

ATM 825
REV A

ALSEP
Qualification Status List
(QSL Package)
Flight 3 Configuration



**Aerospace
Systems Division**

ALSEP Array B QSL Data Sheets
Appendix B

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** Reference only, see text of ATM, Section 4.0.



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1.0 INTRODUCTION

In compliance with NASA Contract NASA 9-5829 requirements, this document provides a Qualification Status List (QSL) for use as part of the ALSEP Flight 3 Acceptance Data Package (ADP).

As of the date of publication, the information herein reflects the status of qualification following the system level tests which are completed on the ALSEP Qual SB system model.

Minutes 974-1264, of the 1/29/69 "QAR Board Meeting on Qual SB" have established that ALSEP B Array qualification will be considered successfully completed with the closeout of Category II Open Items, i.e., open items which constrain qualification of Array B. These open items are summarized on page 2 and the equipment subsections which follow. All open items have been closed and ALSEP Array B is considered qualified for Flight 3.

Minutes dated 1/28/69 on the "QAR, Qual SB General Meeting" defined the ALSEP hardware being qualified as:

Subpackage #1

Data Processor - Patch plane board only
Central Station Wire Harness
Sunshield
Antenna Gimbal Box
PSE Sensor/Shroud - Gnomon only
Heat Flow Experiment
Charged Particle Lunar Environment Experiment
Cold Cathode Gage Experiment

Subpackage #2

Drill Carrier Subpackage
Interface of Drill Carrier with Subpackage #2

General

Weight and C.G.

Prepared by:

J. Taylor
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Approved by:

S. J. Ellison
S. J. Ellison, Manager
ALSEP Reliability

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The qualification data herein, however, covers all major assemblies and subassemblies which were qualified under either the Qual SA or the Qual SB test programs. The discussion data in the following subsections and the QSL Summary Sheets of the Appendix reflect the appropriate qual history comments. The organization of these data is as follows:

<u>Section</u>	<u>Subtitle</u>
2.0	SUBPACKAGE #1
2.1	Antenna Assembly
2.2	Central Station Electronics Diplexer Filter & Diplexer Switch Command Receiver Command Decoder Transmitters Data Processor & Multiplexer Power Distribution Unit Power Conditioning Unit
2.3	Passive Seismic Experiment
2.4	Heat Flow Experiment
2.5	Cold Cathode Gage Experiment
2.6	Charged Particle Lunar Environment Experiment
3.0	SUBPACKAGE #2
3.1	RTG Assembly
3.2	RTG Shorting Plug Assembly
3.3	APOLLO Lunar Handling Tool (ALHT)
3.4	APOLLO Lunar Scientific Drill (ALSD)
4.0	FUEL CASK ASSEMBLY

Appendix

A-Figures 1-5 Vibration Specification; B-QSL Data Sheets. All open items have been closed and ALSEP Array B is considered qualified.

For convenience, a brief summary of Category II Open Items which were defined by the 1/29/69 QAR Board Meeting is as follows:

Subpackage #1: Center of Gravity out of tolerance. A Bendix defined specification change had been submitted by MSC to Grumman. GAEC action was scheduled for 2/7/69.

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A TWX to R. A. Long from H. B. Edwards (Reference: Contract NAS 9-5829, TD3/T264(CLN) allowed waiver for Flight 3, S/P 1, this open item was closed per CCO 79 and 80, 2/19/69.

Subpackage #1 & #2: Combined overweight condition was to be defined by Bendix on 2/5/69 for MSC consideration of a specification change. Also, by 2/5/69, BxA was to report technical feasibility of off-loading any experiment or subsystem on Flight 3 to achieve a combined weight of 215 pounds.

TWX TD/2-7-69/B-107 (DGW) dated 2/7/69 from MSC to BxA granted an increase in S/P 1 weight from 115 to 125 lbs. Flight 3 CARR Chit 30-2 reduced the weight of S/P 2 from 97.12 to 89.45 lbs., by removal of tools. The present total of 212.38 is within 215 lb. maximum. This open item was closed per CCO 84, 2/2/69.

CPLEE: The following items were Category II and were to be dispositioned as provided for in the Qual Verification Plan 9713-11-565, namely:

- 1) Intermittent Amplifier Operation; Channels A-1, A-3, A-5, B-1, B-3, B-4 and B-6, FR 200/DR's 2499, 2488, 2489 and 2709.
- 2) High Science Counts in Detectors A-1 and B-1; FR 199/DR 2468.
- 3) CPLEE Sync Loss at Lunar Noon; FR 211/DR 2502 (19 bit problem).

The following items were generated during the Qual Verification Testing:

- 1) High Science counts in detector A-6
FR 245/DR 4995
- 2) Intermittent Amplifier Operation, Channel B-4
FR 246/DR 4996

The following open items were written against the Qual SB CPLEE SN 2 ADP:

- 1) The Channel B-2 amplifier failed during the first acceptance test at BRLD.
BRLD FR 016
- 2) The Channel A-2 amplifier failed during the second acceptance test at BRLD.
BRLD FR 017-3

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- 3) The Channel A-4 amplifier failed during the third acceptance test at BRLD.
BRLD FR 018-2

All of the above open items have been closed per CCO 128 and 129, 5/8/69.

PSE: Open items which remain are residual from the Qual SA program per "PSE Qual SB QAR Minutes" 9713-10-3021 and BxA Memo 9713-10-3007, "PSE Qual SA Plan to Close", namely:

- 1) Post Qualification functional testing of PSE. Was to be closed by test of Sensor, SN/06 was to be completed in March 69 and reported by 1 April 1969.
- 2) Caging Leak Test was to be completed on Sensor SN/02 and reported by 15 February 1969. Includes the completion of FAR #206/DR AB 2869.

A request that Qual SA open items and status be carried as Qual SB items of the PSE was disapproved.

The open items on PSE are retained on Qual SA open item list, and were not subject to qualification of Qual SB. The Gnomon passed qualification. No additional action required by BxA. The open items are closed per CCO 108, 4/22/69.

HFE: Qualified except for MSC approval of a specification change which will allow HFE to operate down to 0°F vs. plus 10°F (RFC H-1);

BxA requested a Specification Change to revise IC 314109 to extend lower limit to 0°C without impacting accuracy specification.

CRD 56290 authorized Specification Change Notice No. 10 to IC 314109 and SCN changed the low limit of the thermal plate from +10°C to 0°C. The open item was closed per CCO-62, 2/6/69.



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CCGE: The closeout of FR 204 on cracked case damage to CCGE SN/02 was defined as a constraint on qualification by the "minutes of the ALSEP Qual SB ADP Review", dated 1/28/69. A CRD for weight specification change was identified in Minutes 9713-09-537.

The CCGE Log (of ADP) states that the cable reel drops down on two forward screws and does not deploy easily. This was considered another constraint.

Entries in CCGE Log Book were made as follows:

"Item 68: Refer. Item 29 - Interference of reel with screw did not affect qualification test acceptability. A design change has been made to flight model to assure ease of deployment by Astronaut". Under Item 29: "Reference Item 68."

CRD 56312 has been assigned to the Spec Change and added to the DR. (CRD 56312 will be prepared when go-ahead received from MSC on CCP-135).

The open items were closed per CCO 57, 58 and 59.

Central Station: The completion of C/S Timer reliability evaluation tests (March 1969) was an outstanding open item against Array A qualification. These evaluation tests were completed, documented in ATM 828 and the open item was closed.

ALSD: The drill interface was out of tolerance and a chamfer redesign to the drill mounts was required for Flight 3.

A Letter TD/1-30/69/B-33 (DGW) from Small to Weatherred requested waiver to the interface and a letter BxP.O. 2519, 69-970-2756 from Weatherred to Small granted the interface waiver.

MSC is redesigning the drill casings and associated drill carrier interface, establishment of qualification of this equipment will follow. The design change does not effect the ALSEP interface, therefore, previous acceptable ALSEP qualification tests are still valid. Also, the ALS D envelope will not be exceeded.

These open items were closed per CCO 108, 4/22/69.



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2.0 SUBPACKAGE #1 (SP #1)

The qualification of Subpackage #1 was initially accomplished as a result of Qual SA model system level tests which are itemized in the Appendix QSL Sheet B-1. This QSL sheet is the top assembly record which is mechanically and environmentally applicable to all SP #1 equipment used in both the ALSEP Array A & B Configurations.

The basic structure thermal differences between the A & B Array are the Sunshield Assembly, Antenna Gimbal Container and Array B experiment interfaces were reviewed in the "QAR-Qual SB Structure Thermal Minutes dated 1/28/68" for Qual B test results and discrepancies. As a result of this review and the "QAR Board Meeting, Qual SB Minutes 974-1264," the Array B Subpackage #1 Structure/Thermal Configuration is considered to be fully qualified.

The assemblies and components listed in the following subsections are the Array B/Flight 3 assemblies and experiments. The differences which exist are noted and justified on the basis of similarity, as applicable.



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2.1 Antenna Assembly

The qualification status of the antenna assembly has been established by system qualification testing, and the details are itemized in the Appendix QSL Sheet B-2. The subassemblies, i. e., helical antenna, antenna cable and aiming mechanism, were qualified by virtue of successful completion of the Qual SA system tests and subsequent (9/12/68) functional testing of the antenna subsystem per the as-run test procedure, BxA TP #2338629. The successful test results were documented in the test report BRL #4620 to close out the Qual SA open item qualification status.

The antenna gimbal package for stowing the aiming mechanism on the Configuration B Subpackage 1 is qualified by virtue of successful Qual SB testing with no open items as recorded by the "Minutes of the QAR Board Meeting, Qual SB 974-1264".

2.2 Central Station Electronics

The Central Station components are comprised of the following:

- Diplexer Filter
- Diplexer Switch
- Command Receiver
- Command Decoder
- Data Processor
- 90 Channel Multiplexer/Converter
- Transmitters
- Power Distribution Unit
- Power Conditioning Unit
- Central Station Harness
- Central Station Timer
- PSE Central Electronics (See Section 2.3)

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With exception to those areas discussed below, the Central Station was successfully qualified under the Qual SA program. The QSL sheets provided in Appendix B for the Central Station Electronic Assemblies reflect the Qual SA test results except where noted on the applicable sheets or discussed herein.

Qualification Accomplished During Qual SB Testing

Data Processor - Except for the patch plane board, the Data Processor was fully qualified during the Qual SA program. The function of the patch plane board is to provide the telemetry format for the Flight 3 experiment array. The functional and environmental capability was fully demonstrated and thus no constraints on qualification are outstanding.

Command Decoder - The uplink command address format for Flight 3 was qualified as part of the Qual SB program. Hardware differences between the Qual SA and Qual SB command decoder consist of a patch plane similar to the one employed by in the Data Processor. The Command Decoder is considered qualified.

Central Station Harness - The Flight 3 configuration of the Central Station harness was successfully qualified during Qual SB testing.

Flight 3 Vs. Qual SB Hardware Differences

Differences between Qual SB and Flight 3 hardware were reviewed and documented in the FTRR Flight 3 minutes 9712-1075, dated 11/21/68. In comparing Flight 3 hardware and previously qualified hardware it was agreed by BxA and NASA that "there are certain known differences such as (1) new transmitter frequency, (2) command address, (3) Data Processor S/N identification, and (4) thermal plate has two (2) new holes, however, these known differences will not constrain Flight 3 Acceptance Test and are considered qualified by similarity." Based on the QTRR memo 971-476, there are no known differences between the Central Station Electronics Qual SB and Flight 3 items.

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2.3 Passive Seismic Experiment

The qualification status of the PSE was initially established by Qual SA model system level tests and reports data which are itemized in the Appendix B-QSL Sheets B18 through B-20 on the Sensor, Electronics and Thermal Control Shroud.

One difference between the Qual SB and Flight Gnomons is a teflon washer added to the flight models to ensure erection. This difference does not affect qual status, and the PSE Gnomon is considered fully qualified.

All open items have been closed and the Passive Seismic Experiment is considered qualified for Flight 3.

2.4 Heat Flow Experiment (HFE)

The HFE has been functionally and environmentally qualified as a result of system level testing on the Qual SB Subpackage #1 configuration. The applicable tests, test levels and report references are itemized in Appendix B, QSL Sheet B-22.

The HFE Qual SB vs. flight model differences were reviewed during the 1/28/69 QAR meeting and by the QTRR based on BxA Minutes 9713-13-422. PC Board hard wiring, RCR vs. ultronic resistors, and heater circuit resistance value differences were considered to be qualified by similarity.

All open items have been closed and the Heat Flow Experiment is considered qualified for Flight 3.

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2.5 Cold Cathode Gage Experiment (CCGE)

The CCGE has been functionally and environmentally qualified as a result of system level testing on the Qual SB Subpackage #1 configuration. The applicable tests, test levels and report references are itemized in Appendix B, QSL Sheet B-23.

Qual vs. flight model differences for the CCGE were reviewed in the QAR Qual SB Minutes 9713-09-537; CCGE reel stowage and minor wiring differences previously reviewed at QTRR and Flight 3 FTRR were resolved as having no affect on qualification (BxA Memo 971-476).

All open items have been closed and the Cold Cathode Gage Experiment is considered qualified for Flight 3.

2.6 Charged Particle Lunar Environment Experiment (CPLEE)

The CPLEE has been functionally and environmentally qualified during Qual SB system level tests as reflected by the test and report data itemized in Appendix B, QSL Sheet B-24, except for outstanding problems in thermal vacuum environment.

Design differences between the SN/2 qual and flight models were reviewed in the 9713-11-565 Qual SB QAR Minutes. Signal ground changes resulting from FR #197, changes in grounding connections, and high voltage enable plug modifications reviewed were judged to have no affect on the validity of qual test results.

All open items have been closed and the Charged Particle Lunar Environment Experiment is considered qualified for Flight 3.

3.0 SUBPACKAGE #2 (SP #2)

The qualification of Subpackage #2 was initially accomplished as a result of Qual SA system level tests which are itemized in Appendix B, QSL Sheet B-25. This QSL sheet is mechanically environmentally applicable to all SP #2 equipment used in both the ALSEP Array A and B Configurations.

The assemblies and components listed in the following subsections are SP #2 installed equipment items reviewed for qualification and qual/flight difference considerations, as applicable.

All open items have been closed and Subpackage #2 is considered qualified for Flight 3.



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3.1 RTG Assembly

The qualification of the RTG was initially accomplished by the subcontractor test and report documents cited in the Appendix B QSL Sheet B-26, and subsequently by BxA system level tests on Qual SA as recorded on QSL Sheet B-26.

No qual vs. flight model differences or outstanding qual test open items exist on this hardware.



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3.2 RTG Shorting Plug Assembly

The qualification of the RTG Shorting Plug Assembly was qualified during Qual SA model system tests to configuration drawing BxA 2335520, and in accordance the test and report documentation "itemized" in Appendix B, QSL Sheet B-27.

The B Configuration Shorting Plug Assembly which is identified by a BxA 2338017 drawing is identical to the Revision C BxA 2335520 part number qualified in the Array A configuration.

No outstanding open items constraining qualification exist on this hardware.



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3.3 ALSEP Lunar Handling Tool (ALHT)

The ALHT mass simulator rather than Flight Hardware was used in the Qual SB system level dynamic tests. The test conditions and reports data identified for SP #2 is applicable from a dynamic environment interface standpoint (QSL Sheet B-25).

The QAR-Qual SB Structural/Thermal Minutes of Meeting dated 1/28/69 reviewed the qual status of the ALHT, however, no Category II open items to constrain qualification were identified.

The ALHT has been previously qualified by MSC.



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3.4 ALSEP Lunar Surface Drill (ALSD)

The ALSD is GFE and was previously qualified at a subsystem level by Martin prior to Drill/ALSEP-Interface qualification on BxA Qual SB system level tests. The test conditions and report documents itemized for SP #2 dynamic environment testing recorded on QSL Sheet B-25 is applicable.

The QAR-Qual SB Minutes of Meeting 9713-13-345 reviewed the qualification status of the ALSD interface and established that no Category II open items exist to constrain qualification.



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3.5 Passive Seismic Experiment Leveling Stool

The PSE Leveling Stool was qualified as a result of the Qual SA Test Program as reflected by the QSL Sheet B-30 in Appendix B.

No outstanding open items constraining qualification exist on this hardware.



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4.0 Fuel Cask Assembly

The ALSEP Fuel Cask Assembly Qualification Test Program (CCP #89) was defined separate from the BxA Qual model tests on ALSEP for conduct at GE facilities (BxA Letter 68-500-507).

A separate document, BxA ATM 780, has been established as the means by which QSL data will be documented for the subject hardware.

There are no open items against the Fuel Cask Assembly and it is considered qualified.

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APPENDIX A

QSL SHEET COMPARISON CRITERIA

The qualification status defined in the Appendix B QSL Sheets (BxA format 970-12) is presented in a manner to compare ALSEP equipment specified environment or parametric requirements to the stress levels achieved during ALSEP system level or previous equipment level testing.

The qualification status has been established by the qualification testing accomplished at BxA and is reflected on the applicable QSL sheets by the listing of the appropriate test procedure, test reports and remarks relative to each test.

Qualification testing of ALSEP for vibration shock, and acceleration was required at the ~~system~~ level only. That is, all equipments that comprise ALSEP were subjected to design limit levels for a stowed configuration, simulating the mounting of ALSEP into the LM compartment. The qualification vibration levels are depicted in Figures 1 through 5. These levels are in accordance with those specified by NASA Letter TD3/LO23/68/B-26(JAC).

With exception to the pressure, the intention is to demonstrate each environmental and/or parametric capability to equal to exceed the specified requirement under test. In the instance of pressure, the low level is limited by the capability of the test equipment.

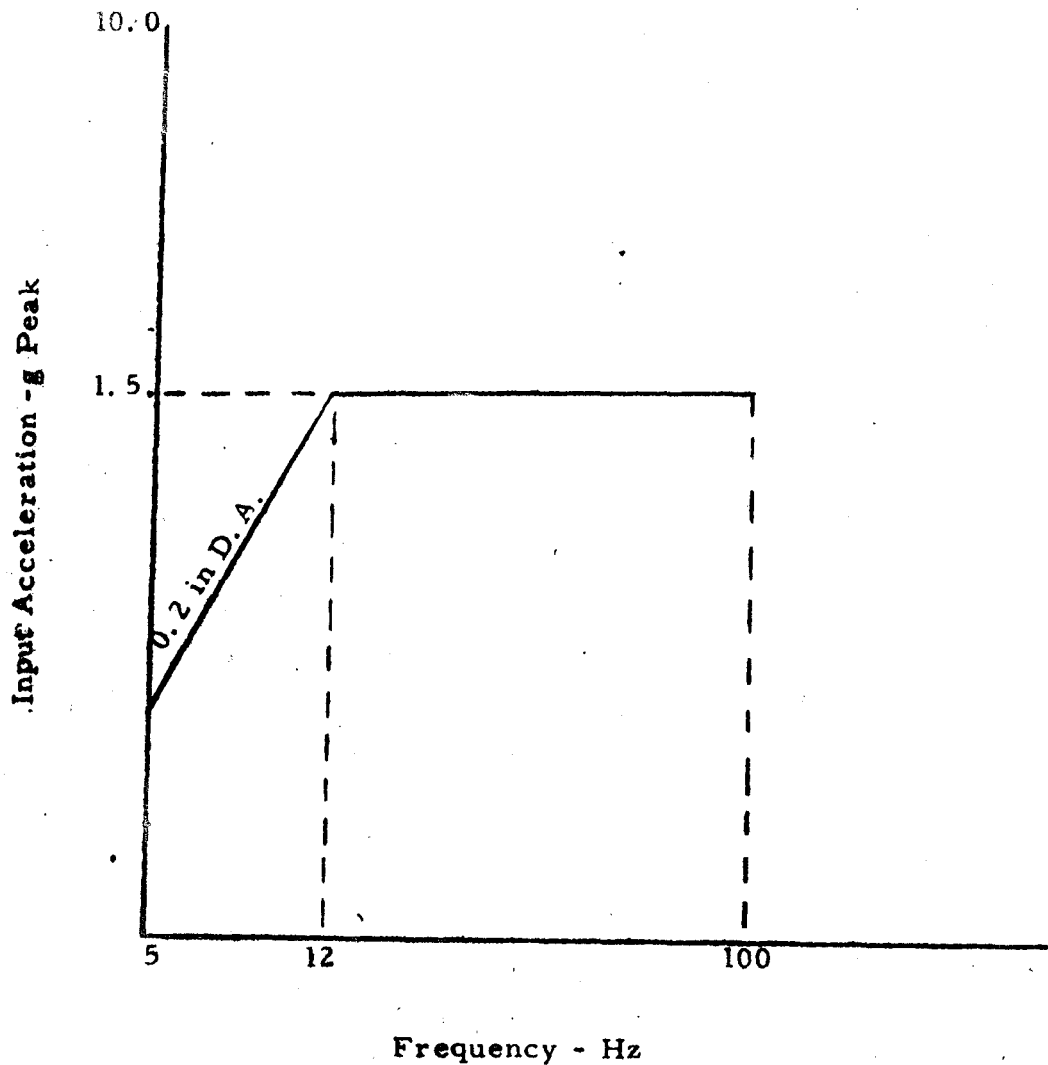


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Sweep Rate = $3/4$ Octave/Minute
(5-100-5 cps), g-peak Tolerance $\pm 10\%$



Subpackage 1 & 2
Launch Boost & Lunar Descent, Sine
Vibration Design Limit. All-Axes

Figure 1

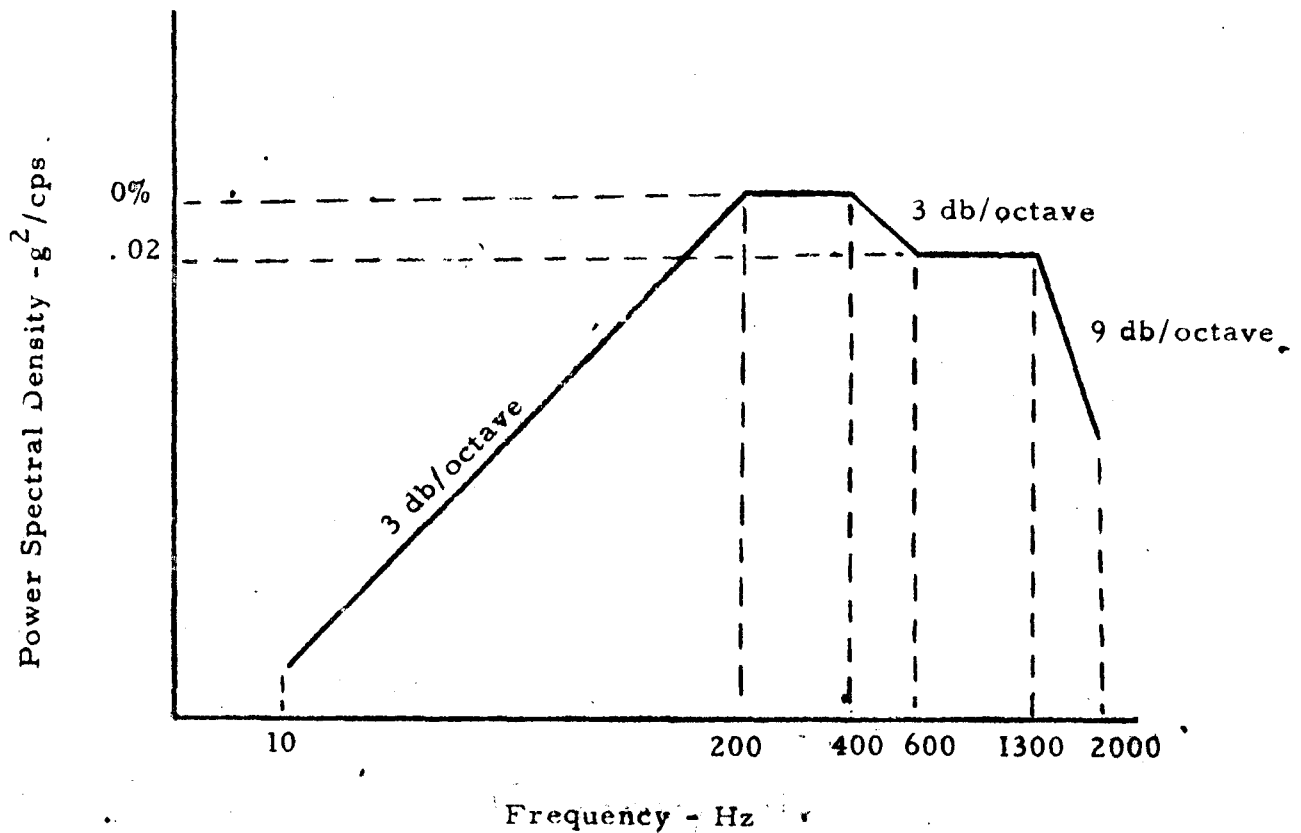


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Test duration 2.5 minutes power
spectral density tolerance ± 3 db



Subpackage 1
Earth Launch Boost Phase Random
Vibration Spectrum Design Limit.
X-Axis only

Figure 2

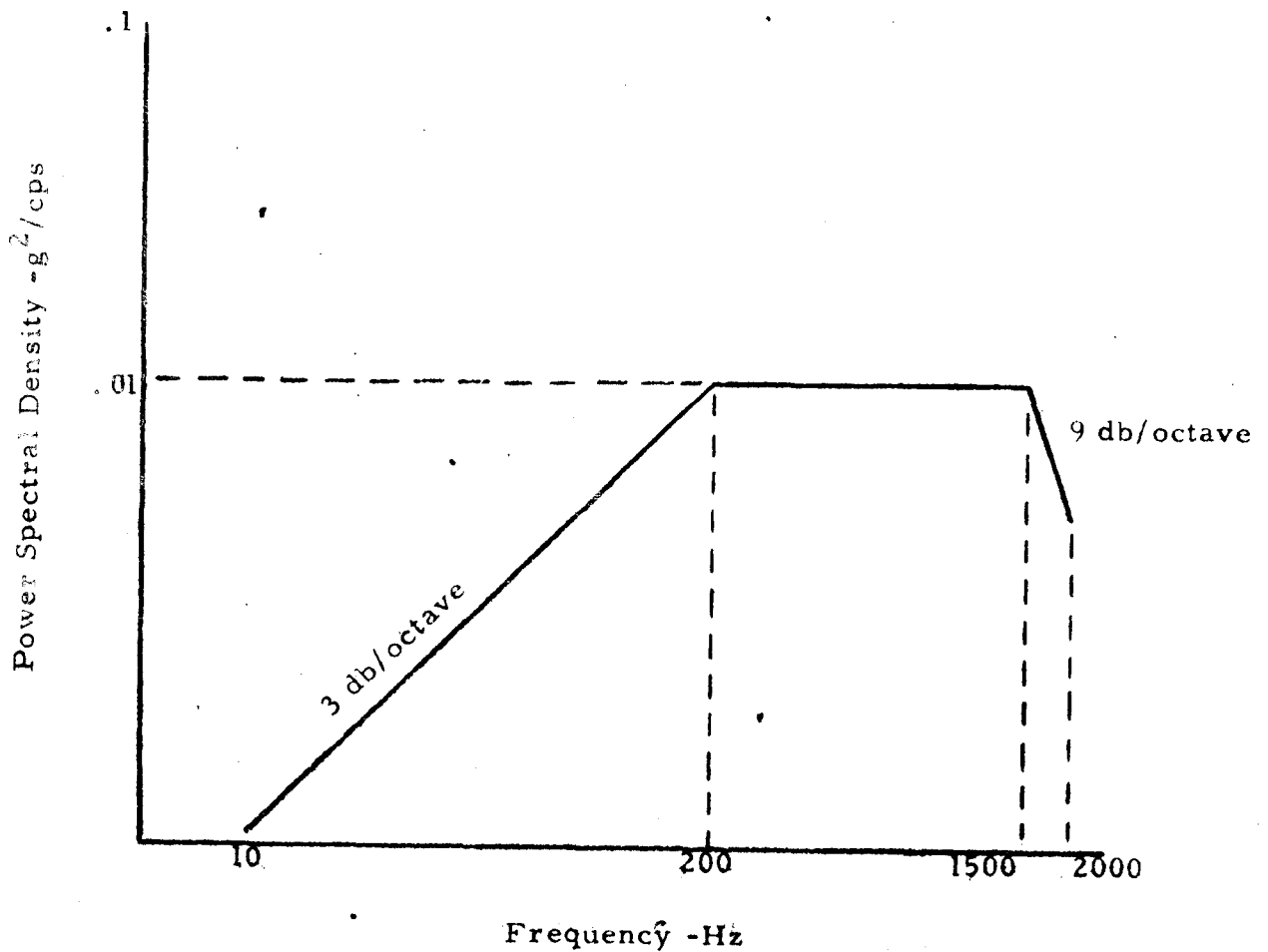


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Test Duration 2.5 Minutes
Power Spectral Density tolerance
+3 db



Subpackage 1 & 2
Earth Launch Boost Phase Random Vibration
Spectrum Design Limit. Y - Axis only

Figure 3

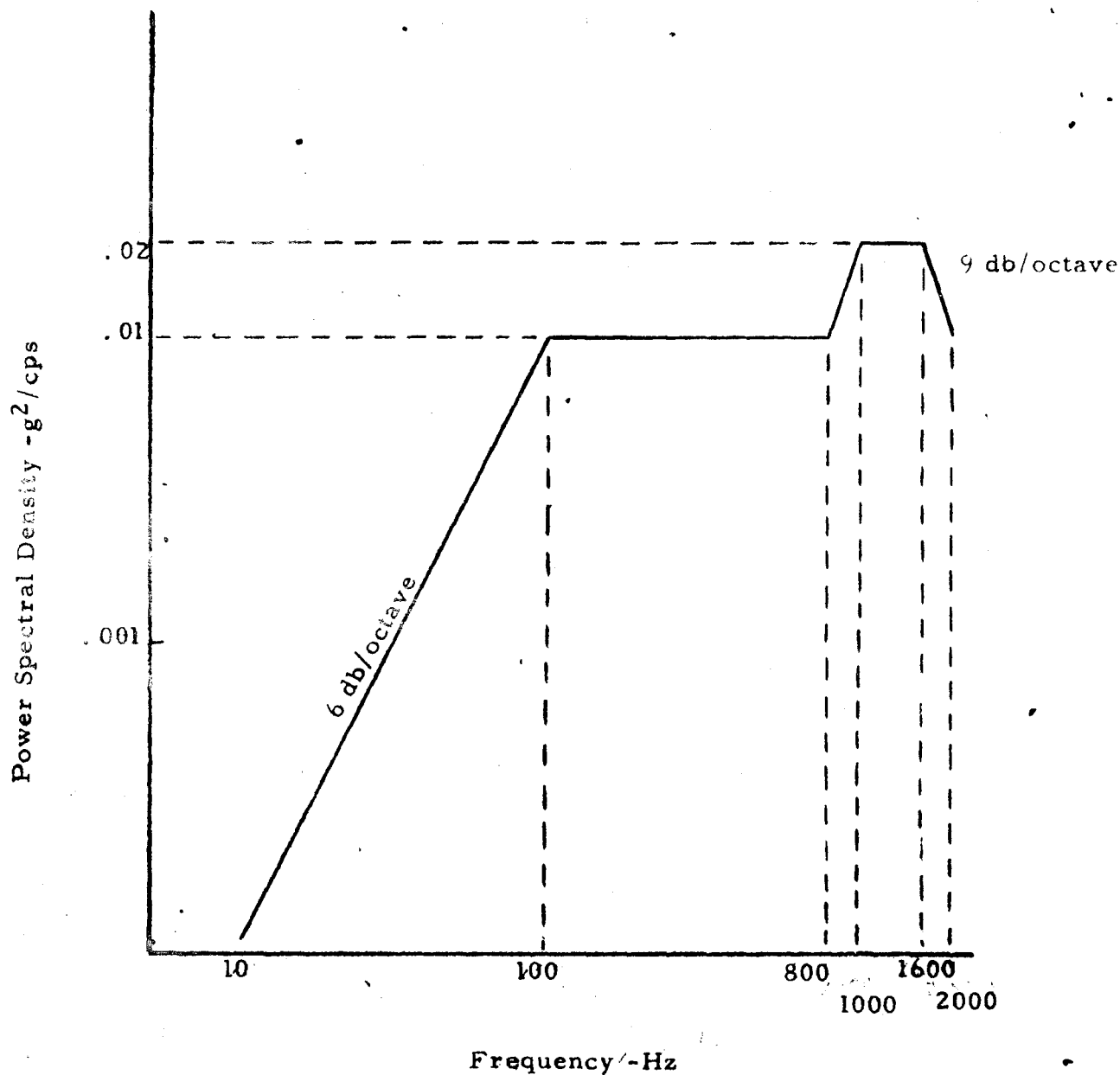


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Power Spectral Density Tolerance ± 3 db
Test duration 2.5 minutes



Subpackage 1 & 2
Earth Launch Boost Phase Random Vibration
Spectrum Level, Z-Axis only

Figure 4

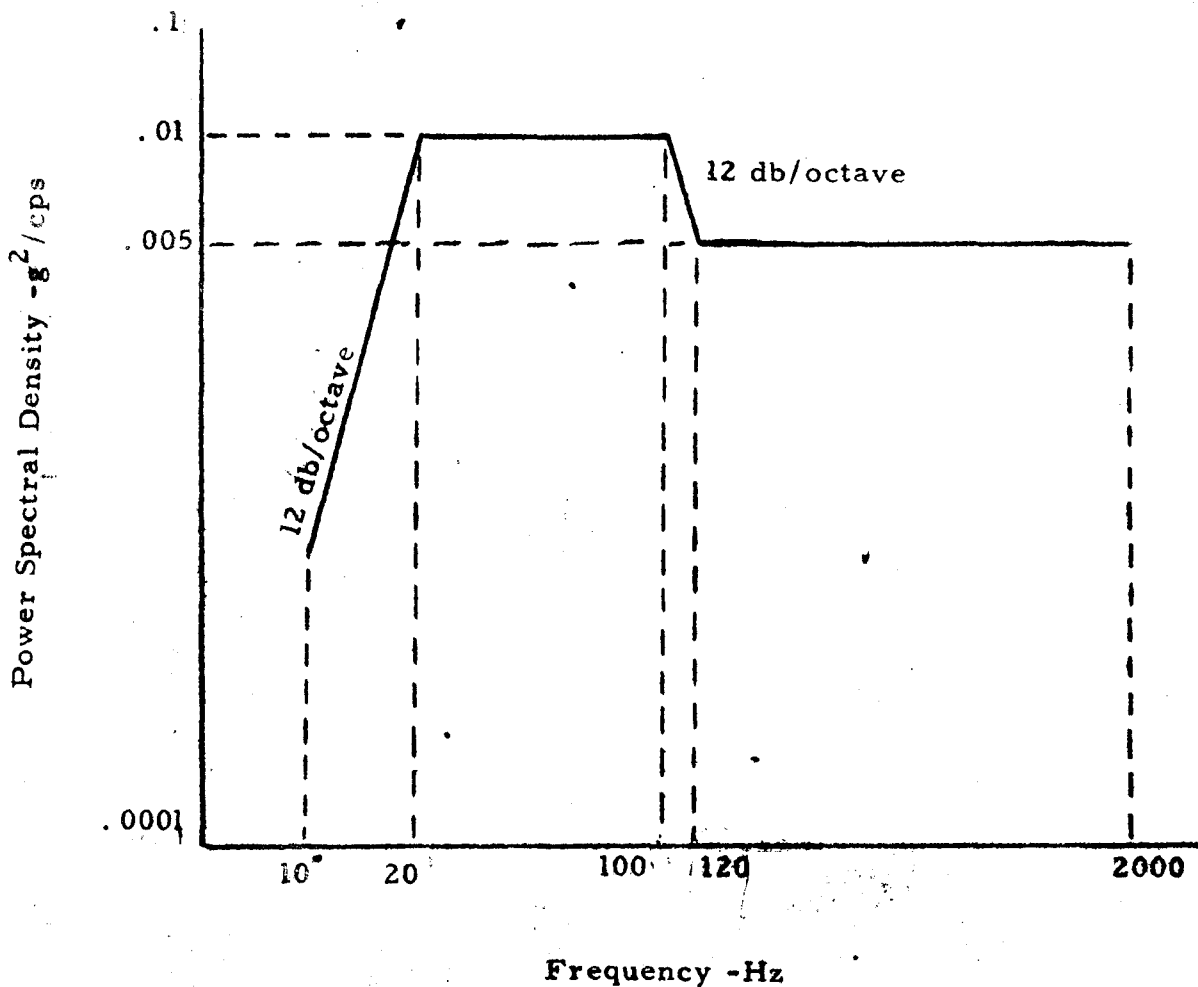


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Test Duration 12.5 minutes Power
Spectral Density ± 3 db



Subpackage 1 & 2
Lunar Descent Random Vibration Spectrum
Design Limit. All Axes

Figure 5

QUALIFICATION STATUS LIST-ALSEP PROGRAM - ASSEMBLY, SUBPACKAGE #1

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Subpackage #1 BxA 2334843 S/N-6	<u>ENVIRONMENTAL</u> 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 (See Note 1) -300 °F to +250 °F	BxA	Ann Arbor, Michigan	TP2334335 TP2333032 ATR-60, 70 BSR-2367, 2376	6/10/68	Successfully Qualified on Qual SA, See Note 1
	Pressure Operating Non-Operating	10 ⁻¹² Torr SL to 10 ⁻¹² Torr	Tested to 5 x 10 ⁻⁶ Torr	BxA	Ann Arbor, Michigan	Same as above	6/10/68	Test level limited by test equipment capabilities
	Humidity Operating Non-Operating	N/A 15 - 100%	Design to meet Requirements	BxA	Ann Arbor, Michigan	N/A	N/A	No testing planned to the 100% humidity level: ALSEP QTRR Board decision
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	N/A Refer to CEI Specification CP100001	Tested to Design Limit Vib. Levels indicated in Figures 1-5	BxA	Ann Arbor, Michigan	TP2334343 ATR-82, 83 BSR-2402, 2403	6/28/68	Successfully qualified on QSA See Note 1 and 2
	Acceleration Operating Non-Operating	N/A CP100001	Tested to 14 ± 1g 1 min du- ration each axis	BxA	Ann Arbor, Michigan	TP 2334343 ATR-90, 91 BSR-2412, 2413	7/4/68	
	Shock Operating Non-Operating	N/A CP100001	Tested to 15 ± 2g 11 ms saw- tooth ea. axis	BxA	Ann Arbor, Michigan	TP2334328 ATR-86, 87 BSR-2406, 2407	6/29/68	
	Salt Spray	N/A						No test required
	Sand & Dust	Not Defined						No test required
	Fungus	N/A						No test required
	Acoustical Noise	Not Defined						No test required
	Rain	N/A						No test required
	Radiation	LED-520	130W/FT ² , IR	BxA	Ann Arbor, Mich	TP 2334335	6/10/68	See operating temperature
	Explosion Proof	N/A						No test required
	<u>PARAMETRIC</u> Mission Simulation	ATM-785 Section 5.3	Capable of startup and operation lunar surface	BxA	Ann Arbor, Michigan	TP 2334345 TP 2338610 ATR, 101-102	8/7/68	Qualified on Qual SA
	Note 1: Differences for Array B configuration defined in 2.0 were qualified to comparable environmental levels in accordance with as run test procedures and reports referenced in Addendum 1 dated 1/27/69 of ALSEP TM-321 Note 2: See Section 2.0 discussion							

QUALIFICATION STATUS LIST-ALSEP PROGRAM SUBPACKAGE I, ANTENNA ASSEMBLY

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Antenna Assembly Helical Antenna BxA 2330307 Flt. #3 SN-10	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	-250°F to +300°F -65°F to +160°F N/A	Tested in Space Simulation Chamber for temp excursions of -300°F to +250°F	Bendix Aerospace Systems	Ann Arbor, Mich	TP 2334335 ATR-60, 70 BSR-2367, 2376	May-June 1968	Qualification of the Antenna Assy has been accomplished at the system level.
	Pressure Operating Non-Operating	1x10 ⁻¹² mmHg Sea L to 10 ⁻⁸ mmHg	Verified to 5x10 ⁻⁶ Torrs in Space Sim Cham	Bendix Aerospace Systems	Ann Arbor, Mich	TP2334335 ATR-60, 70 BSR-2367, 2376		Test level limited by test equipment capabilities
	Humidity Operating Non-Operating	N/A 15% to 100% RH	Designed to meet Humidity Req'tmt	Bendix Aerospace Systems	Ann Arbor, Mich	N/A	N/A	No Testing required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	N/A Refer to ATR-16 Addendum 1	Tested in stowed configuration to vibration design limits indicated in Figs 1 thru 5	Bendix Aerospace Systems	Ann Arbor, Mich	T. P. 2334346 ATR-82, 83 BSR-2402, 2403	June-July 1968	In stowed configuration, the aiming mechanism is mounted on S/P#2. Refer to ATM-776 for x-Axis Random Vibration Qual level for Earth Launch
	Acceleration Operating Non-Operating	N/A ATR-16, Add. 1	Tested in stowed configuration 14 ± 1g, 1 min 5 tests ea axis	Bendix Aerospace Systems	Ann Arbor, Mich	TP 2334343 ATR-90, 91 BSR-2412, 2413	July 1968	Boost Phase Successfully qualified (See note)
	Shock Operating Non-Operating	N/A ATR-16, Add. 1	Tested in stowed configuration 15g±2, 11 ms 3 times ea axis	Bendix Aerospace Systems	Ann Arbor, Mich	TP 2334328 ATR-86, 87 2406, 2407	July 1968	↓
	Salt Spray	N/A						
	Sand & Dust	LED-520	Exceeds Req	Bendix Research Labs	Southfield, Mich	Design Verif.	June 1967	Verified by Analysis
	Fungus	N/A						
	Acoustical Noise	N/A						
Antenna Cable BxA 2330309 Flt. #3 SN-8	Rain	N/A						
	Radiation	LED-520	Exceeds Req	Bendix Research Labs	Southfield, Mich	Design Verif.	June 1967	Verified by Analysis
	Explosion Proof	N/A						
	<u>PARAMETRIC</u> Radiated Power (Eff. Beamwidth Transmit/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 Verif. Report #4028	June 1967	Past environmental functional tests successfully performed on the antenna assembly at Bx Research
	Input VSWR @Transmitter f _o @Receiver f _o	1.25:1 1.5:1	1.25:1 1.50:1	Bendix Research Labs	Southfield, Mich.	Design Verif. Report #4028		on 9/12/68 per TP2338629 and documented by Report BRL #4620
	Minimum Power Handling Capability	1.5w CW @Transmitter f _o	1.5w CW @Transmitter f _o	Bendix Research Labs	Southfield, Mich	Design Verif.		
	Maximum Aiming Error	1.16° RMS	0.75° RMS			Design Verif. Report #4037		
Antenna Gimbal Package BxA 2335765 Flt. #3 SN-3								

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Note: See Section 2.1 discussion

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CENTRAL STATION ELECTRONICS
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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Filter, Diplexer BxA #2330525 Flt #3 S/N 10	<u>ENVIRONMENTAL</u> 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, Calif	Rantec #66279-QTP	2/19/67 2/6/67	Qualified as part of an integrated system and at the sub assembly level.
	Pressure Operating Non-Operating	<10-12 Torr 30 to 1.3 Torr	1 x 10 ⁻⁵ Torr OK	Wyle Labs	El Segundo, Calif		2/20/67	(Qualified in system to 5 x 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	No testing required at system level. Qualified as a sub-assembly.
	Vibration-Operating Non-Operating	N/A Random: 15 to 150 cps, 0.2g ² /cps Sine: 5 to 20 cps 0.4 in. D. A. 20 to 100 cps 8g's	OK per reqm.				2/13/67	Qualified in the Stowed Configuration and at the sub ass'y level
	Acceleration Non-Operating	N/A 25 g's ea. axis	OK per reqm				2/10/67	"
	Shock Operating Non-Operating	N/A 20 g's ea. axis	OK per reqm.				2/9/67	"
	Salt Spray	N/A	N/A					
	Sand & Dust	N/A	N/A					
	Fungus	N/A	N/A					
	Acoustical Noise	N/A	N/A					
	Rain	N/A	N/A					
	Radiation EMI	Radiated at fo***	52db	Bunker Ramo	Canoga Park Calif	66279-QTP	2/22/67	
	Explosion Proof	N/A	N/A					
	<u>PARAMETRIC</u> VSWR	1.36:1 Max all ports	1.22:1 max 33 Mc Min	Rantec	Calabasas, Calif.	66279-PTP-D	Before and after each environmental test	Qualified as part of an integrated system in the space simulation chamber.
	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 f _r to f _{LO} 80 db f _t to f _r	90 db min > 100 db min	Rantec	Calabasas, Calif.	66279-PTP-D	1/16/67 to 2/23/67	

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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 Flt #2 S/N 10	<u>ENVIRONMENTAL</u> Temperature: Operating	-25°F to -160°F	OK per reqm.	Rantec	Calabasas, Calif	66279-QTP	2/19/67	Qualified as part of an Integrated System and at the sub ass'y level.
	Non-Operating Earth Moon	-65°F to -160°F ---	OK per reqm.	Wyle Labs	El Segundo Calif		2/6/67	
	Pressure Operating	10-12 Torr	1 x 10 ⁻⁵ Torr	Wyle Labs	El Segundo Calif	66279-QTP	2/20/67	Qualified in system to 5 x 10 ⁻⁶ Torrs
	Non-Operating	30 to 1.3 Torr	OK					
	Humidity Operating		100% RH at 160°F				2/8/67	No testing required at system level. Qualified as a sub- assembly.
	Non-Operating	15 to 100% R. H.	100% RH at 120°F					
	Vibration -Operating	N/A					2/13/67	Qualified in the Stowed Configuration and at the sub ass'y level.
	Non-Operating	Random: 15 to 150 cps, 0.2g ² /cps Sine: 5 to 20 cps 0.4 in. D. A. 20 to 100 cps, 8'gs	OK per reqm					
	Acceleration Operating	N/A	OK per reqm.				2/10/67	"
	Non-Operating	25g's ea axis						
	Shock Operating	N/A	OK per reqm				2/9/67	"
	Non-Operating	20 g's ea axis						
	Salt Spray	N/A	N/A					
	Sand & Dust	N/A	N/A					
	Fungus	N/A	N/A					
	Acoustical Noise	N/A	N/A					
	Rain	N/A	N/A					
	Radiation	Radiated at fo=**	50 db	Bunker Ramo	Canoga Park Calif	66279-QTP	2/22/67	
	Explosion Proof	N/A	N/A					
<u>PARAMETRIC</u> VSWR		1.36:1 Max	1.21:1 max (130 Mc min)	Rantec	Calabasas, Calif	66279-PTP-S	Before and after each environmental test	Qualified as part of an integrated system in the space simulation chamber.
	Insertion Loss	0.7 db Max	0.63 db max	Rantec	Calabasas, Calif	66279-PTP-S	1/16/67 to 2/23/67	
	Isolation between Channels	20 db Min Port A to Port B or vice versa	22 db min	Rantec	Calabasas, Calif	66279-PTP-S	1/16/67 to 2/23/67	

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Command Receiver BxA # 23305 23 Flt #3 S/N 10	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	-10°F to +140°F -65°F to +160°F N/A	-10°F to +140°F -65°F to +160°F	Philco-Ford	Palo Alto, California	Qualification Test Report RN-DA1664	March 1968	Qualified as part of an Integrated system and at the sub ass'y level.
	Pressure Operating Non-Operating	1 x 10 ⁻¹² mm Sea Level-10 ⁻⁸ mm	1x10 ⁻⁵ mmHg 1x10 ⁻⁵ mmHg	↑	↑	↑		Qualified in System to 5 x 10 ⁻⁶ Torrs
	Humidity Operating Non-Operating	15% - 100%	15% - 100%					No testing required at system level. Qualified as a sub- assembly.
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	N/A Refer to ATR-16 Addendum #1	N/A 9.0G - peak 20 - 100 cps					Qualified as part of system for S/P #1 Design Limit Test in the Stowed Configuration
	Acceleration Operating Non-Operating	N/A ATR-16, Add. #1	N/A 14G - 1 min. each of 3 axes					"
	Shock Operating Non-Operating	N/A ATR-16, Add. #1	N/A 20G - 10ms rise each of 3 axes	↓	↓	↓		"
	Salt Spray	N/A	N/A					
	Sand & Dust	Not Defined	N/A					No testing required
	Fungus	N/A	N/A					
	Acoustical Noise	Not Defined	N/A					
	Rain	N/A	N/A					No testing required
	Radiation	N/A	N/A					
	Explosion Proof	N/A	N/A					
	<u>PARAMETRIC</u> Performance Specification	Per AL310700		Philco-Ford	Palo Alto, California	Qualification Test Report RN-DA 1664	March 1968	
	Functional Performance	Tested aspect of Integrated System in Space Simulation Chamber.		BxA	Ann Arbor, Michigan	TP 2333032 ATR-60, 70 BSR-2367, 2376	May-June 1968	
	EMI Performance	Tested As part of Integrated System		BxA	↓	TP 2333087 ATR-27, 33 BSR-2300, 2320		

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CENTRAL STATION ELECTRONICS COMPONENTS

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Command Decoder BxA #2330509 Flt #3 S/N 6	ENVIRONMENTAL Temperature: Operating Non-Operating Earth Moon	-22°F to +158°F -65°F to +160°F N/A	-22°F to +158°F -65°F to +160°F N/A	Bendix Aerospace	Ann Arbor, Mich.	TP 2334335 ATR-60, 70 BSR-2363, 2376	May-June 1968	Qualified as part of an Integrated system.
	Pressure Operating Non-Operating	1 x 10 ⁻¹² mmHg S/L to 1 x 10 mmHg	Tested in Spare Sim. Chamber to 5 x 10 ⁻⁶ Torr	Bendix Aerospace	Ann Arbor, Mich.	BSR-2363, 2376	May-June 1968	Test Level Limited by Equipment Capability
	Humidity Operating Non-Operating	N/A 15% to 100%	Designed to meet Humidity Re- quirements	Bendix Aerospace	Ann Arbor, Mich.	N/A	N/A	No testing required.
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	N/A Refer to ATR-16 Addendum 1	Tested to S/P #1 Design Limit Test Levels Refer to figures 1 through 5	Bendix Aerospace	Ann Arbor, Mich.	TP2334346 ATR-82, 83 BSR-2402, 2403	June 1968	Qualified to Design Limit Test Levels for Subpackage #1 (in the stowed configuration)
	Acceleration Operating Non-Operating	N/A ATR-16, Add. 1	Tested to 14 ± 1 g 1 Min Dur- ation 5 times in Axis	Bendix Aerospace	Ann Arbor, Mich.	TP 2334343 ATR-90, 91 BSR-2414, 2413	July 1968	Qualified to Design Limit Test Levels for Subpackage #1 (in the stowed configuration)
	Shock Operating Non-Operating	N/A ATR-16, Add. 1	Tested to 15 ± 2 g 11 ms Saw- tooth 3 times in Axis	Bendix Aerospace	Ann Arbor, Mich.	TP 2334328 ATR-86, 87 BSR-2406, 2407	July 1968	Qualified to Design Limit Test Levels for Subpackage #1 (in the stowed configuration)
	Salt Spray	N/A	N/A	Bendix Aerospace	Ann Arbor, Mich.			
	Sand & Dust	Not Defined	Designed to Meet	Bendix Aerospace	Ann Arbor, Mich.			
	Fungus	N/A	N/A	Bendix Aerospace	Ann Arbor, Mich.			
	Acoustical Noise	Not Defined		Bendix Aerospace	Ann Arbor, Mich.			
	Rain	N/A	N/A	Bendix Aerospace	Ann Arbor, Mich.			
	Radiation	Not Defined	I. R. 130 w/ft ²	Bendix Aerospace	Ann Arbor, Mich.	TP 2334335	May-June 1968	
	Explosion Proof	N/A	N/A	Bendix Aerospace	Ann Arbor, Mich.			
	PARAMETRIC See Table 1 Sheet B-7	Tested as part of Integrated System in space Chamber	Simulation	Bendix Aerospace	Ann Arbor, Mich.	TP 2333032 ATR-60, 70 BSR-2367, 2376	May-June 1968	Qualified via Integrated System Thermal Vacuum Test for a Simulated Lunar Mission
	EMI Performance	Tested as part of Integrated System		Bendix Aerospace	Ann Arbor, Mich.	TP2333087 ATR-27, 33 BSR-2300, 2320	May-June 1968	

Note: See Section 2.2 discussion



**Aerospace
Systems Division**

Qualification Status List
Command Decoder Assembly

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TABLE I

COMMAND DECODER PARAMETRIC REQUIREMENTS

PARAMETER	REQUIREMENT
Demodulator Input NRZ Bi-Phase Mod.	2kc Subcarrier 1kc sync. 5vpp +10% 29.4 db SNR
Command Format	61 Bits
Preamble	20 Bits (zeros)
Decoder Address	7 Bits
Cmd Complement	7 Bits
Command	7 Bits
Cmd Execution Timing	20 Bits (ones)
Command Verification	7 Bits + parity
Normal Cmd Rate	1 message/second
Slow Cmd Rate	1 message/2 sec.
Command Capability	100
Commands Used	66

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement AL 310900	Capability	Agent	Location	Document Reference	Date	
Data Processor (DA06) BxA #2330521 S/N 8 Flight #3	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	-22°F to +158°F -65°F to +185°F N/A	-22°F to +158°F -65°F to +185°F	Bendix Aerospace Systems Division	Ann Arbor, Mich	T. P. 2334335 ATR-60, 70 BSR-2367, 2376	May-June 1968	Successfully tested model on Qual SA model
	Pressure Operating Non-Operating	1x10 ⁻¹² mmHg AMB to 1x10 ⁻¹² mmHg	Tested in spare chamber to 5 x 10 ⁻⁶ Torr					Test level limited by Equip- ment Capability.
	Humidity Operating Non-Operating	N/A 15% to 100%	Designed to meet humidity requirements			N/A	N/A	No testing required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	NA Refer to ATR-16 Addendum 1	Tested to S/P #1 Design Limit Test Levels. Re- fer to figures 1 thru 5.			T. P. 2334346 ATR-82, 83 BSR-2402, 2403	June-July 1968	Qualified at Subpackage #1 Design Limit Test Levels for a stowed configuration.
	Acceleration Operating Non-Operating	N/A ATR-16, Add. 1	Tested to 14 ± 1g 1 Min Duration 5 times ea. Axis.			T. P. 2334343 ATR-90, 91 BSR-2412, 2413		
	Shock Operating Non-Operating	N/A ATR-16, Add. 1	Tested to 15 ± 2g 11 ms sawtooth 3 times ea. Axis.			T. P. 2334328 ATR-86, 87 BSR-2406, 2407		
	Salt Spray	N/A	N/A					
	Sand & Dust	Not Defined						
	Fungus	N/A	N/A					
	Acoustical Noise	Not Defined	--					
	Rain	N/A	N/A					
	Radiation	Not Defined	130 w/ft ² IR Lamp			T. P. 2334335	May-June '68	
	Explosion Proof	N/A	N/A					
	<u>PARAMETRIC</u> See Table I Sheet B-9	Tested as part of Integrated System in Space Simulation Chamber				T. P. 2333032 ATR-60, 70 BSR-2367, 2376	May-June 1968	Qualified via Integrated System Thermal Vacuum Test for a simulated lunar mission.
	EMI Performance	Tested as part of Integrated System				TP2333087 ATR-27, 33 BSR-2300, 2320	May-June 1968	



**Aerospace
Systems Division**

Qualification Status List
Data Processor & 90 Channel
Multiplexer/Converter Assemblies

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Table I

Environment and/or Parameter	Stress Level	
	Requirement AL 310900	Capability
<u>TELEMETRY FORMAT</u>		
Frame Format	64 Words	64 Words
Word Length	10 Bits	10 Bits
<u>FRAME FORMAT</u>		
Control Words	3	3
Passive Seismic Exp.	43	43
Magnetometer Exp.	7	7
Solar Wind Exp.	4	4
SIDE/CCG Exp.	5	5
Command Verification Word	1	1
Housekeeping Word	<u>1</u>	<u>1</u>
Total	64	64
<u>OPERATIONAL MODES</u>		
Normal Bit Rate	1060 bps	1060 bps
Slow Bit Rate	530 bps	530 bps
Active Seismic Bit Rate	N/A	N/A
<u>OUTPUT DATA TO XMTR</u>		
Split-Phase-Modulated (Square Wave Data)	5.0v + 0.5v, -2.5v 0.0v, + 0.4v	5.0v, +0.5, -2.5v 0.0v, + 0.4v
<u>TIMING & CONTROL SIGNALS</u>		
Frame Mark	118 μ s	118 μ s
Even Frame Mark	118 μ s	118 μ s
Shift Pulse	472 μ s	472 μ s
Data Demand Pulse	9.4 ms/18.8 ms	9.4 ms/18.8 ms
Data Gate Pulse	118 μ s	118 μ s
90th Frame Pulse	> 1 μ s	> 1 μ s
Analog Multiplexer Advance	> 1 μ s No less than	> 1 μ s, No less than
A/D Start Pulse	118 μ s apart	118 μ s apart

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Data Processor, 90 Channel Analog Multiplexer/Con- verter BxA 2330524 S/N 11	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	-22°F to +158°F -65°F to +185°F	Tested to Same	Dynatronics	Orlando, Florida	Qualification Test Report 90 Channel Ana- log Mult/Conv.	7 March 1967	Qualified as part of an integrated system and at the subassembly level
	Pressure Operating Non-Operating	Sea Level to 10-12mm Hg	Tested to 10-5 mm Hg @ +158°F					Qualified as part of an integrated system and at the subassembly level
	Humidity Operating Non-Operating	15% - 100% R.H.	Tested to 72 Hr @ 95% RH During Temp. Cycle +25°C to +70°C					No testing required at system level. Qualified as a sub- assembly.
	Vibration Operating N/A Non-Operating Launch & Flight Lunar Landing	Random 7g RMS 20 min Sinusoidal 0.4 in DA 5-20cps, 8g 20-100cps 2cyat 1 oct/min	Random - Same Sinusoidal - same plus 9g 50-100 cps for 2 min					Tested in the stowed configuration and at the subassembly level
	Acceleration Operating Non-Operating	ATR-16 Adden I	Tested to 14 ± 1g 1 Min Duration 5 times ea. Axis.	Bendix Aerospace	Ann Arbor, Michigan	TP2334343 ATR-90, 91 BSR-2412, 2413	July 1968	Verified at S/P #1 Level Qualification, Qual SA
	Shock Operating Non-Operating	N/A 20g for 11 ms	N/A Same	Dynatronics, Inc.	Orlando, Florida	Qualification Test Report 90 ch. Mult/Conv.	7 March 1967	Tested in the stowed configuration and at the subassembly level
	Salt Spray	N/A	N/A					
	Sand & Dust	N/A	N/A					
	Fungus	N/A	N/A					
	Acoustical Noise	N/A	N/A					
	Rain	N/A	N/A					
	Radiation	N/A	N/A					
	Explosion Proof	N/A	N/A					
	<u>PARAMETRIC</u> Multiplexer Analog Input Volt. Analog Accuracy Crosstalk (F.Scale)	0 - 5.0 v 0.33% ±0.1% (max)	-0.0196 to 5.0196v 0.33% ±0.1%	Dynatronics, Inc.	Orlando, Florida	Qualification Test Report 90 Ch. Analog Mult/Converter	7 March 1967	
	Leakage Current: ON OFF Input Impedance: ON OFF	<0.5 µa <0.2 µa >50 Megohms >1 Megohms	<20 nano amp < 2.3 nano amp >100 Megohms >1 Megohms					
	Analog Overvoltage: Operating Non Operating Power Consumption	See Remarks ± 12 v (max) 738 mw	Same ± 12 Same					Ch. 6, 7, 26, 52, 67, 70: +8v, -9v Ch. 21, 36, 45, 80: +8v, -6.5v All remaining Chs: +8v, -5v

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
90 Channel Multiplexer/Converter (cont.)	<u>PARAMETRIC</u>							
	A/D Converter Resolution Quantizing Error	8 bits ± 1/2 bit	8 bits ± 1/2 bit	Dynatronics	Orlando, Florida	Qualification Test Report 90 Channel Analog Multiplexer/Converter	7 March 1967	
	Output Signal Level Logical "1" Logical "0"	0 to +0.4 v +2.5 to 5.5v	Same					
	Data Availability (After Encode Pulse)	165 µsec	118 µsec					
	Power Consumption	593.3 mw	Same					
	Multiplexer/Conv. Operating Life	1 Year	1 Year with Probability of 0.953			Reliability Analysis Report for 90 channel System	1 March 1967	
	Storage Life	2 Years	Unit does not contain parts or material with known age limitations			"	"	
	Functional Performance	Tested as part of Integrated System in space Simulation Chamber		BxA	Ann Arbor, Michigan	TP2333032 ATR-60, 70 BSR, 2367, 2376	May, -June 1968	Qualified as part of an integrated system, Qual SA
	EMI Performance	Tested as part of Integrated System		BxA	Ann Arbor, Michigan	TP2333087 ATR-27, 33 BSR-2300, 2320	May 1968	

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Note: See Section 2.2 Discussion

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Transmitter BxA #2330527 S/N 17 } F14#3 S/N 18 }	ENVIRONMENTAL							
	Temperature:			Philco-Ford	Palo Alto California	Qualification Test Report RN-DA-1795		Qualified as a subassembly
	Operating	-10°F to +140°F	-10°F to +140°F					
	Non-Operating	-65°F to +160°F	-65°F to +160°F					
	Earth	N/A						
	Moon							
	Pressure							
	Operating	1 x 10 ⁻¹² mm	1x10 ⁻⁵ mmHg					
	Non-Operating	Sea Level-10 ⁻⁸ mm	1x10 ⁻⁵ mmHg					
	Humidity							
	Operating	15% - 100%	15% - 100%					
	Non-Operating							
	Vibration							
	Operating	N/A	N/A					Qualified at S/P #1
	Non-Operating	Refer to ATR-16	9.0G - peak					Design Limit Test Level
	Launch & Flight	Addendum #1	20 - 100 cps					Test Levels per figures 1-5
	Lunar Landing							
	Acceleration							
	Operating	N/A	N/A					Qualified as a subassembly
	Non-Operating	ATR-16, Add. #1	14G - 1 min. each of 3 axes					
	Shock							
	Operating	N/A	N/A					Qualified as a subassembly
	Non-Operating	ATR-16, Add. #1	20G - 10 ms rise each of 3 axes					
	Salt Spray	N/A	N/A					
	Sand & Dust	N/A	N/A					
	Fungus	N/A	N/A					
	Acoustical Noise	N/A	N/A					
	Rain	N/A	N/A					
	Radiation	N/A	N/A					
	Explosion Proof	N/A	N/A					
	PARAMETRIC							
	Functional Performance	Tested as part of Integrated System in Space Simulation Chamber		BxA	Ann Arbor, Michigan	TP 2333032 ATR-60, 70 BSR-2367, 2376	May-June 1968	Successful
	EMI Performance	Tested as part of Integrated System		BxA	Ann Arbor, Michigan	TP 2333087 ATR-27, 33 BSR-2300, 2320	May-June 1968	FAR-139 analyzed as not significant on 285 KHZ EMI

Note: See Section 2.2 Discussion

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Power Distribution Unit BxA 2330450-2 S/N 8	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	-22°F to +158°F -65°F to +160°F N/A	-22°F to +158°F -65°F to +160°F	Bendix Aerospace Systems Division	Ann Arbor, Michigan	TP 2334335 ATR-60, 70 BSR-2367, 2376	May-June 1968	Qualified as part of an integrated system
	Pressure Operating Non-Operating	1x10 ⁻¹² mmHg S/L to 1x10 ⁻¹² mmHg	Tested in Space Simul. Chamber to 5x10 ⁻⁶ Torrs	Bendix Aerospace Systems Division	Ann Arbor, Michigan	TP 2334335 ATR-60, 70 BSR-2367, 2376	May-June 1968	Test Level Limited by Equipment Capability
	Humidity Operating Non-Operating	N/A 15% to 100%	Designed to meet Humidity Re- quirements			N/A	N/A	No testing required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	N/A Refer to ATR-16 Addendum 1	Tested to S/P #1 Design Limit Test Levels Refer to fig 1 thru 5			TP 2334346 ATR-82, 83 BSR-2402, 2403	July 1968	Qualified at Subpackage(S/P)#1 Design Limit Test Levels for a Stowed Configuration
	Acceleration Operating Non-Operating	N/A ATR-16, Add. 1	Tested to 14 ± 1g 1 Min. Dur- ation, 5 times ea Axis			TP 2334343 ATR-90, 91 BSR-2412, 2413	July 1968	
	Shock Operating Non-Operating	N/A ATR-16, Add. 1	Tested to 15 ± 2g, 11 mo Saw- tooth 3 times ea Axis			TP 2334328 ATR-86, 87 BSR-2406, 2407	July-Aug 1968	
	Salt Spray	N/A	N/A					
	Sand & Dust	Not Defined	Designed to Meet					No testing required
	Fungus	N/A	N/A					
	Acoustical Noise	Not Defined						No testing required
	Rain	N/A	N/A					
	Radiation	Not Defined	tested to 130w/ft ² IR					
	Explosion Proof	N/A	N/A					
	<u>PARAMETRIC</u> Assembly Performance Specifications	See Table I Sheet B-14	See Table I Sheet B-14	BxA	Ann Arbor, Michigan			
	Functional Performance	Tested as part of Integrated System in Space Chamber	Simulation	BxA	Ann Arbor, Michigan	TP 2333032 ATR-60, 70 BSR-2367, 2376	May-June 1968	
	EMI Performance	Tested as part of Integrated System		BxA	Ann Arbor, Michigan	TP 2333087 ATR-27, 33 BSR-2300, 2320		

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Parametric Req'm'ts	Requirements	Capability
Exp. Pwr Control: Operational Modes	ON/OFF/STDBY	ON/OFF/STDBY
Overload Circuit Protection:		
Experiments (+29v)	500 ma \pm 10%	500 ma \pm 10%
Transmitter (+29v)	600 ma \pm 100 ma	600 ma \pm 100 ma
Transmitter (+12v)	150 ma + 75, - 40 ma	150 ma + 75, - 40 ma
Cmd Receiver (+12v)	150 ma, + 75, - 40 ma	150 ma, + 75, - 40 ma
PDU Pwr Rqmt:		
Quiescent State	3.0 W (Max)	3.0 W (Max)
Cmd Execution	4.4 W Peak	4.4 W Peak
Signal Conditioning:		
Housekeeping Data	0-5 v	0 - 5 v
PCU Loading:		
Reserve Pwr. Dump Capability	0 - 10 w	0 - 10 w
Experiment Ripple-off:		
Response Time (1st Exp)	135 ms \pm 15 ms	135 ms \pm 15 ms
Sequential Switching (3 Experiments)	8 \pm 1 ms ea Exp.	8 \pm 1 ms ea Exp.
Redundant Pwr. Control		
Transmitter	Selects A or B	Selects A or B
Data Processor	Selects X or Y	Selects X or Y
Power Switching Control:		
Switching Relays		
Coil Voltage	26.5 v (Nominal)	26.5 v (Nominal)
Coil Current	22.5 ma (Max)	22.5 ma (Max)
Response Time	8 ms (Max)	8 ms (Max)
Relay Drivers		
Active State (+29.0v)	36 ma (min.)	36 ma (min.)
Inactive State	2 mw (max)	2 mw (max)

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement AL 410100	Capability	Agent	Location	Document Reference	Date	
Power Condition- ing Unit (P. C. U.) S/N 6	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	-22°F to +158°F -65°F to +160°F	-22°F to +158°F -65°F to +160°F	Bendix Aerospace Systems Division	Ann Arbor, Mich.	T. P. 2334335 ATR-60, 70 BSR-2367, 2376	May-June 1968	Qualified in Subpackage #1 system level tests
	Pressure Operating Non-Operating	Sea Level to 1x10 ⁻¹² Torr	Tested to 5x10 ⁻⁶ Torr			T. P. 2334335 ATR-60, 70 BSR-2367, 2376		Test level limited by Test Equipment Capability
	Humidity Operating Non-Operating	15 to 100%	Designed to meet humidity requirements			N/A	N/A	Testing Not Required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	ATR-16 Adden. #1	Tested to S/P#1 Design Limits Test Levels(Refer to Fig 1 thru 5)			T. P. 2334346 ATR-82, 83 BSR-2402, 2403	July 1968	Qualified at Subpackage #1 Design Limit Test Levels for a stowed configuration
	Acceleration Operating Non-Operating	ATR-16 Adden. #1	Tested to 14±1g, 1 min duration, 5 times per axis			T. P. 2334343 ATR-90, 91 BSR-2412, 2413	July 1968	Verified at Subpackage #1 Design Limit Test and for a stowed configuration
	Shock Operating Non-Operating	ATR-16 Adden. #1	Tested to 15±2g, 11 ms 3 times each axis			T. P. 2334328 ATR-86, 87 BSR-2406, 2407	July 1968	Verified at Subpackage #1 Design Limit Test and for a stowed configuration
	Salt Spray	N/A	N/A					
	Sand & Dust	Not Defined	N/A					No Test Required
	Fungus	N/A	N/A					
	Acoustical Noise	Not Defined	NYD					No Test Required
	Rain	N/A	N/A					
	Radiation	Not Defined	NYD					
	Explosion Proof	Not Defined	N/A					
	<u>PARAMETRIC</u> Regulation Ripple	Refer to Table I Refer to Table II	Refer to Table I Refer to Table II	Sheet B-16				Waiver or change to Speci- fication pending on ripple and voltage regulation limits.
	Functional Performance	Tested as part of	Integrated Sys- tem in Space Sim- ulation Chamber	BxA	Ann Arbor, Mich.	T. P. 2333032 ATR-60, 70 BSR-2367, 2376	May-June 1968	
	EMI Performance	Tested as part of	Integrated System	BxA	Ann Arbor, Mich.	T. P. 2333087 ATR-27, 33 BSR-2300, 2320	May-June 1968	

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	<u>Voltage Range (AVG)</u>	<u>Range of Loads</u>	<u>Nominal Loads</u>
Output #1	28.59 to 29.40 VDC	18.0 to 45 watts	34.5 watts
Output #2	14.80 to 15.30 VDC	0.12 to 1.2 watts	1.2 watts
Output #3	11.85 to 12.10 VDC	2.4 to 3.6 watts	3.6 watts
Output #4	4.85 to 5.25 VDC	2.25 to 4.5 watts	4.5 watts
Output #5	-5.86 to -6.10 VDC	0.21 to 0.27 watts	0.27 watts
Output #6	-11.80 to -12.40 VDC	0.48 to 1.8 watts	1.8 watts

TABLE II
PCU PEAK-TO-PEAK RIPPLE VOLTAGE LIMITS

	<u>Volts Peak-to-Peak</u>	<u>Frequency Band</u>	<u>Resistive Loading (watts)</u>
Output #1	0.20	\leq 100 KHz	45 Maximum
(+ 29 VDC Nom.)	0.50	$>$ 100 KHz	18 Minimum
Output #2	0.20	\leq 100 KHz	1.2 Maximum
(+15 VDC Nom.)	0.50	$>$ 100 KHz	0.12 Minimum
Output #3	0.20	\leq 100 KHz	3.6 Maximum
(+12 VDC Nom.)	0.50	$>$ 100 KHz	2.4 Minimum
Output #4	0.20	\leq 100 KHz	4.5 Maximum
(+5 VDC Nom.)	0.50	$>$ 100 KHz	2.25 Minimum
Output #5	0.20	\leq 100 KHz	0.27 Maximum
(-6 VDC Nom.)	0.50	$>$ 100 KHz	0.21 Minimum
Output #6	0.20	\leq 100 KHz	1.8 Maximum
(-12 VDC Nom.)	0.50	$>$ 100 KHz	0.48 Minimum

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Timer, Central Station P/N 2330626	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	-30°C to +80°C -55°C to +100°C -30°C to +80°C	-30°C to +80°C -55°C to +100°C -30°C to +80°C	Bendix Aerospace Systems Division (BxA)	Ann Arbor, Michigan	TP 2334335 ATR-60, 70 BSR-2367, 2376	May-June 1968	Qualification of the Timer has been accomplished at the System Level.
	Pressure Operating Non-Operating	1 x 10 ⁻¹² Torrs 1 x 10 ⁻⁸ Torrs	Verified to 5 x 10 ⁻⁶ Torrs in space Simulation Chamber	BxA	Same	Same	Same	Pressure limited by test chamber capability
	Humidity Operating Non-Operating	N/A 50% to 100% RH	Designed to meet Humidity Requirements	N/A	N/A	N/A	N/A	No Testing Planned to the 100% Humidity Level.
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	N/A Refer to ATR-16 Addendum 1	See Fig 1 thru 5	BxA	Ann Arbor, Michigan	TP 2334346 ATR-82, 83 BSR-2402, 2403	July-Aug. 1968	Qualification of the Timer was accomplished at the System Level.
	Acceleration Operating Non-Operating	N/A ATR-16, Add. 1	Tested at 14+1g 1 Min Duration ea Axis	BxA	Same	TP 2334343 ATR-90, 91 BSR-2412, 2413	July 1968	Qualified to S/P#1 Design Limit Test for a Stowed Configuration
	Shock Operating Non-Operating	N/A ATR-16, Add. 1	Tested to 15+2g 11 ms Sawtooth ea Axis	BxA	Same	TP 2334328 ATR-86, 87 BSR-2406, 2407	July 1968	Same as above
	Salt Spray	N/A	N/A					
	Sand & Dust							
	Fungus							
	Acoustical Noise							
	Rain							
	Radiation							
	Explosion Proof	N/A	N/A					
	<u>PARAMETRIC</u> Power Requirements Volts Current Start Mode Stop Mode	1.2 to 1.5 VDC 12μ amp max 7μ amp max	1.2 to 1.5 VDC 12 μ amp max 7 μ amp max	BxA	Same	TP2334345 ATR-101, 102	August 1968	Qualified contingent on completion of separate 36- cycle reliability evaluation tests, February 1969
	Switch Closures: Repetitive Non-Repetitive	1 minute 12 Hr 720 Day	1 Minute 12 Hr 720 Day	BxA	Same	Same	Same	Same as above

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks			
		Requirement	Capability	Agent	Location	Document Reference	Date				
PSE Sensor Assembly P/N 233425 BxA #2338460-2 Flt #3, S/N 6	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	107° to 125°F -65°F to 160°F Same as Operating	Tested in Space Simulation Chamber for Temperature	Bendix Aerospace Systems Division	Ann Arbor, Michigan	T13022 TP2334335 ATR-60, 70 BSR-2367,2376	11 Jan 69 June 10, 1968	See Note 4 Qualified contingent on resolution of major items listed in Note 1 below at the System Level.			
	Pressure Operating Non-Operating	1 x 10 ⁻¹² mm Hg 1 x 10 ⁻⁸ mm Hg	Verified to 5 x 10 ⁻⁵ Torrs in Space Sim. Cham.					Test level limited by test equipment capability			
	Humidity Operating Non-Operating	Not applicable 50-100% R.H.	Designed to Meet Humidity Requirement			N/A	N/A	N/A			
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	Not Applicable Refer to ATR-16 Addendum 1	Tested in Stowed Configuration to Vibration Design Limits Indicated in Fig. 1 Thru 5.			TP2334346 ATR-82, 83 BSR-2402,2403	6/28/68	Qualified in the stowed configuration			
	Acceleration Operating Non-Operating	Not Applicable ATR-16, Add. 1	Tested in Stowed Configuration to 14 ± 1g, 1 Min.			TP2334343 ATR-90, 91 BSR-2412,2413	7/4/68	Qualified in the stowed configuration			
	Shock Operating Non-Operating	Not Applicable ATR-16, Add. 1	Tested in Stowed Configuration to 15 ± 2g 11ms 3 Times Ea. Axis			TP2334328 ATR-86, 87 BSR-2406,2407	6/24/68	Qualified in the stowed configuration			
	Salt Spray	Not Applicable	Not Applicable								
	Sand & Dust	LED-520	Designed to Meet								
	Fungus	Not Applicable	Not Applicable								
	Acoustical Noise	Not Applicable	Not Applicable								
	Rain	Not Applicable	Not Applicable								
	Radiation	LED-520	Designed to Meet								
	Explosion Proof	Not Applicable	Not Applicable								
	<u>PARAMETRIC</u> Functional Performance	Tested as part of Integrated System in Space Chamber	Simulation	BxA		TP 2333032 ATR-60, 70 BSR-2367,2376	June 10 1968	Qualification contingent on resolution of major open items listed in Notes 2 & 3			
	EMI Performance	Tested as part of integrated system		BxA		TP 2333087 ATR-27, 33 BSR-2300,2320	April 1968				
	Note 1: FR-192 PSE S/N 3 uncage; Final FAR-132A issued Note 2: FR 125 PSE Uncage Final FAR-125A issued Note 3: Retest of PSE S/N 2 required after QSA system level testing Note 4: Thermal Control Qualified per as run T/P T13022 & accepted by MSC per Qual SB QAR Meeting Minutes 9713-10-3021										
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Note: See Section 2.3 discussion

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
PSE Central Station Electronics BxA #2334670 Flt #3 S/N 5	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	107°F to 125°F -65°F to 160°F Same as Operating	Tested in Space Simulation Chamber for Temperature	Bendix Aerospace Systems Division	Ann Arbor, Michigan	TP2334335 ATR-60, 70 BSR-2367,2376	June 10 1968	Successfully tested on BxA Qual SA model
	Pressure Operating Non-Operating	1 x 10 ⁻¹² mm Hg 1 x 10 ⁻⁸ mm Hg	Verified to 5 x 10 ⁻⁵ Torrs in Space Sim. Cham					
	Humidity Operating Non-Operating	Not Applicable	Designed to Meet Humidity Requirements			N/A	N/A	N/A
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	Not Applicable Refer to ATR-16 Addendum 1	Tested in Stowed Configuration to Vibration Design Limits Indicated in Figs. 1 Thru 5.			TP2334346 ATR-82, 83 BSR-2402,2403	6/28/68	Successfully Tested
	Acceleration Operating Non-Operating	Not Applicable ATR-16, Add. 1	Tested in Stowed Configuration to 14 ± 1g. 1 Min.			TP2334343 ATR-90, 91 BSR-2412,2413	7/4/68	Successfully Tested
	Shock Operating Non-Operating	Not Applicable ATR-16, Add. 1	Tested in Stowed Configuration to 15 ± 2g 11ms 3 Times Ea. Axis			TP2334328 ATR-86, 87 BSR-2406,2407	6/24/68	Successfully Tested
	Salt Spray	Not Applicable	Not Applicable					
	Sand & Dust	LED-520	Designed To Meet					
	Fungus	Not Applicable	Not Applicable					
	Acoustical Noise	Not Applicable	Not Applicable					
	Rain	Not Applicable	Not Applicable					
	Radiation	LED-520	Designed to Meet					
	Explosion Proof	Not Applicable	Not Applicable					
	<u>PARAMETRIC</u> Functional Performance	Tested as part of the integrated system in the space simulation chamber		BxA	Ann Arbor, Michigan	TP 2333032 ATR-60-70 BSR-2367,2376	June 10, 1968	
	EMI Performance	Tested as part of the integrated system		BxA	Ann Arbor, Michigan	TP 2333087 ATR-27, 33 BSR-2300,2320	April 1968	

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Item Nomenclature PSE	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Shroud, Thermal Control P/N 233415	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	-300 - +250° F	-300 - +250° F	Earth Sciences Division-Teledyne during DVT thermal vacuum tests	Hughes Aircraft Space Simulation Laboratory El Segundo, Cal.	Engineering Report No. 640-0268-0053	8 Feb. 1968	See Note Below
	Pressure Operating Non-Operating	1 x 10 ⁻¹² mm Hg Same as oper.	1 x 10 ⁻⁷ mm Hg	"	"	"	"	See Note Below
	Humidity Operating Non-Operating	Not applicable 50%-100% R. H.	Designed to Meet Humidity Requirements					No testing required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	See Remarks	Hz g ³ /Hz 23-58 0.304 58-100 12db/oct 100-200 0.039 200-430 12db/oct 430-1000 0.99	Earth Sciences Division - Teledyne	Bunker Ramo Corporation Testing Lab Canoga Park, Calif.	DVT Report ENV-R-2363	Nov. 1967	See Note Below
	Acceleration Operating Non-Operating	Not applicable 14 ⁺¹ ₋₀	14 g's	"	"	"	"	See Note Below
	Shock Operating Non-Operating	Not applicable 20 ± 1 g	20 g ± 10% saw tooth 10 msec rise 1 msec decay	"	"	"	"	See Note Below
	Salt Spray	Not applicable	Not applicable					
	Sand & Dust	LED-520	Designed to Meet					
	Fungus	Nonnutrient	Nonnutrient					
	Acoustical Noise	Not applicable	Not applicable					
	Rain	Not applicable	Not applicable					
	Radiation	LED-520	Designed to Meet					
	Explosion Proof	Not applicable	Not applicable					
	<u>PARAMETRIC</u>							
		NOTE: PSE Shroud qualified on Subpackage #1 installation per test and report references shown on SP#1 Sheet E-1.						

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
PSE Gnomon Assembly BxA #2338016	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	107° F to 125° F -65° F to 160° F Same as Operating	Tested in Space Simulation Chamber for Temperature	Bendix Aerospace Systems Division	Ann Arbor, Michigan	TP2334378 ATR-160 BSR-2570	12/30/68	Successfully Tested at System Level as a Result of Qual SB Test Program
	Pressure Operating Non-Operating	1 x 10 ⁻¹² mmHg 1 x 10 ⁻⁸ mmHg	Verified to 5 x 10 ⁻⁵ Torr in Space Sim. Cham					
	Humidity Operating Non-Operating	Not Applicable	Designed to Meet Humidity Requirements			N/A	N/A	N/A
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	Not Applicable Refer to ATR-16 Addendum 1	Tested in Stowed Configuration to Vibration Design Limits Indicated in Figs. 1 Thru 5.			TP2337905 ATR-149 BSR-2546	12/19/68	Successfully Tested at System Level as a Result of Qual SB Test Program
	Acceleration Operating Non-Operating	Not Applicable ATR-16, Add. 1	Tested in Stowed Configuration to 14 ± 1g. 1Min.	BMSD	Mishawauka Indiana	TP2337915 ATR-164 BSR-2574	1/15/69	
	Shock Operating Non-Operating	Not Applicable ATR-16, Add. 1	Tested in Stowed Configuration to 15 ± 2g 11ms 3 Times Ea. Axis	Bendix Aerospace Systems Division	Ann Arbor Michigan	TP2337917 ATR-161 BSR-2571	1/7/69	
	Salt Spray	Not Applicable	Not Applicable					
	Sand & Dust	LED-520	Designed to Meet					
	Fungus	Not Applicable	Not Applicable					
	Acoustical Noise	Not Applicable	Not Applicable					
	Rain	Not Applicable	Not Applicable					
	Radiation	LED-520	Designed to Meet					
	Explosion Proof	Not Applicable	Not Applicable					
	<u>PARAMETRIC</u>							

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Heat Flow Experiment 2330661 S/N 05	<u>ENVIRONMENTAL</u> 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	TP 2334387 ATR-160 BSR-2570	Dec 1968	Qual SB Test
	Pressure Operating Non-Operating	Sea Level to 10-12 TORR	5 x 10 ⁻⁷ TORR	BxA	Ann Arbor, Michigan	TP 2334387 ATR-160 BSR-2570	Dec 1968	BxA facilities will not allow testing to below 5 x 10 TORR
	Humidity Operating Non-Operating	15 to 100%	Designed to Meet Humidity Requirement	BxA	Ann Arbor, Michigan	N/A	N/A	No testing planned to 100% level.
	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	BxA	Ann Arbor, Michigan	TP 2337905 ATR-149 BSR-2546	Dec 1968	Qual SB Design Limit Test
	Acceleration Operating Non-Operating	N/A ATR-16 ADD. 1	14g ± 1g/1 min.	BxA/BMSD	Mishawauka Indiana	TP 2337915 ATR-164 BSR-2574	Dec 1968	Qual SB Design Limit Test
	Shock Operating Non-Operating	N/A 15g± 2g Sawtooth	15g± 2g Sawtooth	BxA	Ann Arbor, Michigan	TP 2337917 ATR-161 BSR-2571	Jan 1969	Qual SB Design
	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						
	<u>PARAMETRIC</u> functional performance	Tested as a part of integrated system in the Space Simulation chamber		BxA	Ann Arbor, Michigan	TP 2338640 (Mod. IST) ATR-163 BSR-2573	Jan 1969	Qual SB Test
	Note: See Section 2.4 discussion							

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COLD CATHODE GAUGE EXPERIMENT

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Cold Cathode Gauge Experiment BxA 2338549 S/N 1003	<u>ENVIRONMENTAL</u> 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 -300°F to +250°F	BxA	Ann Arbor, Michigan	TP2334387 ATR 60 BSR-2570	Dec. 1968	Qual SB Test
	Pressure Operating Non-Operating	10 ⁻¹² Torr SL-10 ⁻¹² Torr	Tested to 5 x 10 ⁻⁶ Torr	BxA	Ann Arbor, Michigan	TP2334387 ATR 60 BSR-2570	Dec. 1968	Test level limited by test equipment capability
	Humidity Operating Non-Operating	N/A 15-100%	Designed to meet Humidity Re- quirements	BxA	Ann Arbor, Michigan	N/A	N/A	No testing planned to 100% level
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	N/A IC 314105	Tested in stowed conf. to design limit levels in- dicated in fig- ures 1-5	BxA	Ann Arbor, Michigan	TP2337905 ATR 149 BSR-2546	Dec. 1968	Qualified in the stowed configuration
	Acceleration Operating Non-Operating	N/A IC 314105	Tested to 14 ± 1 g 1 Min Duration	BxA	Ann Arbor, Michigan	TP2337915 ATR 164	Jan. 1969	Tested in stowed configura- tion during design limit test
	Shock Operating Non-Operating	N/A IC 314105	Tested to 15g±2g 1ms sawtooth ea Axis	BxA	Ann Arbor, Michigan	TP2337917 ATR 161 BSR-2571	Jan. 1969	Tested in stowed configuration during design limit test
	Salt Spray	N/A						
	Sand & Dust	N/A Not defined						No testing planned
	Fungus	N/A						
	Acoustical Noise	Not Defined						No testing planned
	Rain	N/A						
	Radiation	N/A						
	Explosion Proof	N/A						
	<u>PARAMETRIC</u> Functional Per- formance		Tested as part of Integrated System	BxA	Ann Arbor, Michigan	TP2338640 ATR-163 BSR-2573	Jan. 1969	Modified IST (Post Shock)

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CHARGED PARTICLE LUNAR ENVIRONMENT EXPERIMENT

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
CPLEE BRL#2165701	<u>ENVIRONMENTAL</u> 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 -300°F to +250°F	Bendix Aerospace Systems Division	Ann Arbor, Michigan	TP2334387 TP2337912 ATR160/BSR2570	12/30/68	Qualified during Qual SB Thermal Vac. in part and during the Re-Qual Thermal Vac in part
	Pressure Operating Non-Operating	10 ⁻¹² torr 10 ⁻¹² torr	Tested to 10 ⁻⁶ torr 10 ⁻⁶ torr	"	"	TP2334387 and TP2337912 ATR160/BSR2570	12/30/68	Qualified during Qual SB Thermal Vac. in part and during the Re- Qual Thermal Vac in part
	Humidity Operating Non-Operating	NA 15% to 100% Relative	Designed to meet Humidity Requirements	"	"	NA	NA	No testing required.
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	NA Design Limit vib. Defined in figures 1-5	Tested to Design Limit vib. Levels indicated in figures 1-5	"	"	TP2337905C ATR149/BSR2545 TP2338640 ATR163/BSR2573	12/19/68 1/13/69	Capability to meet require- ment verified by system level qualification testing.
	Acceleration Operating Non-Operating	NA 14g±1g min in the +X Direction	Tested to 14±1g 1 min in the +X Direction	BMSD	Mishawauka, Indiana	TP2337915A ATR149/BSR2546 TP2338640 ATR163/BSR2573	12/19/68 1/13/69	↓
	Shock Operating Non-Operating	NA 15g±2g, 11ms Sawtooth ea axis	Tested to 15g±2g 11ms Sawtooth ea axis	Bendix Aerospace Systems Division	Ann Arbor, Michigan	TP2337917A ATR161/BSR2571 TP2338640 ATR163/BSR2573	1/7/69 1/13/69	
	Salt Spray	NA						
	Sand & Dust	NA						
	Fungus	NA						
	Acoustical Noise	NA						
	Rain	NA						
	Radiation	NA						
	Explosion Proof	NA						
	<u>PARAMETRIC</u> Functional Performance	Tested as part of integrated system in Space Simulation Chamber.		"	"	TP2334375 ATR167/BSR2577	1/15/69	See First Remark.
	Note: See Section 2.6 discussion.							

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
Subpackage #2 BxA 2334844 Flt. #3 S/N 8	<u>ENVIRONMENTAL</u> Temperature:							
	Operating	-300°F to +250°F	-300°F to +270°F	BxA	Ann Arbor, Michigan	TP2334335 (ENV TP2333032 (IST) ATR-60, 70	6/10/68	Completed testing with no open items
	Non-Operating	-65°F to +160°F	(See note 1)					
	Earth							
	Moon	-300°F to +250°F	-300°F to +250°F			BSR-2367, 2376		
	Pressure							
	Operating	10 ⁻¹² Torr	Tested to	BxA	Ann Arbor, Michigan	Same as above	6/10/68	Test level limited by test equipment capabilities.
	Non-Operating	SL to 10 ⁻¹² Torr	5 x 10 ⁻⁶ Torr					
	Humidity							
	Operating	N/A	Designed to	BxA	Ann Arbor, Michigan	N/A	N/A	No Testing planned to the 100% humidity level: ALSEP QTRR Board decision
	Non-Operating	15-100%	Meet Humidity Requirement					
	Vibration							
	Operating	N/A	Tested in Stowed	BxA	Ann Arbor, Michigan	TP 2334348 ATR-84, 85 BSR 2404, 2405	6/28/68	Qualified
	Non-Operating	Refer to	Configuration to					
	Launch & Flight	CP 100001	Desing Limit					
	Lunar Landing		Levels Indicated in Figures 1-5.					
	Acceleration							
	Operating	N/A	Tested to 14± 1g	BxA	Ann Arbor, Michigan	TP 2334330 ATR-92, 93	7/6/68	Successful test
	Non-Operating	CP100001	each axis					
	Shock							
	Operating	N/A	Test to 15 ± 2g	BxA	Ann Arbor, Michigan	TP2334331 ATR - 88, 89 BSR - 2408, 2409	6/30/68	Successful test
	Non-Operating	CP100001	each axis					
	Salt Spray	N/A						
	Sand & Dust	Not Defined						
	Fungus	N/A						
	Acoustical Noise	Not Defined						No test required
	Rain	N/A						
	Radiation	LED-520	130 w/ft ² I.R.	BxA	Ann Arbor, Michigan	TP2334335	6/10/68	See operating temperature
	Explosion Proof	N/A						No test required
	<u>PARAMETRIC</u>							
	Mission	ATM-785	Capable of		Ann Arbor, Michigan	TP 2334345 TP 2338610 ATR-101, 102	8/7/68	Qualified contingent on completion of open items in note 3
	Simulation	Section 5.3	startup and operation on lunar surface	BxA				
	Note 1: Temperature storage tests may be replaced by an added deployment test per MSC Letter BG 931/L226/T97(CCP-122).							
	Note 2: Differences for Array B configuration is defined in Section 3.0 were qualified to comparable environment levels in accordance with test procedures and reports referenced in addendum #1 dated 1/27/69 of ALSEP TM-321.							
	Note 3: See Section 3.0 discussion.							

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SUBPACKAGE II, RTG ASSEMBLY

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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. 21 632011	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	1000°F to 1140°F -380°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 1x10 ⁻¹² torr	5x10 ⁻⁵ torr 16x10 ⁻⁸ torr	BxA	Ann Arbor, Michigan	↓	↓	Test level limited by test equipment capability
	Humidity Operating Non-Operating	15 to 100%	Designed to meet humidity require- ments	N/A	N/A	N/A	N/A	No testing required
	Vibration Operating 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. Refer to ATR-84, 85
	Acceleration Operating 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 Non-Operating	ATR-16 Addendum 1	15 G each axis 11 msec± 10%	BxA	↓	TP 2334331 ATR-88, 89 BSR-2408.2409	June 1968	" "
	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		
	Explosion Proof	NYD	NYD	G. E.	Phil. Penn.	NYD		
	<u>PARAMETRIC</u>							

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SUBPACKAGE II, RTG SHORTING PLUG

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
RTG Shorting Plug BxA 2338017 Flt. #3 S/N-5 See Note 1.	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	-300°F to +50°F -60°F to +160°F	-300°F to +250°F -60°F to +160°F	Bendix Aerospace System	Ann Arbor Michigan	TP2334335 TP2333032 ATR-60, 70 BSR-2367, 2376	June 1968	Successfully tested on Qual SA model.
	Pressure Operating Non-Operating	1x10 ⁻¹² Toors SL to 1x10 ⁻¹²	Tested to 5x10 ⁻⁶ Toors					Capability limited by test Equipment Capability
	Humidity Operating Non-Operating	N/A	Designed to meet Humidity Requirements		N/A	N/A	N/A	No testing required
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	N/A Refer to Fig. 1-5	Tested in stowed configuration to Design Limit levels indicated by Fig. 1-5		Ann Arbor Michigan	TP2334348 ATR-84, 85 BSR-2404, 2405	July 1968	Successfully Tested, Qual SA
	Acceleration Operating Non-Operating	N/A LTA-3D/R	Tested to 14 ± 1g 1 min duration 5 times @ axis			TP2334330 ATR-92, 93	June 1968	" "
	Shock Operating Non-Operating	N/A LTA-3D/R	Tested to 15 ± 2g 11 ms sawtooth 5 times @ axis.			TP2334331 ATR-88, 89 BSR-2408, 2409	June 1968	" "
	Salt Spray	N/A						
	Sand & Dust	Not Defined						
	Fungus	N/A						
	Acoustical Noise	Not Defined						
	Rain	N/A						
	Radiation	Not Defined	IR 130W/ft ²					
	Explosion Proof	N/A						
	<u>PARAMETRIC</u>							
		Note 1: Qualified on Qual SA configuration as BxA 2335520 Assembly Revision C which is identical to BxA 2338017 Assembly used on Array B.						

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SUBPACKAGE #2, APOLLO LUNAR HANDLING TOOL (ALHT)

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
ALHT SEB39101165 SN/102	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon							See Notes Below
	Pressure Operating Non-Operating							
	Humidity Operating Non-Operating							
	Vibration Operating Non-Operating Launch & Flight Lunar Landing							
	Acceleration Operating Non-Operating							
	Shock Operating Non-Operating							
	Salt Spray							
	Sand & Dust							
	Fungus							
	Acoustical Noise							
	Rain							
	Radiation							
	Explosion Proof							
	<u>PARAMETRIC</u> Note 1: The ALHT mass simulator rather than a flight configuration model was used for the BxA Qual SB system level dynamic tests.							
	Note 2: Refer to SP#2 QSL Sheet B-25 for shock, vibration and acceleration environment levels which apply to the interface qualification.							
	Note 3: Minutes 974-1264 on the QAR Board Meeting for Qual SB reflect that no category II open items exist to contain qualification.							

SUBPACKAGE #2, APOLLO LUNAR SCIENTIFIC DRILL (ALSD)

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See Notes Below

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SUBPACKAGE #2, PSE LEVELING STOOL

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Item Nomenclature	Environment and/or Parameter	Stress Level		Verification of Stress Level Capability				Remarks
		Requirement	Capability	Agent	Location	Document Reference	Date	
PSE Leveling Stool Assembly P/N 233400 BxA #2333795	<u>ENVIRONMENTAL</u> Temperature: Operating Non-Operating Earth Moon	107°F to 125°F -65°F to 160°F Same as Operating	Tested in Space Simulation Chamber for Temperature	Bendix Aerospace Systems Division	Ann Arbor, Michigan	TP2334335 ATR-60, 70 BSR-2367 2376	May-June 1968	Qualification Accomplished at the System Level, QSA
	Pressure Operating Non-Operating	1 x 10 ⁻¹² mm Hg 1 x 10 ⁻⁸ mm Hg	Verified to 5 x 10 ⁻⁵ Torrs in Space Sim. Cham			↓	↓	
	Humidity Operating Non-Operating	Not Applicable	Designed to Meet Humidity Requirements			N/A	N/A	
	Vibration Operating Non-Operating Launch & Flight Lunar Landing	Not Applicable Refer to ATR-16 Addendum 1	Tested in Stowed Configuration to Vibration Design Limits Indicated in Figs. 1 Thru 5			TP 2334348 ATR-84, 85 BSR-2404, 2405	July-Aug 1968	
	Acceleration Operating Non-Operating	Not Applicable	Tested in Stowed Configuration to 14 ± 1g 1 Min.			TP 2334330 ATR-92, 93	7/4/68	
	Shock Operating Non-Operating	Not Applicable ATR-16- Add. 1	Tested in Stowed Configuration to 15 ± 2g 11ms 3 Times Ea Axis			TP 2334331 ATR-88, 89 BSR-2408, 2409	6/24/68	
	Salt Spray	Not Applicable	Not Applicable					
	Sand & Dust	LED-520	Designed to Meet					
	Fungus	Not Applicable	Not Applicable					
	Acoustical Noise	Not Applicable	Not Applicable					
	Rain	Not Applicable	Not Applicable					
	Radiation	LED-520	Designed to Meet					
	Explosion Proof	Not Applicable	Not Applicable					
	<u>PARAMETRIC</u>							