-oper Test at SPI level
*Flight LMS has MULTI-Mode Emission Control. See following sheet for QUAL of MM EC Electronics	Acceleration Operating and Non-Operating	NA	NA	NA	NA	NA	NA	Accel. Test not Req'd
	Shock Operating (N/A) Non-Operating	NA See Appendix A	NA 15g per fig A-10	NA BxA	NA Ann Arbor	NA TP 2365579	NA July 1972	Oper. Shock not Req'd Non-oper shock at SPI level
	Salt Spray							
	Sand & Dust							
	Fungus							
	Acoustical Noise	NA	NA	NA	NA	NA	NA	No tests Req'd
	Rain							
	Radiation							
	Explosion Proof							
	PARAMETRIC PIA (LMS)	Complete LMS test using vacuum to operate LMS analyzer with $\leq 10^{-6}$ vacuum internal. external ambient environment.	Functional cart	BxA	Ann Arbor	TP 2365500	March 1972 Pre-system Integration August 1972 post-system environmental	Test at LMS level Test at LMS level
	EMI/EMC	Per AL 770000 (system EMI)	Radiated susceptibility and interference ok. Also shown EMC with system.	BxA	Ann Arbor	TP 2365565	May 1972	Test at System level

QUALIFICATION STATUS LIST-ALSEP PROGRAM

LMS MULTI-MODE EMISSION CONTROL ELECTRONICS

Date 8-10-72	No. ATM-1106	Rev. No.
Analyst JEH	Page 1 of 2 Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
LMS prototype experiment with Qual Multi-Mode emission control electronics.	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	 -300°Fto+250°F -10°Fto+160°F NA	 -300°Fto+250°F -10°Fto+160°F NA	BxA	Ann Arbor	TP 2368967 (LMS T/V)	June 1972	In process: Hot, cold, amb. Test at LMS level (LMS in- (LMS instrument analyzer in use at vaccum of $\angle 10^{-6}$
LMS PN-2347400-201 LMS SN-4	Pressure Operating and Non-Operating	Sea level to 10^{-12} to RR	$\angle 10^{-6}$	BxA	Ann Arbor	TP 2365501 (LMS T/V)	Aug. 1972	Test at LMS level (LMS instrument analyzer in use at vacuum of $\angle 10^{-6}$)
MMEC Assy 151-560 MMEC BD 151-550	Humidity Operating Non-Operating	NA 15-100%	Designed to meet humidity requirement	BxA	Ann Arbor	NA	NA	No Test Required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	See Appendix A NA	Meets requirements NA	BxA NA	Ann Arbor NA	TP 2368970(acc) NA	July 1972 NA	Test at LMS level NA
	Acceleration Operating and Non-Operating	NA	NA	NA	NA	NA	NA 8/16/72	Accel. Test not Req'd
	Shock Operating (N/A) Non-Operating	NA 15g per fig A-10	NA 15g per fig A-10	NA BxA	NA Ann Arbor	NA TP 2365506	NA	Oper shock not req'd Test at LMS level
	Salt Spray							
	Sand & Dust							
	Fungus							
	Acoustical Noise	NA	NA	NA	NA	NA	NA	No Tests Req'd
	Rain							
	Radiation							
	Explosion Proof							
	PARAMETRIC PIA (LMS)	Complete LMS using vacuum cart to operate LMS analyzer with $\angle 10^{-6}$ vacuum internal. External Ambient environment	functional test	BxA	Ann Arbor	TP 2368972	Aug. 1972	Test at LMS level
	EMI/EMC	Per AL 770000 (system EMI)	Radiated susceptibility and interference ok. EMC with system	BxA BxA	Ann Arbor Ann Arbor	TP 2368982 TP 2365565	Aug. 1972 June 1972	Test at LMS level (proto- with Qual MMEC) Test with FLT system (FLT LMS used AAS MMEC capability)
								Same EMI/EMC procedure is used for Qual & FLT.

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date	No.	Rev. No.
22 Sept. 1972	ATM1106	
Analyst: Van Hoorde	Page 1 of 1 Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
LEAM Qual Model 2347700-101 S/N 2 LEAM Flight Model 2347700-101 S/N 3	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	-22°F to +149°F -300°F to +250°F (external) +15°F to +100°F (internal)	meets requirements	BxA	Ann Arbor	Times Zero TP 2365582 2365581	 5/15/72 5/15/72 7/20/72	In process: Hot, cold, Amb capability demonstrated during system testing
	Pressure Operating Non-Operating	Sea level to 10^{-12} Torr	Demonstrated to 5×10^{-6} Torr	BxA	Ann Arbor	2365581 2365582	5/15/72	Test level limited by equipment capability
	Humidity Operating Non-Operating	N/A 15-100%	Designed to meet requirements					No test required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	See Appendix A	Tested to design limit vibration levels indicated in appendix	BxA	Ann Arbor	2365514 2365578	3/17/72 5/24/72	At experiment levels At subpack II "
	Acceleration Operating N/A Non-Operating	1.0g vert Flight LIS 35022402	Designed to meet requirements					No test required
	Shock Operating (N/A) Non-Operating	See Appendix A	meets requirements	BxA	Ann Arbor	2365580 TM 569	3/17/72 8/30/71	At subpack II levels Se fig A-10
	Salt Spray	N/A						
	Sand & Dust	N/A						
	Fungus	N/A						
	Acoustical Noise	N/A						No test required
	Rain	N/A						
	Radiation	N/A						
	Explosion Proof	N/A						
	PARAMETRIC PIA TV	Tested as part of the integrated system in space simulation chamber	Capable to start up and operation in lunar surface	BxA	Ann Arbor	2365512 (PIA) 2365582 2365581	3/10/72 5/15/72 5/15/72	Capability demonstrated during system testing.
	EMI	Per IC314130 section 5.7 and AL 770000	Meet requirements	BxA	Ann Arbor	2365565	5/31/72	At subpack II level

QUALIFICATION STATUS LIST-ALSEP PROGRAM

Date	No.	Rev. No.
11 Sept 1972	ATM 1106	
Analyst	Page ____ of ____ Pages	

Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Heat Flow Experiment Flight 6 BxA 2345430 S/N 7	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	 -300°F to +250°F -65°F to +160°F -300°F to +250°F	 -300°F to +250°F Not Tested	BxA	Ann Arbor, Michigan	TP2334387 ATR-160 BSR-2570	Dec 1968	Qual SB Test
	Pressure Operating Non-Operating	Sea Level to 10^{-12} torr	5×10^{-6} torr	BxA	Ann Arbor, Michigan	TP2334387 ATR-160 BSR-2570	Dec 1968	Test level limited by equipment capability
	Humidity Operating Non-Operating	15 to 100%	Designed to meet humidity requirement	BxA	N/A	N/A	N/A	No test required
Qual SD BxA 2345430 S/N 2	Vibration Operating Non-Operating Launch & Flight Lunar Landing	N/A LTA-3D/R LTA-3D/R	Tested without failure to levels shown in figures 1-5 SB, 1, 3, 4, 5, 6 Array D	BxA	Ann Arbor, Michigan	TP2337905 ATR-149 BSR-2546	Dec 1968	Qual SB Design Limit Test Array D - See Note 1 & 2
	Acceleration Operating Non-Operating	N/A ATR-16 ADD 1	14g ±1g/1 min.	BxA/BMSD	Mishawaka Indiana	TP2337915 ATR-164 BSR-2574	Dec 1968	Qual SB Design Limit Test
	Shock Operating Non-Operating	N/A 15g±2g Sawtooth	15±2g Sawtooth	BxA	Ann Arbor, Michigan	TP2337917 ATR-161 BSR-2571	Jan 1969	Qual SB Design Array D - See Note 1 & 2
	Salt Spray	N/A						
	Sand & Dust	N/A						
	Fungus	N/A						
	Acoustical Noise	N/A						
	Rain	N/A						
	Radiation	N/A						
	Explosion Proof	N/A						
	PARAMETRIC Functional performance	Tested as part system in the chamber	of integrated Space Simulation	BxA	Ann Arbor, Michigan	TP2338640 (Mod. IST) ATR-163 BSR-2573	Jan 1969	Qual SB Test
		Note 1: S/N 02 subsequently requalified on SP#2 as noted in Array D Qualification Assessment Review Board Minutes 9703B-26 dated 19 February 1971. TP 2346328 is the document covering the Design Limit Vibration testing for SP#2 Array D, and TP2346829 is the document covering the Shock requirements of SP#2, Array D.						
		Note 2: Design limit (x, y, z) with the S/N-2HFE on Array D SP#2 were performed January 1971 at the following levels: a. ~~Sine (3 Oct/min, 5-100-5 Hz) Duration 0.50 min~~ b. L&B random (1.0 min) 3.00 min c. Lunar descent random (12.5 min) 37.50 min d. Shock (15) 0.05 min						