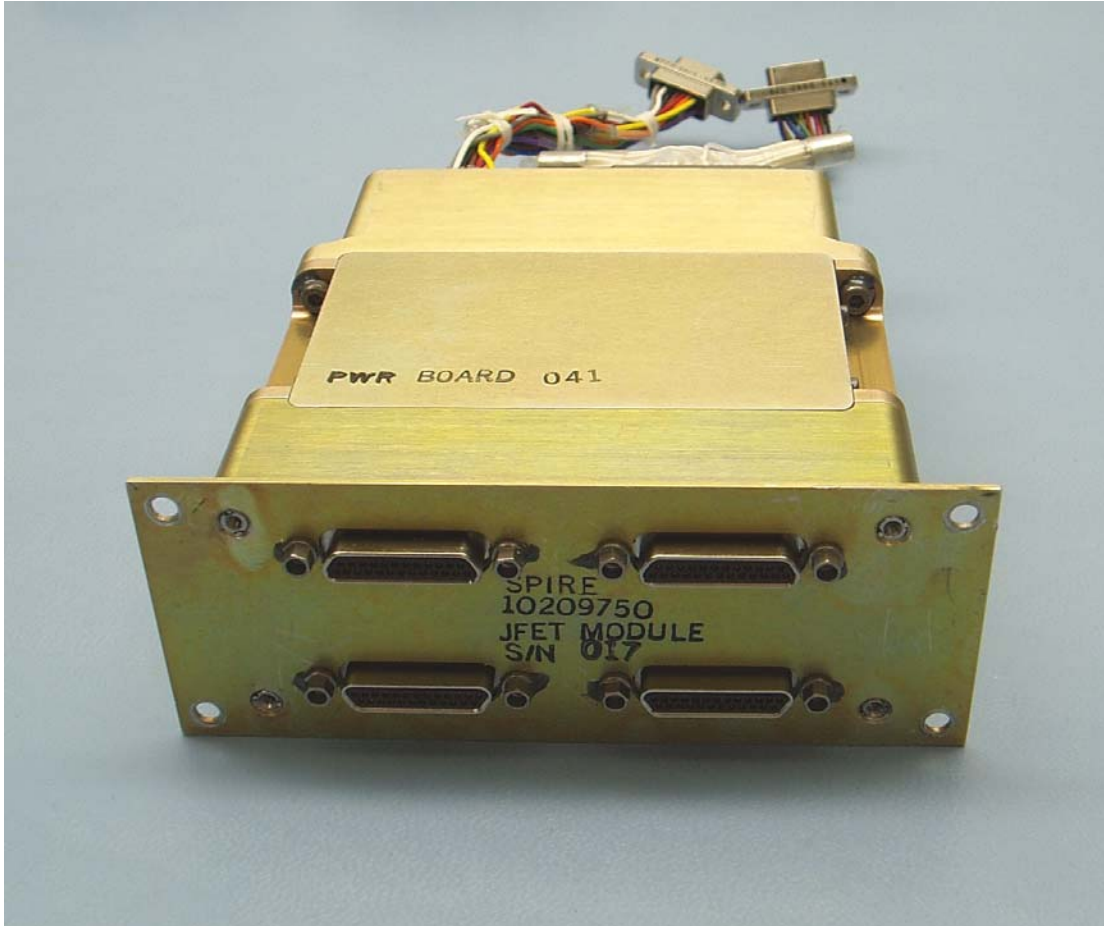


JPL Hardware Requirements Certification Review – SPIRE Element No. D-32239

JPL Hardware Requirements Certification Review – SPIRE Element No. D-32239

| Assembly / Subsystem | | PEM | | | Phone | | Section | | Date |
|--------------------------------------------------------------------------------------------|-----------|---------------|---|---|---------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------------------------------------|
| SPIRE | | Martin Herman | | | (818) 354-8541 | | 385 | | 17 June, 2005 |
| Drawing/ Part No. | Dwg. Rev. | Nomenclature | | | Serial No. | Model | Type | Final IR No. | Mass (Meas. / Req.) |
| 10209750-1 | B | JFET Module | | | 017 | FLT-Spare | N/A | 926198 | 273.5 gm / 305 gm |
| Check applicable answer and provide explanation in remarks column | | Y | N | N | Remarks | | Data Attachments | | Signature & Date |
| 1. Are all drawings and specifications complete, approved, released and frozen? | | X | | | | | 14. Latest Top Assembly drawings <input checked="" type="checkbox"/> Attached <input type="checkbox"/> None | | Cognizant Engineer <i>Steve Tsang 6/17/05</i> |
| 2. Do the released drawings and specifications reflect all approved changes? | | X | | | | | 15. List of open ECRs <input type="checkbox"/> Attached <input checked="" type="checkbox"/> None | | PEM <i>Martin P 6/17/05</i> |
| 3. Is hardware identical to other hardware delivered? If no, provide difference list. | | X | | | | | 16. Waivers (RFW request for waiver) <input checked="" type="checkbox"/> Attached <input type="checkbox"/> None | | QA/Engineer <i>Scott Huck 6/17/05</i> |
| 4. Does the hardware meet its functional requirements, specifications, waivers, ICDS? | | X | | | EIDP attached. Also see item # 8 attachments. | | 17. Open MRB <input type="checkbox"/> Attached <input checked="" type="checkbox"/> None | | Environments/Reliability <i>J - 120 6/17/05</i> |
| 5. Are all IR and MRB dispositioned and concurred by QA? | | X | | | | | 18. Open PFR on this H/W <input type="checkbox"/> Attached <input checked="" type="checkbox"/> None | | Mission Assurance Mgr. <i>J - 120 6/17/05</i> |
| 6. Is complete as-built list information included in the build book? | | X | | | | | 19. Open PFR on similar H/W <input type="checkbox"/> Attached <input checked="" type="checkbox"/> None | | Project Office <i>Margaret 6/17/05</i> |
| 7. Have all required environmental tests & analyses been completed? | | X | | | ETAS attached | | 20. Handling Document → See Item 11 <input checked="" type="checkbox"/> Attached <input type="checkbox"/> None | | PI <i>James J. Bal 6/19/05</i> |
| 8. Is all required assembly and/or subsystem level functional testing complete? | | X | | | Performance Test Data Attached. Also see EIDP in item # 4. | | 21. Shortage List <input type="checkbox"/> Attached <input checked="" type="checkbox"/> None | | |
| 9. Have all piece parts, processes and materials been approved by JPL? | | X | | | | | 22. Requirements Verification Matrix <input checked="" type="checkbox"/> Attached (See #4, #7, #8) <input type="checkbox"/> None | | |
| 10. Does this hardware meet all contamination control requirements? | | X | | | Parts, processes and MIUL met all contamination control and out-gassing requirements. | | 23. Qualification Status <input checked="" type="checkbox"/> Attached <input type="checkbox"/> None | | |
| 11. Are all shipping containers, shipping and special handling procedures ready? | | X | | | See Attached Document D-26790 | | 24. Mate / Demate Record <input checked="" type="checkbox"/> Attached <input type="checkbox"/> None | | |
| 12. Is additional work required to bring this hardware to flight (flight-spare) readiness? | | | X | | | | 25. Operating Log <input checked="" type="checkbox"/> Attached (See Item # 24) <input type="checkbox"/> None | | |
| 13. Is this hardware acceptable for flight? | | X | | | | | 26. MICD <input checked="" type="checkbox"/> Attached <input type="checkbox"/> None | | |



RAL EIDP Table of Contents Versus JPL HRCR Check List Item Numbers

| RAL EIDP Section Number | RAL EIDP Title | JPL HRCR Check List Item Number | Notes |
|-------------------------|------------------------------------------------------------|---------------------------------|-----------------------------------|
| 1 | Shipping Documents | | Shipper and Final IR |
| 2 | Transportation, Packing, Handling & Integration Procedures | 11 | Special Handling Document D-26790 |
| 3 | Certificate of Conformance / Delivery Review Board MOM | | HRCR book is the C of C |
| 4 | As Built Configuration Status List | 1 & 2 | Assembly Drawings |
| 5 | List of Waivers | 4 | RFW (request for waiver) Attached |
| 6 | Copies of Waivers | 4 & 7 | RFW (request for waiver) Attached |
| 7 | List of Non-Conformance Reports | | See RFW in 4 & 7 |
| 8 | Copies of Non-Conformance Reports | | See RFW in 4 & 7 |
| 9 | Cleanliness Statement | | Final IR QA Inspection |
| 10 | Operational Manual | | NA |
| 11 | Top Level Drawings (inc. Family Tree) | 14 | Top Assembly Drawing |
| 12 | Interface Drawings | 26 | MICD Drawing |
| 13 | Functional, Block & Mechanical Drawings | | NA |
| 14 | Electrical Circuit Drawings | | NA |
| 15 | Serialized Components List | | In build books – not shipped |
| 16 | Mass Properties/ Power Budget | HRCR Check List Page 1 | Mass listed in HRCR check list |
| 17 | Qualification Status List / Test Matrix | 23 | Qualification Unit Test Matrix |
| 18 | Test Reports | 4, 7, 8, 23 | |
| 19 | Open Work / Deferred Work / Open Tests | | NA |
| 20 | Calibration Data | | NA |
| 21 | Historical Record | 23 | Qualification Unit Test Matrix |
| 22 | Manufacturing Logbook(s) | | In build books – not shipped |
| 23 | Operating Time / Cycle Record | 25 | |
| 24 | Connector Mating Record | 24 | |
| 25 | Age Sensitive Items Record | | NA |
| 26 | Pressure Vessels – History/Test Record | | NA |
| 27 | Temporary Installation Record | | NA |
| 28 | Reference List of EIDPs (Lower level) | | NA |
| 29 | Other Useful Information | | NA |

JPL Hardware Requirements
Certification Review (HRCR)

Junction Field Effect Transistor (JFET)
Flight Module

10209750-1 S/N 017

SPIRE Element
Herschel Space Observatory Project

June 17, 2005

Configuration of Module, Boards & Membranes

| | | |
|------------------------|---------|---------|
| Module 10209750-1 | S/N 17 | S/N 17 |
| PWB 10209760-1 | S/N 041 | S/N 043 |
| Membrane 10209758-1 | J6.11.3 | J6.16.1 |

Attachment of HRCR Items #1 Drawing Release Status

ALL ASSEMBLY & PARTS DRAWINGS ARE RELEASED IN PDMS

Released Drawings:

- 10209719-1 assembly built per released Rev. A drawing (studlock)**
- 10209722-1 assembly built per released Rev. B drawing (interface drawing)**
- 10209750-1 assembly built per released Rev. B drawing (module assy)**
- 10209751-1 assembly built per released Rev. B drawing (chassis 1)**
- 10209752-1 assembly built per released Rev. A drawing (chassis 2)**
- 10209753-1 assembly built per released Rev. A drawing (chassis 3)**
- 10209754-1 assembly built per released Rev. C drawing (mount)**
- 10209756-1 assembly built per released Rev. B drawing (chassis lid)**
- 10209757-1 assembly built per released Rev. A drawing (membrane)**
- 10209758-1 assembly built per released Rev. A drawing (membrane assy)**
- 10209759-1,-2,-4 redlined Rev. B drawing (gasket)**
- 10209760-1 assembly built per released Rev. C drawing (board assembly)**
- 10209761-1 assembly built per released Rev. C drawing (solder connector)**
- 10209769-1 assembly built per released Rev. A drawing (stiffener)**
- 10209777-1 assembly built per released Rev. B drawing (board)**
- 10209858-2 assembly built per released Rev. A drawing (special fastener)**
- 10217636-1 assembly built per released Rev. A drawing (clip)**

Attachment of HRCR Item #4: EIDP (End Item Data Package)

EIDP Coveragepage For JFET Testing

| Unit Identification | | | | | | |
|---------------------|---|-----------------|--|--|--|--|
| Name | : | JFET PFM Module | | | | |
| Part # | : | 10209750-1 | | | | |
| S/N | : | #017 | | | | |

| Environmental Testing | | | | | | |
|---------------------------|-------------|-------------|---------------------|-------------|-------------------|-------------------|
| | Axes Tested | Temp | Duration/# of Cycle | Requirement | Source | Waiver |
| Random Vibration Test | X, Y, Z | Rm T | 1 min/axis | X, Y, Z | SSSD, JFET-DES-07 | |
| High Level Sine Vibe Test | None | NA | NA | X, Y, Z | SSSD, JFET-DES-07 | HR-SP-JPL-RFW-005 |
| Bakeout | NA | 80 C | 24 hrs | > 24 HRS | | |
| Thermal Cycles | NA | RmT to 80 K | 2 | Minimum 1 | D-20549 | |

| Performance Characteristics | | | | | | |
|-------------------------------------------------|---------------------------------------------|--------------------------------|-------------------------|--------------------------------|-------------------|--|
| | | Specification | | Source | Waiver | |
| Power needed for <11 bad channels (Min Perf.) | 6.59 mW | 11 mW for CQM, 7 mW for PFM/FS | | SSSD, JFET-TEC-05, JFET-PER-02 | HR-SP-JPL-RFW-004 | |
| Power needed for <4 bad channels (Design Value) | 7.07 mW | 11 mW for CQM, 7 mW for PFM/FS | | SSSD, JFET-TEC-05, JFET-PER-02 | | |
| Power needed for 100 % Yield per unit | 7.78 mW | NA | | NA | | |
| Median Noise at < 11 bad chs. | 9.72 nV/rtHz | <15 nV/rtHz Min Performance | <7 nV/rtHz Design Value | SSSD, JFET-PER-01 | | |
| Median Noise at < 4 bad chs. | 8.42 nV/rtHz | | | SSSD, JFET-PER-01 | | |
| Median Noise at 100 % Yield. | 7.55 nV/rtHz | | | SSSD, JFET-PER-01 | | |
| # of Channels over the max. offset voltage | 0 | < 15 mV | | SSSD, BDA-DRCU-27 | | |
| Common Mode Rejection Ratio | < -80 dB by design, as measured in EM4 unit | | | SSSD, BDA-DRCU-11 | | |


| Board Level Details | | | | | | |
|---------------------------------------------|---|------------------------|-------------|--------------------------|-------------|-------------------|
| | | Board SN 041 (JAA-JDD) | | Board SN 043 (JAA'-JDD') | | Source |
| # Channels Tested | : | 24 | | 24 | | |
| Median Noise at 3.5 mW | : | 9.05 nV/rtHz | | 9.09 nV/rtHz | | SSSD, JFET-PER-01 |
| # of good channels at 3.5 mW | : | 21 | 87.5% Yield | 21 | 87.5% Yield | SSSD, JFET-PER-02 |
| Power Needed for 100 % Yield | : | 3.99 mW | | 3.77 mW | | SSSD, JFET-PER-02 |
| Median Noise at High Power (w/ 100 % Yield) | : | 7.47 nV/rtHz | | 7.58 nV/rtHz | | SSSD, JFET-PER-01 |
| Median Gain at High Power | : | 0.98 | | 0.97 | | NA |
| Heater Resistance, 4K Reference value | : | 2.42 kΩ | | 3.25 kΩ | | NA |

| Definitions | | | | | | |
|---------------|---|--------------------------------------------------------|--|--|--|--|
| Good Channels | : | Noise less than a min. performance value of 15 nV/rtHz | | | | |
| Yield | : | # of Good Channels / 24 | | | | |

| Filenames | | | | | | |
|---------------------------|---|---------------------------------------------------------|--|--|--|--|
| Noise Measurements | : | JFET_Mod17_brd41_Noise_perf.pdf | | | | |
| Source Voltages (RmT, 4K) | : | JFET Module 16, 17 voltage data, 40,45,41,43 040105.pdf | | | | |

| Notes | | | | | | |
|-----------------------------------------------------------------------|--|-----------------------|--|-----------------------|--|--|
| 1) The Base temperature for all performance characterization was 4K | | | | | | |
| 2) All Noise Measurements were made with the inputs shorted to ground | | | | | | |
| 3) Type of membranes: | | SN041: 43% Overetched | | SN043: 41% Overetched | | |

Attachment of HRCR Item #7: RFW (Request For Waiver)

| | | |
|-----------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------|
|  | REQUEST FOR WAIVER / DEVIATION (RFW/RFD) | PRODUCT ASSURANCE Space Science and Technology Department |
|-----------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------|

| | |
|------------------------|----------------------------|
| RFW/RFD Number: | HR-SP-JPL-RFW-005v1 |
|------------------------|----------------------------|

| | | | | | |
|------------------------------------|-----------------|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------|
| Spacecraft / Project | Herschel | Originator's Name | Kalyani Sukhatme | | |
| System / Experiment / Model | SPIRE | Signature / Date | | | |
| Sub-System | detectors | Request Type (Highlight applicable request) | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Waiver (RFW)</td> <td style="width: 50%;">Deviation (RFD)</td> </tr> </table> | Waiver (RFW) | Deviation (RFD) |
| Waiver (RFW) | Deviation (RFD) | | | | |
| Assembly | | Organisation | Jet Propulsion Laboratory | | |
| Sub-Assembly | | Ref. Doc. / Drwg No. | SPIRE-JPL-PRJ-000456 | | |
| Item | | References | | | |
| Serial No. | | | | | |

| | |
|----------------------|-----------------------------------------------|
| RFW/RFD Title | BDA and JFET module sine test deletion |
|----------------------|-----------------------------------------------|

| End Items(s) Affected (Hardware, Software) | | |
|------------------------------------------------|-----------|------------------------------|
| Name | CI-Number | Model(s) |
| Bolometric Detector Assemblies JFET Modules | | CQM, PFM, FS CQM, PFM, FS |

| Requirement / Interface Documents Affected | | | | |
|--------------------------------------------|--------|-------|-------------|-------------------------|
| Specification/Drawing Title | Number | Issue | Date | App. Paragraph |
| BDA-SSSD (SPIRE-JPL-PRJ-000456) | | 3.2 | Jan 7, 2003 | BDA-DES-10, JFET-DES-07 |

Description of Deviation / Discrepancy / Non-Conformance

High Level Sine- Vibe Test is not performed on these units


Other Items or Requirements (Potentially) Affected

Need for RFW/RFD and Rationale for Acceptance

The hardware has to be qualified under a cold vibration test and is installed in the cold vibration facility for the purpose of the test. The high level sine vibration test configuration will put the hardware and the personnel at risk since the cold vibration facility is not structurally capable of withstanding the high levels. Obtaining additional resources (cost and schedule) for developing a new set-up is not feasible at this time.

Up issue RFW to 5v1 with this note added

There is no Requirement to do a high level sine test on previously Qualified units, Only Random Acceptance level test are required.

| | Approved | Rejected | Name | Date |
|-------------------------------|-----------------------------------|----------|--------------------------------------------------------------------------------------|-----------------------|
| Engineering: | REF SPIRE – RAL-MOM- 002250 | |  | 20 December 04 |
| Product Assurance: | | | | 20 December 04 |
| CCB-Chairman: | | | | |
| Principle Investigator | | | | |
| Product Assurance: | | | | |
| Co-Investigator | | | | |
| Prime Contractor | | | | |
| ESA Project Office | | | | |

Attachment of HRCR Item #7: ETAS (Environmental Test Summary)

| JPL ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS) | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| AUTHORIZATION SECTION | | | | | |
| PROJECT Herschel | | | LOG NO. HSD40 | | |
| SYSTEM/ASSEMBLY TITLE JFET Modules S/N 16,17 | | | | DATE ISSUED 4/12/05 | |
| REFERENCE DESIGNATION NUMBER | | PART NO. (IF MULTIPLE, ATTACH LIST) 10209750-1 | | REV. SERIAL NO. 016,017 | |
| HARDWARE TYPE <input type="checkbox"/> EM QUAL <input checked="" type="checkbox"/> FLIGHT <input type="checkbox"/> FLIGHT SPARE <input type="checkbox"/> OTHER | | | PRE-ENVIRONMENTAL INSPECTION REPORT NUMBER (ATTACH IR) | | |
| WIRING HARNESS <input type="checkbox"/> EM QUAL <input type="checkbox"/> FLIGHT <input type="checkbox"/> EM <input type="checkbox"/> SE | | | PART NO. | | REV. SERIAL NO. |
| TEST DESCRIPTION (CHECK ALL APPLICABLE) <input type="checkbox"/> SINE VIBRATION <input type="checkbox"/> PYROSHOCK <input type="checkbox"/> ACOUSTIC <input type="checkbox"/> EMC <input type="checkbox"/> OTHER _____ <input checked="" type="checkbox"/> RANDOM VIBRATION <input checked="" type="checkbox"/> THERMAL VAC. <input type="checkbox"/> THERMAL ATMOSPHERE | | | | TYPE OF TEST <input type="checkbox"/> QUALIFICATION <input type="checkbox"/> FLIGHT ACCEPTANCE <input checked="" type="checkbox"/> PROTO FLIGHT <input type="checkbox"/> RETEST | |
| WILL ALL TESTS/LEVELS/DURATIONS REQUIRED BY THE PROJECT DOCUMENTS BE PERFORMED ON THIS UNIT? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (IF NO, ATTACH EXCEPTIONS LIST) ENTER PROJ. DOC. NO. AND REV. _____ | | | | | |
| HAS THE UNIT PASSED ALL PRE-ENVIRONMENTAL FUNCTIONAL TESTS? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION _____ | | | | | |
| HAVE ALL DESIGN ANALYSES BEEN COMPLETED AND REQUIRED CHANGES BEEN IMPLEMENTED? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION _____ | | | | | |
| IS THE TEST ARTICLE IDENTICAL TO OTHER FLIGHT UNITS? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION _____ | | | | | |
| ARE ALL PFRs AGAINST THIS UNIT CLOSED? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION _____ | | | | | |
| HAVE ALL WAIVERS AND ECRs BEEN APPROVED AND ARE THEY INCORPORATED? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION _____ | | | | | |
| TEST AUTHORIZED BY | | | | | |
| COGNIZANT ENGINEER <i>R. H. Hinde</i> | | DATE 4/13/05 | | TECHNICAL MGR./INSTR MRG./PI PREP REP <i>M. Martin</i> | |
| | | | | DATE 4/13/05 | |
| | | | | ENVIRONMENTAL REQUIREMENTS ENG. <i>D. J. Howell</i> | |
| | | | | DATE 4/13/05 | |
| SUMMARY SECTION | | | | | |
| TEST AGENCY (IF MULTIPLE, ATTACH SUMMARY AND TEST DATES) JPL Building 144 | | TEST INITIATION DATE 04/15/05 | | ACCUMULATED OPERATING HOURS PRIOR TO FIRST ENVIRONMENTAL TEST | |
| SERIAL NUMBERS ACTUALLY TESTED 016/017 | | TEST TERMINATION DATE | | OPERATING HOURS DURING ENVIRONMENTAL EXPOSURE | |
| TEST DESCRIPTION | | | | | |
| VIBRATION AXES: X Y Z SINE VIBRATION <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> RANDOM VIBRATION <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> | | ACOUSTIC <input type="checkbox"/> | | PYROSHOCK SHOCK AXES: X Y Z <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> SHOCKS/AXIS: _____ | |
| EMC <input type="checkbox"/> ESD <input type="checkbox"/> COND. SUSC. <input type="checkbox"/> RAD. SUSC. <input type="checkbox"/> COND. EMIS. <input type="checkbox"/> RAD. EMIS. <input type="checkbox"/> ISOLATION <input type="checkbox"/> MAGNETICS | | TEMP. LEVEL (°C) AND ACCUMULATED DURATION (HRS.) HOT: _____°C _____h COLD: _____°C _____h HOT: _____°C _____h COLD: _____°C _____h | | <input checked="" type="checkbox"/> THERMAL VACUUM PRESSURE: <10E-5 <77K NO OF CYCLES: 2<= # <=3 <input type="checkbox"/> TEMPERATURE ATMOSPHERE <input type="checkbox"/> OTHER | |
| WERE THERE ANY PFRs GENERATED DURING ENVIRONMENTAL TESTS? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO (IF NO, ATTACH EXCEPTIONS LIST) | | | LIST PFR NOS. / BRIEF EXPLANATION | | |
| ARE THE POST ENVIRONMENTAL DAMAGE INSPECTIONS COMPLETE? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (IF YES, ATTACH A COPY OF THE INSPECTION REPORTS. IF NO, ATTACH EXPLANATION) | | | LIST PFR NOS. / BRIEF EXPLANATION | | |
| WERE ALL PLANNED TESTS/LEVELS/DURATIONS ACHIEVED? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (IF NO, ATTACH EXCEPTIONS LIST) | | | LIST PFR NOS. / BRIEF EXPLANATION | | |
| <input type="checkbox"/> TESTS HAVE NOT BEEN SUCCESSFULLY COMPLETED. SEE THE ATTACHED SUMMARY FOR ACTIONS THAT NEED TO BE TAKEN. | | | | | |
| COGNIZANT ENGINEER | | DATE | | TECHNICAL MGR./INSTR MRG./PI PREP REP | |
| | | | | DATE | |
| | | | | ENVIRONMENTAL REQUIREMENTS ENG. | |
| | | | | DATE | |
| SOFTWARE HAS SUCCESSFULLY COMPLETED THE ENVIRONMENTAL TESTS LISTED ON THIS FORM OR REMAINING ACTIONS HAVE BEEN TAKEN, INCLUDING RETEST. | | | | | |
| COGNIZANT ENGINEER <i>R. H. Hinde</i> | | DATE 6/14/05 | | TECHNICAL MGR./INSTR MRG./PI PREP REP <i>M. Martin</i> | |
| | | | | DATE 6/14/05 | |
| | | | | ENVIRONMENTAL REQUIREMENTS ENG. <i>D. J. Howell</i> | |
| | | | | DATE 6-14-05 | |

Attachment of HRCR Item #7: ETAS (Environmental Test Summary)



ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS)

OTHER AUTHORIZATION PROVISIONS AND EXPLANATIONS

is a 3-axis warm vibration test (room temp) done on the JFET flight modules SN016 and 017. The test will be done with the JFET unit mounted inside a mock-up JFET rack. The unit will be assessed both before and after the test with visual inspections and electrical checkouts. 3 response accelerometers will be mounted onto the JFET rack in order to give response data.

2 to ~~3~~ vacuum thermal cycles will also be completed.

Attachment of HRCR Item #7: ETAS (Environmental Test Summary)



ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS)
 ENVIRONMENTAL TEST SUMMARY

| HARDWARE | S/N | ETAS | TEST ENVIRONMENT LEVELS & DURATION | DATE TEST PERFORMED | TEST AGENCY | PASS/ FAIL | COMMENTS | | | | | | | | | | | | | | |
|-------------------------|---------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------|------------|----------|-----|------|-----|------|-----|--------|-----|--------|------|---------|--|--|--|--|
| SPIRE JFET (10209750-1) | 016,01 7 | HSO40 | <p>X, Y, and Z 1 minute Random Vibe</p> <table border="1"> <thead> <tr> <th>Frequency [Hz]</th> <th>Spec [g².Hz]</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>0.01</td> </tr> <tr> <td>100</td> <td>0.05</td> </tr> <tr> <td>300</td> <td>0.05</td> </tr> <tr> <td>499</td> <td>0.0214</td> </tr> <tr> <td>500</td> <td>0.0214</td> </tr> <tr> <td>2000</td> <td>0.00214</td> </tr> </tbody> </table> <p>Each axis 1/4 g sine sweep 20-2000 Hz each axis</p> <p>2-3 vacuum thermal cycles. <10E-5 mbar, <70K</p> | Frequency [Hz] | Spec [g ² .Hz] | 20 | 0.01 | 100 | 0.05 | 300 | 0.05 | 499 | 0.0214 | 500 | 0.0214 | 2000 | 0.00214 | | | | |
| Frequency [Hz] | Spec [g ² .Hz] | | | | | | | | | | | | | | | | | | | | |
| 20 | 0.01 | | | | | | | | | | | | | | | | | | | | |
| 100 | 0.05 | | | | | | | | | | | | | | | | | | | | |
| 300 | 0.05 | | | | | | | | | | | | | | | | | | | | |
| 499 | 0.0214 | | | | | | | | | | | | | | | | | | | | |
| 500 | 0.0214 | | | | | | | | | | | | | | | | | | | | |
| 2000 | 0.00214 | | | | | | | | | | | | | | | | | | | | |

Attachment of HRCR Item # 8: Test Data - Source Voltage Data

JFET SOURCE VOLTAGE MEASUREMENT

Post bake, Post-vibe, SN16,17

| | | pwr1 1,2A | | | | pwr2 3,4A | | | | pwr3 1,2 B | | | | pwr4 3,4B | | | |
|-----------|---|--------------|-------|-----------|-------|--------------|-------|-----------|-------|---------------|-------|-----------|-------|--------------|-------|-----------|-------|
| | | 5/24/2005 | | 5/24/2005 | | 5/24/2005 | | 5/24/2005 | | 5/31/2005 | | 5/31/2005 | | 5/31/2005 | | 5/31/2005 | |
| Date | | 4K T | | 4K T | | 4K T | | 4K T | | Rm T | | Rm T | | Rm T | | Rm T | |
| T. plate | | 4K T | | 4K T | | 4K T | | 4K T | | Rm T | | Rm T | | Rm T | | Rm T | |
| Vdd | | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | |
| Vss | | -1.5 | | 1.5 | | -1.5 | | -1.5 | | -1.5 | | -1.5 | | -1.5 | | -1.5 | |
| Vdd' | | 2.748 | | 2.779 | | 2.676 | | 2.762 | | 2.721 | | 2.748 | | 2.651 | | 2.736 | |
| Vss' | | -1.245 | | -1.277 | | -1.174 | | -1.28 | | -1.218 | | -1.246 | | -1.148 | | -1.233 | |
| idd | | 0.9659 | | 0.8455 | | 1.2443 | | 0.9119 | | 1.0543 | | 0.9504 | | 1.322 | | 0.9988 | |
| iss | | 0.9646 | | 0.8443 | | 1.2431 | | 0.9106 | | 1.053 | | .949 | | 1.3207 | | 0.9953 | |
| SN | | 40 | | 45 | | 41 | | 43 | | 40 | | 45 | | 41 | | 43 | |
| Channel # | | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA | DELTA |
| 1 | a | 0.701 | 0.860 | 0.278 | 0.775 | 0.987 | 1.158 | 0.553 | 1.057 | 0.987 | 1.158 | 0.553 | 1.057 | 0.987 | 1.158 | 0.553 | 1.057 |
| | b | 0.703 | 0.859 | 0.273 | 0.780 | 0.990 | 1.158 | 0.553 | 1.062 | 0.990 | 1.158 | 0.553 | 1.062 | 0.990 | 1.158 | 0.553 | 1.062 |
| 2 | a | 0.718 | 0.147 | 0.734 | 0.899 | 1.005 | 0.488 | 0.997 | 0.983 | 1.005 | 0.488 | 0.997 | 0.983 | 1.005 | 0.488 | 0.997 | 0.983 |
| | b | 0.718 | 0.141 | 0.727 | 0.703 | 1.004 | 0.482 | 0.991 | 0.985 | 1.004 | 0.482 | 0.991 | 0.985 | 1.004 | 0.482 | 0.991 | 0.985 |
| 3 | a | 0.874 | 0.139 | 0.897 | 0.814 | 1.155 | 0.481 | 0.961 | 1.098 | 1.155 | 0.481 | 0.961 | 1.098 | 1.155 | 0.481 | 0.961 | 1.098 |
| | b | 0.880 | 0.144 | 0.701 | 0.809 | 1.160 | 0.480 | 0.966 | 1.090 | 1.160 | 0.480 | 0.966 | 1.090 | 1.160 | 0.480 | 0.966 | 1.090 |
| 4 | a | 0.897 | 0.356 | 0.878 | 0.771 | 0.987 | 0.870 | 0.946 | 1.055 | 0.987 | 0.870 | 0.946 | 1.055 | 0.987 | 0.870 | 0.946 | 1.055 |
| | b | 0.899 | 0.354 | 0.878 | 0.772 | 0.988 | 0.866 | 0.944 | 1.057 | 0.988 | 0.866 | 0.944 | 1.057 | 0.988 | 0.866 | 0.944 | 1.057 |
| 5 | a | 0.841 | 0.912 | 0.883 | 0.862 | 1.123 | 1.213 | 0.965 | 0.947 | 1.123 | 1.213 | 0.965 | 0.947 | 1.123 | 1.213 | 0.965 | 0.947 |
| | b | 0.842 | 0.908 | 0.885 | 0.862 | 1.125 | 1.210 | 0.969 | 0.947 | 1.125 | 1.210 | 0.969 | 0.947 | 1.125 | 1.210 | 0.969 | 0.947 |
| 6 | a | 0.789 | 0.584 | 0.729 | 0.738 | 1.070 | 0.889 | 0.993 | 1.024 | 1.070 | 0.889 | 0.993 | 1.024 | 1.070 | 0.889 | 0.993 | 1.024 |
| | b | 0.792 | 0.589 | 0.728 | 0.732 | 1.072 | 0.894 | 0.993 | 1.021 | 1.072 | 0.894 | 0.993 | 1.021 | 1.072 | 0.894 | 0.993 | 1.021 |
| 7 | a | 0.889 | 0.913 | 0.753 | 0.773 | 1.171 | 1.218 | 1.014 | 1.070 | 1.171 | 1.218 | 1.014 | 1.070 | 1.171 | 1.218 | 1.014 | 1.070 |
| | b | 0.880 | 0.917 | 0.756 | 0.771 | 1.162 | 1.219 | 1.016 | 1.070 | 1.162 | 1.219 | 1.016 | 1.070 | 1.162 | 1.219 | 1.016 | 1.070 |
| 8 | a | 0.708 | 0.919 | 0.770 | 0.885 | 0.998 | 1.216 | 1.031 | 0.972 | 0.998 | 1.216 | 1.031 | 0.972 | 0.998 | 1.216 | 1.031 | 0.972 |
| | b | 0.710 | 0.917 | 0.773 | 0.889 | 1.000 | 1.214 | 1.033 | 0.976 | 1.000 | 1.214 | 1.033 | 0.976 | 1.000 | 1.214 | 1.033 | 0.976 |
| 9 | a | 0.751 | 1.074 | 0.761 | 0.840 | 1.039 | 1.370 | 1.029 | 0.934 | 1.039 | 1.370 | 1.029 | 0.934 | 1.039 | 1.370 | 1.029 | 0.934 |
| | b | 0.758 | 1.073 | 0.763 | 0.847 | 1.044 | 1.370 | 1.032 | 0.940 | 1.044 | 1.370 | 1.032 | 0.940 | 1.044 | 1.370 | 1.032 | 0.940 |
| 10 | a | 0.698 | 0.118 | 0.843 | 0.723 | 0.992 | 0.456 | 1.109 | 1.011 | 0.992 | 0.456 | 1.109 | 1.011 | 0.992 | 0.456 | 1.109 | 1.011 |
| | b | 0.700 | 0.116 | 0.845 | 0.723 | 0.993 | 0.453 | 1.110 | 1.011 | 0.993 | 0.453 | 1.110 | 1.011 | 0.993 | 0.453 | 1.110 | 1.011 |
| 11 | a | 0.710 | 0.908 | 0.868 | 0.893 | 1.005 | 1.214 | 0.946 | 0.993 | 1.005 | 1.214 | 0.946 | 0.993 | 1.005 | 1.214 | 0.946 | 0.993 |
| | b | 0.712 | 0.908 | 0.867 | 0.891 | 1.005 | 1.216 | 0.946 | 0.990 | 1.005 | 1.216 | 0.946 | 0.990 | 1.005 | 1.216 | 0.946 | 0.990 |
| 12 | a | 0.704 | 0.910 | 0.739 | 1.182 | 0.998 | 1.224 | 1.010 | 1.441 | 0.998 | 1.224 | 1.010 | 1.441 | 0.998 | 1.224 | 1.010 | 1.441 |
| | b | 0.702 | 0.909 | 0.742 | 1.158 | 0.995 | 1.225 | 1.013 | 1.435 | 0.995 | 1.225 | 1.013 | 1.435 | 0.995 | 1.225 | 1.013 | 1.435 |
| 13 | a | 0.715 | 0.227 | 0.448 | 0.288 | 1.013 | 0.559 | 0.731 | 0.597 | 1.013 | 0.559 | 0.731 | 0.597 | 1.013 | 0.559 | 0.731 | 0.597 |
| | b | 0.716 | 0.235 | 0.461 | 0.278 | 1.015 | 0.565 | 0.745 | 0.586 | 1.015 | 0.565 | 0.745 | 0.586 | 1.015 | 0.565 | 0.745 | 0.586 |
| 14 | a | 0.661 | 1.108 | 0.625 | 0.696 | 0.962 | 1.410 | 0.999 | 1.002 | 0.962 | 1.410 | 0.999 | 1.002 | 0.962 | 1.410 | 0.999 | 1.002 |
| | b | 0.684 | 1.104 | 0.620 | 0.700 | 0.965 | 1.409 | 0.992 | 1.008 | 0.965 | 1.409 | 0.992 | 1.008 | 0.965 | 1.409 | 0.992 | 1.008 |
| 15 | a | 0.681 | 0.362 | 0.687 | 0.722 | 0.975 | 0.883 | 0.982 | 1.011 | 0.975 | 0.883 | 0.982 | 1.011 | 0.975 | 0.883 | 0.982 | 1.011 |
| | b | 0.679 | 0.371 | 0.691 | 0.720 | 0.975 | 0.892 | 0.983 | 1.009 | 0.975 | 0.892 | 0.983 | 1.009 | 0.975 | 0.892 | 0.983 | 1.009 |
| 16 | a | 0.708 | 0.156 | 0.711 | 0.854 | 1.003 | 0.484 | 0.976 | 0.947 | 1.003 | 0.484 | 0.976 | 0.947 | 1.003 | 0.484 | 0.976 | 0.947 |
| | b | 0.705 | 0.161 | 0.709 | 0.851 | 1.001 | 0.480 | 0.976 | 0.945 | 1.001 | 0.480 | 0.976 | 0.945 | 1.001 | 0.480 | 0.976 | 0.945 |
| 17 | a | 0.739 | 0.250 | 0.711 | 0.878 | 1.029 | 0.573 | 0.980 | 0.969 | 1.029 | 0.573 | 0.980 | 0.969 | 1.029 | 0.573 | 0.980 | 0.969 |
| | b | 0.737 | 0.256 | 0.710 | 0.880 | 1.027 | 0.581 | 0.982 | 0.971 | 1.027 | 0.581 | 0.982 | 0.971 | 1.027 | 0.581 | 0.982 | 0.971 |
| 18 | a | 0.889 | 0.527 | 0.729 | 0.801 | 0.989 | 0.839 | 0.997 | 1.086 | 0.989 | 0.839 | 0.997 | 1.086 | 0.989 | 0.839 | 0.997 | 1.086 |
| | b | 0.885 | 0.533 | 0.733 | 0.802 | 0.988 | 0.844 | 1.001 | 1.088 | 0.988 | 0.844 | 1.001 | 1.088 | 0.988 | 0.844 | 1.001 | 1.088 |
| 19 | a | 0.691 | 1.008 | 0.695 | 0.724 | 0.982 | 1.328 | 0.963 | 1.008 | 0.982 | 1.328 | 0.963 | 1.008 | 0.982 | 1.328 | 0.963 | 1.008 |
| | b | 0.691 | 1.009 | 0.692 | 0.729 | 0.981 | 1.326 | 0.961 | 1.013 | 0.981 | 1.326 | 0.961 | 1.013 | 0.981 | 1.326 | 0.961 | 1.013 |
| 20 | a | 0.659 | 0.360 | 0.728 | 0.710 | 0.983 | 0.891 | 0.992 | 1.011 | 0.983 | 0.891 | 0.992 | 1.011 | 0.983 | 0.891 | 0.992 | 1.011 |
| | b | 0.656 | 0.359 | 0.731 | 0.714 | 0.981 | 0.895 | 0.995 | 1.013 | 0.981 | 0.895 | 0.995 | 1.013 | 0.981 | 0.895 | 0.995 | 1.013 |
| 21 | a | 0.699 | 0.344 | 1.005 | 0.699 | 0.991 | 0.690 | 1.258 | 0.988 | 0.991 | 0.690 | 1.258 | 0.988 | 0.991 | 0.690 | 1.258 | 0.988 |
| | b | 0.702 | 0.337 | 1.008 | 0.698 | 0.992 | 0.653 | 1.262 | 0.989 | 0.992 | 0.653 | 1.262 | 0.989 | 0.992 | 0.653 | 1.262 | 0.989 |
| 22 | a | 0.687 | 0.237 | 0.737 | 0.726 | 0.977 | 0.557 | 1.003 | 1.009 | 0.977 | 0.557 | 1.003 | 1.009 | 0.977 | 0.557 | 1.003 | 1.009 |
| | b | 0.688 | 0.248 | 0.738 | 0.729 | 0.977 | 0.567 | 1.003 | 1.011 | 0.977 | 0.567 | 1.003 | 1.011 | 0.977 | 0.567 | 1.003 | 1.011 |
| 23 | a | 0.727 | 0.296 | 0.696 | 0.787 | 1.013 | 0.614 | 0.962 | 1.068 | 1.013 | 0.614 | 0.962 | 1.068 | 1.013 | 0.614 | 0.962 | 1.068 |
| | b | 0.727 | 0.290 | 0.695 | 0.785 | 1.014 | 0.610 | 0.960 | 1.066 | 1.014 | 0.610 | 0.960 | 1.066 | 1.014 | 0.610 | 0.960 | 1.066 |
| 24 | a | 0.676 | 0.436 | 0.785 | 0.674 | 0.968 | 0.750 | 1.044 | 0.956 | 0.968 | 0.750 | 1.044 | 0.956 | 0.968 | 0.750 | 1.044 | 0.956 |
| | b | 0.679 | 0.441 | 0.788 | 0.677 | 0.968 | 0.753 | 1.047 | 0.983 | 0.968 | 0.753 | 1.047 | 0.983 | 0.968 | 0.753 | 1.047 | 0.983 |
| 25 | a | | | | | | | | | | | | | | | | |
| | b | | | | | | | | | | | | | | | | |
| 26 | a | | | | | | | | | | | | | | | | |
| | b | | | | | | | | | | | | | | | | |
| 27 | a | | | | | | | | | | | | | | | | |
| | b | | | | | | | | | | | | | | | | |
| 28 | a | | | | | | | | | | | | | | | | |
| | b | | | | | | | | | | | | | | | | |
| 29 | a | | | | | | | | | | | | | | | | |
| | b | | | | | | | | | | | | | | | | |
| 30 | a | | | | | | | | | | | | | | | | |
| | b | | | | | | | | | | | | | | | | |

Attachment of HRCR Item # 8: Noise Test Data

| | Pwr1 | Pwr2 | Pwr11 | Pwr5 | Pwr4 | Pwr3 | Pwr7 | Pwr9 | Pwr8 | Pwr10 |
|----------|------------|------------|----------|-----------|-----------|----------|-----------|-----------|-----------|-----------|
| Vdd (V) | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 |
| Vss (V) | -1.6 | -1.4 | -1.3 | -1.26 | -1.23 | -1.2 | -1.1 | -1.08 | -1.05 | -1 |
| Vdd' (V) | 2.539 | 2.527 | 2.499 | 2.453 | 2.486 | 2.509 | 2.527 | 2.513 | 2.535 | 2.504 |
| Vss' (V) | -1.26 | -1.09 | -1.005 | -0.971 | -0.946 | -0.921 | -0.836 | -0.819 | -0.793 | -0.754 |
| Idd (mA) | 1.3316 | 1.2143 | 1.155 | 1.1313 | 1.1136 | 1.096 | 1.0358 | 1.0238 | 1.0058 | 0.9757 |
| Iss (mA) | 1.2975 | 1.1806 | 1.1215 | 1.0979 | 1.0802 | 1.0626 | 1.0028 | 0.9908 | 0.9729 | 0.9429 |
| I (mA) | 1.31455 | 1.19745 | 1.13825 | 1.1146 | 1.0969 | 1.0793 | 1.0193 | 1.0073 | 0.98935 | 0.9593 |
| P (mW) | 4.99397545 | 4.33117665 | 3.988428 | 3.8163904 | 3.7645608 | 3.701999 | 3.4279059 | 3.3563236 | 3.2925568 | 3.1253994 |
| | -8 | -8 | -6 | -8 | -8 | -8 | -8 | -8 | -8 | -8 |

| Channel Num | | | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz |
|---------------------|-------|-------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Channel: 1 | 10.77 | 7.89 | 6.84 | 6.04 | 7.18 | 7.02 | 6.61 | 6.63 | 7.82 | 7.10 | |
| Channel: 2 | 6.63 | 6.95 | 5.91 | 5.85 | 5.75 | 6.20 | 9.11 | 10.37 | 9.51 | 12.74 | |
| Channel: 3 | 6.34 | 5.79 | 7.23 | 6.84 | 6.46 | 7.35 | 6.75 | 7.10 | 7.96 | 9.57 | |
| Channel: 4 | 5.71 | 5.88 | 4.46 | 5.73 | 5.97 | 5.74 | 5.69 | 6.87 | 7.77 | 10.32 | |
| Channel: 5 | 7.65 | 6.12 | 7.67 | 5.34 | 6.32 | 8.15 | 8.16 | 9.34 | 12.47 | 16.33 | |
| Channel: 6 | 6.75 | 9.34 | 7.69 | 8.11 | 6.00 | 8.83 | 10.82 | 12.11 | 16.75 | 21.29 | |
| Channel: 7 | 10.05 | 11.14 | 10.27 | 14.33 | 15.91 | 16.97 | 21.74 | 20.87 | 22.51 | 22.82 | |
| Channel: 8 | 7.75 | 8.91 | 9.25 | 12.54 | 13.21 | 13.84 | 20.69 | 22.98 | 23.65 | 21.23 | |
| Channel: 9 | 10.43 | 11.30 | 9.40 | 8.13 | 9.30 | 7.19 | 8.38 | 8.33 | 8.15 | 11.48 | |
| Channel: 10 | 7.85 | 5.67 | 6.33 | 6.52 | 5.84 | 6.16 | 7.65 | 9.17 | 8.64 | 11.31 | |
| Channel: 11 | 6.43 | 6.44 | 7.33 | 7.54 | 6.64 | 6.34 | 10.09 | 11.52 | 14.37 | 23.12 | |
| Channel: 12 | 7.46 | 7.00 | 7.62 | 6.35 | 8.83 | 7.75 | 8.96 | 8.58 | 10.68 | 10.25 | |
| Channel: 13 | 7.15 | 8.02 | 11.25 | 9.75 | 11.69 | 12.26 | 11.76 | 10.00 | 9.48 | 8.94 | |
| Channel: 14 | 8.28 | 6.28 | 6.87 | 8.67 | 8.89 | 7.22 | 9.66 | 12.59 | 14.31 | 18.41 | |
| Channel: 15 | 8.33 | 8.28 | 7.99 | 9.73 | 10.48 | 7.01 | 9.53 | 10.02 | 11.83 | 15.15 | |
| Channel: 16 | 5.75 | 7.38 | 7.03 | 6.29 | 7.44 | 6.62 | 6.14 | 6.66 | 5.61 | 7.90 | |
| Channel: 17 | 11.08 | 11.47 | 11.92 | 10.30 | 12.34 | 10.47 | 11.28 | 10.78 | 8.74 | 10.84 | |
| Channel: 18 | 5.74 | 5.95 | 6.12 | 6.98 | 6.14 | 7.98 | 6.66 | 8.24 | 6.51 | 9.27 | |
| Channel: 19 | 13.32 | 13.38 | 10.74 | 16.17 | 16.10 | 15.55 | 18.74 | 18.74 | 20.73 | 18.62 | |
| Channel: 20 | 7.29 | 8.65 | 6.30 | 8.04 | 7.84 | 7.98 | 11.07 | 11.73 | 14.04 | 21.39 | |
| Channel: 21 | 7.44 | 5.59 | 6.68 | 8.92 | 7.76 | 6.29 | 8.13 | 9.36 | 7.91 | 10.11 | |
| Channel: 22 | 13.74 | 14.82 | 12.43 | 15.13 | 14.86 | 13.88 | 13.84 | 15.11 | 16.03 | 15.44 | |
| Channel: 23 | 6.04 | 5.79 | 5.55 | 8.55 | 4.91 | 6.49 | 7.32 | 7.64 | 9.08 | 9.30 | |
| Channel: 24 | 8.97 | 9.42 | 8.53 | 9.19 | 7.50 | 7.85 | 8.99 | 9.17 | 8.10 | 8.94 | |
| Median | 7.55 | 7.64 | 7.47 | 8.12 | 7.63 | 7.55 | 9.05 | 9.68 | 9.49 | 11.39 | |
| Overall Mean | 8.21 | 8.23 | 7.97 | 8.79 | 8.89 | 8.80 | 10.32 | 11.00 | 11.78 | 13.83 | |
| Good Mean | 8.21 | 8.23 | 7.97 | 8.17 | 8.24 | 8.12 | 8.88 | 9.31 | 9.63 | 9.86 | |

| | | | | | | | | | | |
|------------|------|------|------|------|------|------|------|------|------|------|
| MP Req'd | | | | | 15 | | | | | |
| Yield | 1.00 | 1.00 | 1.00 | 0.92 | 0.92 | 0.92 | 0.88 | 0.83 | 0.79 | 0.58 |
| # Good Ch. | 24 | 24 | 24 | 22 | 22 | 22 | 21 | 20 | 19 | 14 |
| # Bad Ch. | 0 | 0 | 0 | 2 | 2 | 2 | 3 | 4 | 5 | 10 |

JFET_Mod17_brd41_Noise_perf.xls

Attachment of HRCR Item # 8: Test Data - Source Voltage & Noise

| | Pwr12 | Pwr2 | Pwr3 | Pwr4 | Pwr1 | Pwr10 | Pwr5 | Pwr8 | Pwr13 | Pwr11 | Pwr7 | Pwr5b | Pwr9 |
|----------|---------|-----------|------------|------------|-----------|-----------|-----------|-----------|---------|-----------|----------|-----------|------------|
| Vdd (V) | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 |
| Vss (V) | -1.7 | -1.6 | -1.55 | -1.52 | -1.5 | -1.5 | -1.45 | -1.42 | -1.41 | -1.41 | -1.4 | -1.35 | -1.3 |
| Vdd' (V) | 2.532 | 2.543 | 2.548 | 2.541 | 2.554 | 2.553 | 2.558 | 2.562 | 2.563 | 2.563 | 2.564 | 2.569 | 2.574 |
| Vss' (V) | -1.438 | -1.35 | -1.305 | -1.278 | -1.26 | -1.26 | -1.212 | -1.19 | -1.181 | -1.181 | -1.172 | -1.127 | -1.083 |
| Idd (mA) | 1.0289 | 0.986 | 0.964 | 0.951 | 0.9421 | 0.9423 | 0.9207 | 0.9074 | 0.9036 | 0.9032 | 0.8988 | 0.8767 | 0.8548 |
| Iss (mA) | 0.9938 | 0.951 | 0.9291 | 0.9161 | 0.9073 | 0.9075 | 0.886 | 0.8728 | 0.8689 | 0.8686 | 0.8642 | 0.8422 | 0.8205 |
| I (mA) | 1.01135 | 0.9685 | 0.94655 | 0.93355 | 0.9247 | 0.9249 | 0.90335 | 0.8901 | 0.88625 | 0.8859 | 0.8815 | 0.85945 | 0.83765 |
| P (mW) | 4.01506 | 3.7703705 | 3.64705715 | 3.56522745 | 3.5268058 | 3.5266437 | 3.4056295 | 3.3396552 | 3.31812 | 3.3168096 | 3.293284 | 3.1765272 | 3.06328605 |
| | -6 | -6 | -6 | -6 | -14 | -12 | -6 | -8 | -6 | -6 | -6 | -6 | -8 |

| Channel Num | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz | Vn @150 Hz |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Channel: 1 | 7.25 | 6.29 | 6.26 | 5.43 | 6.49 | 5.64 | 6.82 | 6.30 | 6.57 | 7.30 | 7.26 | 5.82 | 6.39 |
| Channel: 2 | 7.05 | 8.01 | 8.80 | 7.89 | 10.55 | 9.06 | 11.49 | 13.56 | 12.99 | 13.56 | 14.33 | 21.04 | 22.13 |
| Channel: 3 | 8.43 | 7.03 | 5.75 | 9.71 | 8.09 | 10.66 | 11.26 | 10.27 | 11.43 | 11.31 | 13.82 | 18.16 | 19.65 |
| Channel: 4 | 7.12 | 6.99 | 6.59 | 7.16 | 7.67 | 9.14 | 13.39 | 11.81 | 12.75 | 12.43 | 12.00 | 19.60 | 25.75 |
| Channel: 5 | 7.20 | 7.41 | 8.13 | 7.57 | 6.25 | 7.18 | 7.19 | 7.22 | 7.34 | 7.71 | 6.94 | 6.20 | 9.26 |
| Channel: 6 | 6.58 | 6.49 | 7.77 | 8.16 | 7.14 | 9.12 | 8.75 | 9.13 | 7.46 | 8.46 | 8.36 | 10.01 | 11.00 |
| Channel: 7 | 8.48 | 8.05 | 7.52 | 7.27 | 7.10 | 7.92 | 8.06 | 7.24 | 7.52 | 8.16 | 8.89 | 7.61 | 10.18 |
| Channel: 8 | 7.20 | 8.31 | 8.56 | 6.94 | 7.18 | 6.97 | 6.42 | 7.09 | 7.49 | 7.26 | 7.28 | 6.84 | 8.07 |
| Channel: 9 | 8.20 | 6.56 | 7.00 | 6.42 | 6.99 | 6.55 | 7.21 | 5.13 | 6.90 | 6.09 | 6.72 | 6.54 | 6.47 |
| Channel: 10 | 6.25 | 6.68 | 8.23 | 8.24 | 8.72 | 9.27 | 11.20 | 11.27 | 11.64 | 12.27 | 12.82 | 14.84 | 18.32 |
| Channel: 11 | 7.42 | 7.03 | 7.21 | 7.86 | 7.71 | 7.66 | 9.41 | 11.38 | 9.89 | 10.06 | 10.28 | 13.56 | 17.38 |
| Channel: 12 | 6.65 | 7.79 | 7.04 | 6.94 | 7.79 | 7.62 | 8.51 | 10.66 | 8.10 | 10.02 | 9.40 | 10.01 | 14.37 |
| Channel: 13 | 8.87 | 7.45 | 8.51 | 7.49 | 7.60 | 8.12 | 8.13 | 9.39 | 7.97 | 9.25 | 7.64 | 9.20 | 13.82 |
| Channel: 14 | 8.23 | 9.28 | 8.21 | 7.02 | 7.30 | 6.48 | 7.33 | 8.19 | 6.55 | 18.74 | 7.91 | 9.07 | 12.23 |
| Channel: 15 | 8.67 | 7.64 | 10.25 | 9.99 | 9.31 | 9.98 | 10.03 | 9.11 | 9.22 | 8.83 | 9.93 | 9.74 | 10.58 |
| Channel: 16 | 7.24 | 7.49 | 7.03 | 5.88 | 6.68 | 7.73 | 6.31 | 7.35 | 7.19 | 10.19 | 8.03 | 8.19 | 11.00 |
| Channel: 17 | 7.96 | 10.37 | 13.01 | 16.15 | 18.58 | 19.31 | 24.10 | 29.70 | 33.71 | 35.15 | 33.03 | 47.31 | 49.04 |
| Channel: 18 | 6.72 | 6.37 | 6.66 | 7.48 | 6.17 | 7.18 | 6.33 | 6.32 | 7.82 | 9.84 | 8.00 | 6.36 | 10.67 |
| Channel: 19 | 12.99 | 11.75 | 7.54 | 10.77 | 8.98 | 10.76 | 12.58 | 14.58 | 16.39 | 18.96 | 15.59 | 21.06 | 28.48 |
| Channel: 20 | 8.83 | 12.14 | 17.00 | 18.36 | 21.20 | 18.27 | 21.51 | 19.01 | 21.52 | 23.13 | 22.00 | 21.05 | 22.50 |
| Channel: 21 | 6.85 | 6.91 | 8.55 | 10.45 | 34.31 | 9.81 | 10.49 | 14.18 | 15.55 | 15.22 | 15.38 | 23.92 | 22.95 |
| Channel: 22 | 11.79 | 14.31 | 13.72 | 15.19 | 13.36 | 15.62 | 15.25 | 17.96 | 17.04 | 16.42 | 18.62 | 20.45 | 25.98 |
| Channel: 23 | 6.98 | 8.61 | 8.46 | 11.91 | 9.57 | 9.52 | 13.52 | 14.00 | 12.97 | 14.73 | 17.50 | 19.25 | 25.89 |
| Channel: 24 | 10.51 | 11.21 | 10.83 | 10.87 | 14.31 | 10.75 | 10.62 | 11.76 | 11.92 | 12.11 | 12.22 | 10.48 | 11.01 |
| Median | 7.34 | 7.56 | 8.17 | 7.87 | 7.75 | 9.09 | 9.72 | 10.47 | 9.56 | 10.75 | 10.10 | 10.25 | 14.09 |
| Overall Mean | 8.06 | 8.34 | 8.69 | 9.21 | 10.38 | 9.60 | 10.66 | 11.36 | 11.58 | 12.80 | 12.25 | 14.43 | 17.21 |
| Good Mean | 8.06 | 8.34 | 8.33 | 8.16 | 8.33 | 8.43 | 9.29 | 9.81 | 9.14 | 9.98 | 9.55 | 8.96 | 10.39 |
| MP Req'd | | | | | | | | 15 | | | | | |
| Yield | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| # Good Ch. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| # Bad Ch. | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |

JFET_Mod17_brd43_Noise_perf.xls

Attachment of HRCR Item # 9: SPIRE MIUL Cover Page

MIUL = Material Identification & Utilization List

Declared Materials List's and Processes List are not included in this HRCR

Materials and Processes List

SPIRE

JPL D-25725

**REV B
1/05/04**

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Reviewed by:


M. Knopp M&P Engineer

Attachment of HRCR Item # 11:

**See End of This HRCR Package for
“JFET Module Handling Document”**

Attachment of HRCR Item # 23: Qualification Compliance Test

Qualification Model JFET Module

EIDP Coverage For JFET Testing

| Unit Identification | | | | | | |
|-------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------|--------------------|---------------------|--------------------------------|--------------------------------|
| Name | : | JFET QM Module | | | | |
| Part # | : | 10209750-1 | | | | |
| S/N | : | #001 | | | | |
| Environmental Testing | | | | | | |
| | | Axes Tested | Temperature | Duration/# of Cycle | Requirement | Source |
| Random Vibration Test: | | X, Y, Z | 100 K | 2 min/axis | X, Y, Z | SSSD, JFET-DES-07 |
| High Level Sine Vibe Test | | None | NA | NA | X, Y, Z | SSSD, JFET-DES-07 |
| Bakeout | | NA | 80 C | 72 Hours | 90C, 72 Hrs | D-20549 |
| Thermal Cycles | | NA | RmT to 90 K | 27 | Minimum 15 | D-20549 |
| Performance Characteristics | | | | | | |
| | | | | | Specification | Source |
| Power needed for <11 bad channels (Min Perf.) | | 9.1 mW | | | 11 mW for CQM, 7 mW for PFM/FS | SSSD, JFET-TEC-05, JFET-PER-02 |
| Power needed for <4 bad channels (Design Value) | | 10.8 mW | | | 11 mW for CQM, 7 mW for PFM/FS | SSSD, JFET-TEC-05, JFET-PER-02 |
| Power needed for 100 % Yield per unit | | 13.6 mW | | | NA | NA |
| Median Noise at < 11 bad chs. | | 7.13 nV/rtHz | <15 nV/rtHz | | | SSSD, JFET-PER-01 |
| Median Noise at < 4 bad chs. | | 6.1 nV/rtHz | Min | <7 nV/rtHz | | SSSD, JFET-PER-01 |
| Median Noise at 100 % Yield. | | 6.97 nV/rtHz | Performance | Design Value | | SSSD, JFET-PER-01 |
| # of Channels over the max. offset voltage | | 0 | < 15 mV for CQM | | | SSSD, BDA-DRC J-27 |
| | | | < 15 mV for PFM/FS | | | SSSD, BDA-DRC J-11 |
| Common Mode Rejection Ratio | | < -60 dB by design, as measured in EM4 unit | | | | |
| Board Level Detail | | | | | | |
| | | Board SN 001 | | | | Source |
| # Channels Tested | : | 24 | | | | |
| Median Noise at 3.5 mW | : | 18 nV/rtHz | | | | SSSD, JFET-PER-01 |
| # of good channels at 3.5 mW | : | 7 | 29% Yield | | | SSSD, JFET-PER-02 |
| Power Needed for 100 % Yield | : | 6.75 mW | | | | SSSD, JFET-PER-02 |
| Median Noise at High Power (w/ 100 % Yield) | : | 6.97 nV/rtHz | | | | SSSD, JFET-PER-01 |
| Median Gain at High Power | : | 0.98 | | | | NA |
| Definitions | | | | | | |
| Good Channels | : | Noise less than a min. performance value of 15 nV/rtHz | | | | |
| Yield | : | # of Good Channels / 24 | | | | |
| Filenames | : | | | | | |
| Noise Measurements | : | QualJFETPostVibeNoise_Summary.pdf | | | | |
| Notes | | | | | | |
| 1) | The Base temperature for a performance characterization was 4K | | | | | |
| 2) | All Noise Measurements were made with the inputs shorted to ground | | | | | |

Attachment of HRCR Item # 24 & #25: Mate/Demate & Operation Logs

| Hardware ID JFET SN 16,17 | | | | | | | |
|---------------------------|----------|--------|-------|------|--------|-----------|-------------------------------------------------|
| Date | Time | AIDS | Power | Mate | Demate | Transport | Notes |
| 1-Apr | 8:00 AM | 245138 | | | | X | 103 -> 183 |
| 1-Apr | 9:00 AM | 245138 | | X | | | Mate All Connectors |
| 1-Apr | 10:00 AM | 245138 | | | | | Measure all resistances |
| 1-Apr | 1:00 PM | 245138 | X | | | | 30 min each board, warm S.V. test (green dewar) |
| 12-Apr | 8:00 AM | 245138 | | | | | Assemble into CSF |
| 13-Apr | 7:30 AM | 245138 | | | X | | Remove all shorting connectors, close out CSF |
| 15-Apr | 8:00 AM | 245138 | | | | X | 183->144 |
| 15-Apr | 9:00 AM | 245138 | | | | | Pump out |
| 15-Apr | 9:30 AM | 245138 | | | | | Run 3-axis warm shake |
| 15-Apr | 2:00 PM | 245138 | | | | X | 144->183 |
| 16-Apr | 8:00 AM | 245138 | | X | | | Install shorting connectors |
| 16-Apr | 9:00 AM | 245138 | | | | X | Remove JFETs from CSF |
| 18-Apr | 9:00 AM | 245138 | | X | | | Install into blue dewar |
| 18-Apr | 10:00 AM | 245138 | X | | | | Take source voltage measurements |
| 18-Apr | 11:00 AM | 245138 | | | X | | Remove from blue dewar, store in flight cabinet |
| 20-May | 8:00 AM | 245398 | | X | | | Install into green dewar |
| 20-May | 9:00 AM | 245398 | | | | | Pump out |
| 20-May | 10:00 AM | 245398 | X | | | | 30 min each board, warm S.V. test (green dewar) |
| 23-May | 1:00 PM | 245398 | | | | | Transfer LN2 |
| 23-May | 8:00 PM | 245398 | | | | | Transfer Helium |
| 24-May | 8:00 AM | 245398 | X | | | | 30 min each board, cold S.V. test (green dewar) |
| 24-May | 10:00 AM | 245398 | X | | | | 8 hours, board 40 noise |
| 24-May | 6:00 PM | 245398 | X | | | | 3 hours, board 45 noise |
| 25-May | 8:00 AM | 245398 | X | | | | 6 hours, board 45 noise |
| 25-May | 2:00 PM | 245398 | X | | | | 6 hours, board 41 noise |
| 26-May | 8:00 AM | 245398 | X | | | | 10 hours, board 43 noise |
| 27-May | 8:00 AM | 245398 | | | | | warm dewar |
| 31-May | 8:00 AM | 245398 | | | | | pump out |
| 31-May | 9:00 AM | 245398 | X | | | | 30 min each board, warm S.V. test (green dewar) |
| 31-May | 1:00 PM | 245398 | | | | | cool dewar |
| 1-Jun | 8:00 AM | 245398 | X | | | | 30 min each board, cold S.V. test (green dewar) |
| 2-Jun | 10:00 AM | 245398 | X | | | | 2 hours, board 40, gain and CMRR |
| 2-Jun | 12:00 PM | 245398 | X | | | | 2 hours, board 45, gain and CMRR |
| 2-Jun | 2:00 PM | 245398 | X | | | | 2 hours, board 41, gain and CMRR |
| 2-Jun | 4:00 PM | 245398 | X | | | | 2 hours, board 43, gain and CMRR |
| 3-Jun | 8:00 AM | 245398 | X | | | | 8 hours, board 43 noise |
| 3-Jun | 6:00 PM | 245398 | | | | | warm dewar |
| 6-Jun | 8:00 AM | 245398 | X | | | | 30 min each board, warm S.V. test (green dewar) |
| 6-Jun | 1:00 PM | 245398 | | | X | X | Demate, Transport 183->103 |

Attachment of HRCR Item # 24 & #25: Mate/Demate & Operation Logs (continued)

OPERATION LOG SHEET -- SPIRE JFET BOARDS MODULE

USE THE "NOTE" COLUMN TO DESCRIBE ACTIONS
 DEVICE (BRD) S/N: 041 (55) PROJECT: SPIRE/JFET BOARD

| DATE | TIME | TECH | PWR ON | PWR OFF | MATE | | | | DEMATE | | | | TRANSFERT | NOTE |
|----------|---------|--------|--------|---------|------|-----|-----|-----|--------|-----|-----|-----|-----------|--------------------------------|
| | | | | | JAA | JBB | JCC | JDD | JAA | JBB | JCC | JDD | | |
| 11-01-04 | 9:30AM | 103199 | | | ✓ | ✓ | ✓ | ✓ | - | - | - | - | | SAVERS INSTALLED |
| 11-18-04 | | 103199 | | | - | - | - | - | - | - | - | - | | GND'S CHASSIS " |
| 12-10-04 | 7:00 PM | 103199 | | | - | - | - | - | - | - | - | - | | GND'S CHASSIS " |
| 12-10-04 | 1:00 PM | 103199 | ✓ | ✓ | - | - | - | - | - | - | - | - | | SOURCE TEST " |
| 2-9-05 | | 103199 | | | - | - | - | - | - | - | - | - | | GND'S CHASSIS " |
| 2-9-05 | | 103199 | ✓ | ✓ | - | - | - | - | - | - | - | - | | SOURCE TEST " |
| 3-21-05 | 11:00 | 103199 | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | GND'S CHASSIS - |
| 3-21-05 | 1:00 | 103199 | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | | | | SOURCE TEST - |
| 3/24-05 | | ST | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | GND'S CHASSIS |
| 3/24-05 | | ST | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | | | | SOURCE TEST |
| 3-28-05 | | ST | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | GND'S CHASSIS |
| 3-28-5 | ✓ | ST | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | | | | SOURCE |
| 6-17-05 | | N/A | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | SHORT PG 5 SAVERS SOURCES, etc |

NOTE: CONNECTORS ARE RE-USE FROM ASBY # 10209761-1 S/N 045, A/Ds # 240895, IR# 923860 w/fn 10-5-04

Attachment of HRCR Items # 24 & # 25: Mate/Demate & Operation Logs

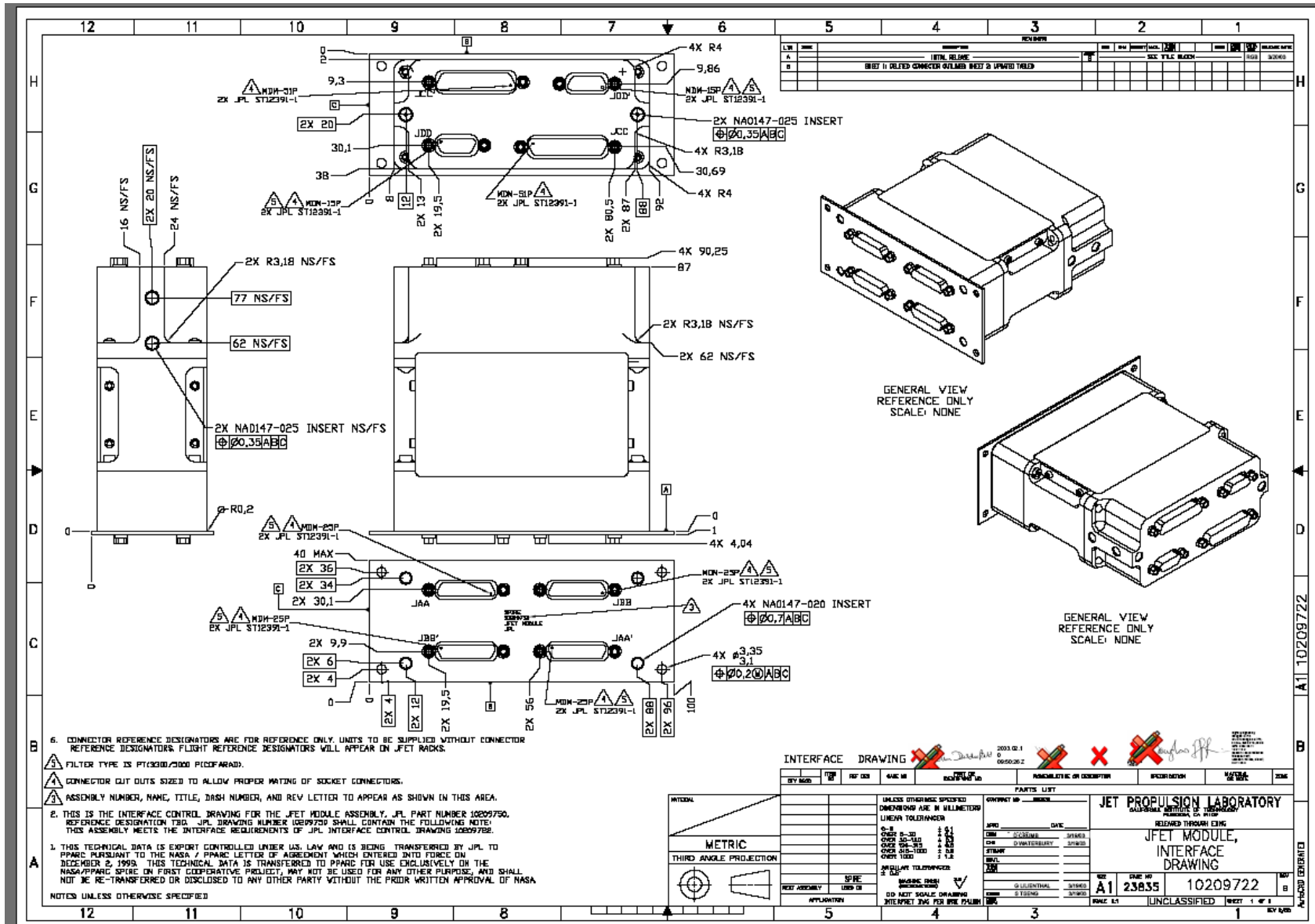
OPERATION LOG SHEET -- SPIRE JFET BOARDS MODULE

USE THE "NOTE" COLUMN TO DESCRIBE ACTIONS
 DEVICE (BRD) S/N: 043 (57) PROJECT: SPIRE/JFET BOARD

| DATE | TIME | TECH | PWR ON | PWR OFF | MATE | | | | DEMATE | | | | TRANSFORT | NOTE |
|-------------------|----------|-------------------|--------|---------|------|-----|-----|-----|--------|-----|-----|-----|-------------|----------------------|
| | | | | | JAA | JBB | JCC | JDD | JAA | JBB | JCC | JDD | | |
| 11-01-04 | 9:30AM | 103199 | | | ✓ | ✓ | ✓ | ✓ | - | - | - | - | | SAVERS INSTALLED ✓ |
| 11-23-04 | 9:25AM | 103199 | | | - | - | - | - | - | - | - | - | | GND & CHASSIS TEST ✓ |
| 12-10-04 | 7:02AM | 103199 | | | - | - | - | - | - | - | - | - | | GND & CHASSIS TEST " |
| 12-10-04 | 10:00 AM | 103199 | ✓ | ✓ | - | - | - | - | - | - | - | - | | SOURCE TEST |
| 2-9-05 | | 103199 | | | - | - | - | - | - | - | - | - | | GND & CHASSIS " |
| 2-9-05 | | 103199 | ✓ | ✓ | - | - | - | - | - | - | - | - | | SOURCE TEST |
| 3/22/05 | | 103199 | | | - | - | - | - | - | - | - | - | | GND & CHASSIS " |
| 3/22/05 | | 103199 | ✓ | ✓ | - | - | - | - | - | - | - | - | | SOURCE TEST " |
| 3/23/05 | | 103199 | | | - | - | - | - | - | - | - | - | | GND & CHASSIS " |
| 3/23/05 | | 103199 | ✓ | ✓ | - | - | - | - | - | - | - | - | | SOURCE " |
| 3-24-05 | | ST | | | | | | | | | | | | GND & CHASSIS |
| 3-24-05 | | ST | ✓ | ✓ | | | | | | | | | | SOURCE TEST |
| 3-28-05 | | ST | | | | | | | | | | | | GND & CHASSIS |
| 3-28-05 | | ST | ✓ | ✓ | | | | | | | | | | SOURCE TEST |
| 6-7-05 | | NAN | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | SHOPPING.PC | SAVER ON SOURCE TEST |

NOTE: CONNECTOR ARE RE USE. FROM ASSY # 10209761-1 S/N: 023, A103 # 240873, IR # 923860 NEW 1/25/05

Attachment of HRCR Item # 26: MICD - JFET Interface Drawing 10209722 (p 1 of 2)



Attachment of HRCR Item # 26: MICD - JFET Interface Drawing 10209722 (p 2 of 2)

| | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | | | | | | |
|----|--------------------|-------------|----|---------------------|-------------|----|------------------|-------------|---|---------------------|--------------|----|-------------------|-------------|-----------|--|--|--|
| H | JAA JFET OUTPUT 1B | | | JAB JFET OUTPUT 2A | | | JCC JFET INPUT 1 | | | JDD JFET SERVICE 1 | | | JCD' JFET INPUT 2 | | | | | |
| | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | | | |
| | 1 | SIGNAL M+ | | 1 | SIGNAL M+ | | 1 | BIAS V+ | | 1 | VSS | | 1 | BIAS V+ | | | | |
| | 2 | SIGNAL N+ | | 2 | SIGNAL N+ | | 2 | BIAS V- | | 2 | V+ | | 2 | BIAS V- | | | | |
| | 3 | SIGNAL P+ | | 3 | SIGNAL P+ | | 3 | SIGNAL Y+ | | 3 | H+ | | 3 | SIGNAL Y+ | | | | |
| | 4 | SIGNAL R+ | | 4 | SIGNAL R+ | | 4 | SIGNAL W- | | 4 | V- | | 4 | SIGNAL W- | | | | |
| | 5 | SIGNAL S+ | | 5 | SIGNAL S+ | | 5 | SIGNAL V+ | | 5 | V- | | 5 | SIGNAL V+ | | | | |
| | 6 | SIGNAL T+ | | 6 | SIGNAL T+ | | 6 | SIGNAL T+ | | 6 | H+ | | 6 | SIGNAL T+ | | | | |
| | 7 | SIGNAL U- | | 7 | SIGNAL U- | | 7 | SIGNAL S- | | 7 | V+ | | 7 | SIGNAL S- | | | | |
| | 8 | SIGNAL V- | | 8 | SIGNAL V- | | 8 | SIGNAL P+ | | 8 | VSS | | 8 | SIGNAL P+ | | | | |
| | 9 | SIGNAL W- | | 9 | SIGNAL W- | | 9 | SIGNAL N- | | 9 | BIAS GND | | 9 | SIGNAL N- | | | | |
| | 10 | SIGNAL X- | | 10 | SIGNAL X- | | 10 | SIGNAL L- | | 10 | Voh | | 10 | SIGNAL L- | | | | |
| | 11 | SIGNAL Y- | | 11 | SIGNAL Y- | | 11 | SIGNAL K+ | | 11 | H- | | 11 | SIGNAL K+ | | | | |
| | 12 | SIGNAL Z- | | 12 | SIGNAL Z- | | 12 | SIGNAL I- | | 12 | CHASSIS GND | | 12 | SIGNAL I- | | | | |
| | 13 | FPU GND | | 13 | FPU GND | | 13 | SIGNAL H+ | | 13 | H- | | 13 | SIGNAL H+ | | | | |
| | 14 | SIGNAL M- | | 14 | SIGNAL M- | | 14 | SIGNAL F+ | | 14 | Voh | | 14 | SIGNAL F+ | | | | |
| | 15 | SIGNAL N- | | 15 | SIGNAL N- | | 15 | SIGNAL E- | | 15 | BIAS GND | | 15 | SIGNAL E- | | | | |
| | 16 | SIGNAL P- | | 16 | SIGNAL P- | | 16 | SIGNAL C+ | | JDD' JFET SERVICE 2 | | | | 16 | SIGNAL C+ | | | |
| | 17 | SIGNAL R- | | 17 | SIGNAL R- | | 17 | SIGNAL B- | | PIN # | PIN PURPOSE | | 17 | SIGNAL B- | | | | |
| | 18 | SIGNAL S- | | 18 | SIGNAL S- | | 18 | SIGNAL A- | | 1 | VSS' | | 18 | SIGNAL A- | | | | |
| | 19 | SIGNAL T- | | 19 | SIGNAL T- | | 19 | BIAS GND | | 2 | V+ | | 19 | BIAS GND' | | | | |
| | 20 | SIGNAL U+ | | 20 | SIGNAL U+ | | 20 | SIGNAL Z+ | | 3 | H+ | | 20 | SIGNAL Z+ | | | | |
| | 21 | SIGNAL V+ | | 21 | SIGNAL V+ | | 21 | SIGNAL X- | | 4 | V- | | 21 | SIGNAL X- | | | | |
| | 22 | SIGNAL W+ | | 22 | SIGNAL W+ | | 22 | SIGNAL W+ | | 5 | V- | | 22 | SIGNAL W+ | | | | |
| | 23 | SIGNAL X+ | | 23 | SIGNAL X+ | | 23 | SIGNAL U- | | 6 | H+ | | 23 | SIGNAL U- | | | | |
| 24 | SIGNAL Y+ | | 24 | SIGNAL Y+ | | 24 | SIGNAL T- | | 7 | V+ | | 24 | SIGNAL T- | | | | | |
| 25 | SIGNAL Z+ | | 25 | SIGNAL Z+ | | 25 | SIGNAL R+ | | 8 | VSS' | | 25 | SIGNAL R+ | | | | | |
| G | JBB JFET OUTPUT 1A | | | JBB' JFET OUTPUT 2B | | | JCC JFET INPUT 1 | | | JDD JFET SERVICE 1 | | | JCD' JFET INPUT 2 | | | | | |
| | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | | | |
| | 1 | SIGNAL A+ | | 1 | SIGNAL A+ | | 26 | SIGNAL P- | | 9 | BIAS GND' | | 26 | SIGNAL P- | | | | |
| | 2 | SIGNAL B+ | | 2 | SIGNAL B+ | | 27 | SIGNAL M+ | | 10 | Voh' | | 27 | SIGNAL M+ | | | | |
| | 3 | SIGNAL C+ | | 3 | SIGNAL C+ | | 28 | SIGNAL L+ | | 11 | H- | | 28 | SIGNAL L+ | | | | |
| | 4 | SIGNAL D+ | | 4 | SIGNAL D+ | | 29 | SIGNAL J- | | 12 | CHASSIS GND' | | 29 | SIGNAL J+ | | | | |
| | 5 | SIGNAL E+ | | 5 | SIGNAL E+ | | 30 | SIGNAL I+ | | 13 | H- | | 30 | SIGNAL I+ | | | | |
| | 6 | SIGNAL F+ | | 6 | SIGNAL F+ | | 31 | SIGNAL G- | | 14 | Voh' | | 31 | SIGNAL G- | | | | |
| | 7 | SIGNAL G- | | 7 | SIGNAL G- | | 32 | SIGNAL F- | | 15 | BIAS GND' | | 32 | SIGNAL F- | | | | |
| | 8 | SIGNAL H- | | 8 | SIGNAL H- | | 33 | SIGNAL D+ | | | | | | 33 | SIGNAL D+ | | | |
| | 9 | SIGNAL I- | | 9 | SIGNAL I- | | 34 | SIGNAL C- | | | | | | 34 | SIGNAL C- | | | |
| | 10 | SIGNAL J- | | 10 | SIGNAL J- | | 35 | SIGNAL A+ | | | | | | 35 | SIGNAL A+ | | | |
| | 11 | SIGNAL K- | | 11 | SIGNAL K- | | 36 | SIGNAL Z- | | | | | | 36 | SIGNAL Z- | | | |
| | 12 | SIGNAL L- | | 12 | SIGNAL L- | | 37 | SIGNAL Y- | | | | | | 37 | SIGNAL Y- | | | |
| | 13 | FPU GND | | 13 | FPU GND | | 38 | SIGNAL X+ | | | | | | 38 | SIGNAL X+ | | | |
| | 14 | SIGNAL A- | | 14 | SIGNAL A- | | 39 | SIGNAL V- | | | | | | 39 | SIGNAL V- | | | |
| | 15 | SIGNAL B- | | 15 | SIGNAL B- | | 40 | SIGNAL U+ | | | | | | 40 | SIGNAL U+ | | | |
| | 16 | SIGNAL C- | | 16 | SIGNAL C- | | 41 | SIGNAL S+ | | | | | | 41 | SIGNAL S+ | | | |
| | 17 | SIGNAL D- | | 17 | SIGNAL D- | | 42 | SIGNAL R- | | | | | | 42 | SIGNAL R- | | | |
| | 18 | SIGNAL E- | | 18 | SIGNAL E- | | 43 | SIGNAL N+ | | | | | | 43 | SIGNAL N+ | | | |
| | 19 | SIGNAL F- | | 19 | SIGNAL F- | | 44 | SIGNAL M- | | | | | | 44 | SIGNAL M- | | | |
| | 20 | SIGNAL G+ | | 20 | SIGNAL G+ | | 45 | SIGNAL K- | | | | | | 45 | SIGNAL K- | | | |
| | 21 | SIGNAL H+ | | 21 | SIGNAL H+ | | 46 | SIGNAL J+ | | | | | | 46 | SIGNAL J+ | | | |
| | 22 | SIGNAL I+ | | 22 | SIGNAL I+ | | 47 | SIGNAL H- | | | | | | 47 | SIGNAL H- | | | |
| | 23 | SIGNAL J+ | | 23 | SIGNAL J+ | | 48 | SIGNAL G+ | | | | | | 48 | SIGNAL G+ | | | |
| 24 | SIGNAL K+ | | 24 | SIGNAL K+ | | 49 | SIGNAL E+ | | | | | | 49 | SIGNAL E+ | | | | |
| 25 | SIGNAL L+ | | 25 | SIGNAL L+ | | 50 | SIGNAL D- | | | | | | 50 | SIGNAL D- | | | | |
| F | JAA JFET OUTPUT 1B | | | JAB JFET OUTPUT 2A | | | JCC JFET INPUT 1 | | | JDD JFET SERVICE 1 | | | JCD' JFET INPUT 2 | | | | | |
| | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | | | |
| | 1 | SIGNAL M+ | | 1 | SIGNAL M+ | | 51 | SIGNAL B+ | | | | | | 51 | SIGNAL B+ | | | |
| | 2 | SIGNAL N+ | | 2 | SIGNAL N+ | | | | | | | | | | | | | |
| | 3 | SIGNAL P+ | | 3 | SIGNAL P+ | | | | | | | | | | | | | |
| | 4 | SIGNAL R+ | | 4 | SIGNAL R+ | | | | | | | | | | | | | |
| | 5 | SIGNAL S+ | | 5 | SIGNAL S+ | | | | | | | | | | | | | |
| | 6 | SIGNAL T+ | | 6 | SIGNAL T+ | | | | | | | | | | | | | |
| | 7 | SIGNAL U- | | 7 | SIGNAL U- | | | | | | | | | | | | | |
| | 8 | SIGNAL V- | | 8 | SIGNAL V- | | | | | | | | | | | | | |
| | 9 | SIGNAL W- | | 9 | SIGNAL W- | | | | | | | | | | | | | |
| | 10 | SIGNAL X- | | 10 | SIGNAL X- | | | | | | | | | | | | | |
| | 11 | SIGNAL Y- | | 11 | SIGNAL Y- | | | | | | | | | | | | | |
| | 12 | SIGNAL Z- | | 12 | SIGNAL Z- | | | | | | | | | | | | | |
| | 13 | FPU GND | | 13 | FPU GND | | | | | | | | | | | | | |
| | 14 | SIGNAL M- | | 14 | SIGNAL M- | | | | | | | | | | | | | |
| | 15 | SIGNAL N- | | 15 | SIGNAL N- | | | | | | | | | | | | | |
| | 16 | SIGNAL P- | | 16 | SIGNAL P- | | | | | | | | | | | | | |
| | 17 | SIGNAL R- | | 17 | SIGNAL R- | | | | | | | | | | | | | |
| | 18 | SIGNAL S- | | 18 | SIGNAL S- | | | | | | | | | | | | | |
| | 19 | SIGNAL T- | | 19 | SIGNAL T- | | | | | | | | | | | | | |
| | 20 | SIGNAL U+ | | 20 | SIGNAL U+ | | | | | | | | | | | | | |
| | 21 | SIGNAL V+ | | 21 | SIGNAL V+ | | | | | | | | | | | | | |
| | 22 | SIGNAL W+ | | 22 | SIGNAL W+ | | | | | | | | | | | | | |
| | 23 | SIGNAL X+ | | 23 | SIGNAL X+ | | | | | | | | | | | | | |
| 24 | SIGNAL Y+ | | 24 | SIGNAL Y+ | | | | | | | | | | | | | | |
| 25 | SIGNAL Z+ | | 25 | SIGNAL Z+ | | | | | | | | | | | | | | |
| E | JAA JFET OUTPUT 1B | | | JAB JFET OUTPUT 2A | | | JCC JFET INPUT 1 | | | JDD JFET SERVICE 1 | | | JCD' JFET INPUT 2 | | | | | |
| | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | | | |
| | 1 | SIGNAL M+ | | 1 | SIGNAL M+ | | | | | | | | | | | | | |
| | 2 | SIGNAL N+ | | 2 | SIGNAL N+ | | | | | | | | | | | | | |
| | 3 | SIGNAL P+ | | 3 | SIGNAL P+ | | | | | | | | | | | | | |
| | 4 | SIGNAL R+ | | 4 | SIGNAL R+ | | | | | | | | | | | | | |
| | 5 | SIGNAL S+ | | 5 | SIGNAL S+ | | | | | | | | | | | | | |
| | 6 | SIGNAL T+ | | 6 | SIGNAL T+ | | | | | | | | | | | | | |
| | 7 | SIGNAL U- | | 7 | SIGNAL U- | | | | | | | | | | | | | |
| | 8 | SIGNAL V- | | 8 | SIGNAL V- | | | | | | | | | | | | | |
| | 9 | SIGNAL W- | | 9 | SIGNAL W- | | | | | | | | | | | | | |
| | 10 | SIGNAL X- | | 10 | SIGNAL X- | | | | | | | | | | | | | |
| | 11 | SIGNAL Y- | | 11 | SIGNAL Y- | | | | | | | | | | | | | |
| | 12 | SIGNAL Z- | | 12 | SIGNAL Z- | | | | | | | | | | | | | |
| | 13 | FPU GND | | 13 | FPU GND | | | | | | | | | | | | | |
| | 14 | SIGNAL M- | | 14 | SIGNAL M- | | | | | | | | | | | | | |
| | 15 | SIGNAL N- | | 15 | SIGNAL N- | | | | | | | | | | | | | |
| | 16 | SIGNAL P- | | 16 | SIGNAL P- | | | | | | | | | | | | | |
| | 17 | SIGNAL R- | | 17 | SIGNAL R- | | | | | | | | | | | | | |
| | 18 | SIGNAL S- | | 18 | SIGNAL S- | | | | | | | | | | | | | |
| | 19 | SIGNAL T- | | 19 | SIGNAL T- | | | | | | | | | | | | | |
| | 20 | SIGNAL U+ | | 20 | SIGNAL U+ | | | | | | | | | | | | | |
| | 21 | SIGNAL V+ | | 21 | SIGNAL V+ | | | | | | | | | | | | | |
| | 22 | SIGNAL W+ | | 22 | SIGNAL W+ | | | | | | | | | | | | | |
| | 23 | SIGNAL X+ | | 23 | SIGNAL X+ | | | | | | | | | | | | | |
| 24 | SIGNAL Y+ | | 24 | SIGNAL Y+ | | | | | | | | | | | | | | |
| 25 | SIGNAL Z+ | | 25 | SIGNAL Z+ | | | | | | | | | | | | | | |
| D | JAA JFET OUTPUT 1B | | | JAB JFET OUTPUT 2A | | | JCC JFET INPUT 1 | | | JDD JFET SERVICE 1 | | | JCD' JFET INPUT 2 | | | | | |
| | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | | | |
| | 1 | SIGNAL M+ | | 1 | SIGNAL M+ | | | | | | | | | | | | | |
| | 2 | SIGNAL N+ | | 2 | SIGNAL N+ | | | | | | | | | | | | | |
| | 3 | SIGNAL P+ | | 3 | SIGNAL P+ | | | | | | | | | | | | | |
| | 4 | SIGNAL R+ | | 4 | SIGNAL R+ | | | | | | | | | | | | | |
| | 5 | SIGNAL S+ | | 5 | SIGNAL S+ | | | | | | | | | | | | | |
| | 6 | SIGNAL T+ | | 6 | SIGNAL T+ | | | | | | | | | | | | | |
| | 7 | SIGNAL U- | | 7 | SIGNAL U- | | | | | | | | | | | | | |
| | 8 | SIGNAL V- | | 8 | SIGNAL V- | | | | | | | | | | | | | |
| | 9 | SIGNAL W- | | 9 | SIGNAL W- | | | | | | | | | | | | | |
| | 10 | SIGNAL X- | | 10 | SIGNAL X- | | | | | | | | | | | | | |
| | 11 | SIGNAL Y- | | 11 | SIGNAL Y- | | | | | | | | | | | | | |
| | 12 | SIGNAL Z- | | 12 | SIGNAL Z- | | | | | | | | | | | | | |
| | 13 | FPU GND | | 13 | FPU GND | | | | | | | | | | | | | |
| | 14 | SIGNAL M- | | 14 | SIGNAL M- | | | | | | | | | | | | | |
| | 15 | SIGNAL N- | | 15 | SIGNAL N- | | | | | | | | | | | | | |
| | 16 | SIGNAL P- | | 16 | SIGNAL P- | | | | | | | | | | | | | |
| | 17 | SIGNAL R- | | 17 | SIGNAL R- | | | | | | | | | | | | | |
| | 18 | SIGNAL S- | | 18 | SIGNAL S- | | | | | | | | | | | | | |
| | 19 | SIGNAL T- | | 19 | SIGNAL T- | | | | | | | | | | | | | |
| | 20 | SIGNAL U+ | | 20 | SIGNAL U+ | | | | | | | | | | | | | |
| | 21 | SIGNAL V+ | | 21 | SIGNAL V+ | | | | | | | | | | | | | |
| | 22 | SIGNAL W+ | | 22 | SIGNAL W+ | | | | | | | | | | | | | |
| | 23 | SIGNAL X+ | | 23 | SIGNAL X+ | | | | | | | | | | | | | |
| 24 | SIGNAL Y+ | | 24 | SIGNAL Y+ | | | | | | | | | | | | | | |
| 25 | SIGNAL Z+ | | 25 | SIGNAL Z+ | | | | | | | | | | | | | | |
| C | JAA JFET OUTPUT 1B | | | JAB JFET OUTPUT 2A | | | JCC JFET INPUT 1 | | | JDD JFET SERVICE 1 | | | JCD' JFET INPUT 2 | | | | | |
| | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | PIN # | PIN PURPOSE | | | | |
| | 1 | SIGNAL M+ | | 1 | SIGNAL M+ | | | | | | | | | | | | | |
| | 2 | SIGNAL N+ | | 2 | SIGNAL N+ | | | | | | | | | | | | | |
| | 3 | SIGNAL P+ | | 3 | SIGNAL P+ | | | | | | | | | | | | | |
| | 4 | SIGNAL R+ | | 4 | SIGNAL R+ | | | | | | | | | | | | | |
| | 5 | SIGNAL S+ | | 5 | SIGNAL S+ | | | | | | | | | | | | | |
| | 6 | SIGNAL T+ | | 6 | SIGNAL T+ | | | | | | | | | | | | | |
| | 7 | SIGNAL U- | | 7 | SIGNAL U- | | | | | | | | | | | | | |
| | 8 | SIGNAL V- | | 8 | SIGNAL V- | | | | | | | | | | | | | |

Attachment of HRCR Item # 11:

JFET Module

Handling Document D-26790

Field Effect Transistor (JFET) Module 10209750-1

Prepared by: Kalyani Sukhatme 10 September, 2003

Revised by: Roger Welker & Steve Tseng 15 June, 2005

1. Introduction

This document provides guidelines for electrical handling for the SPIRE JFET Module.

1.1 Hardware Description

Each JFET module has two sets of 24 JFET channels. The JFET channels are populated on 1.0 micron thick Silicon Nitride membranes which provides thermal isolation. The operating temperature for these JFETs is ~ 120 K. The process of powering up the JFETs dissipates heat into the membrane resulting in a temperature increase with respect to the base temperature (4K to 10 K). Higher the power dissipation, higher is the temperature of the JFETs.

Each JFET channel consists of a matched pair of FETs (Figure 1.1-1) with a requirement for the offset voltage of less than **15 mV** between the matched pair. [The characteristic offset voltage is the difference between the source voltages (V_{sa} and V_{sb} with respect to ground) of the two FETs.]

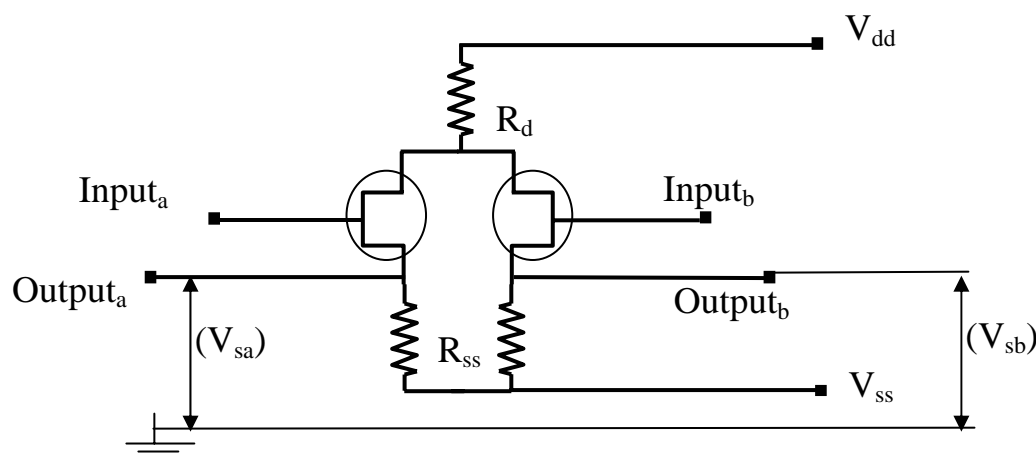


Figure 1.1-1

The Gates of the JFETs are the ‘Inputs’ of the circuit and the Sources (V_{sa} and V_{sb}) of the JFETs are the outputs, as marked in Figure 1.1-1. V_{dd} and V_{ss} are the power lines for the circuit.

2. Handling

1. **The JFET Module is Contamination Sensitive:** Open shipment suitcase in an ISO 14644 Class 7 (FED-STD-209 Class 10,000) or cleaner cleanroom. Handle hardware with approved¹ nitrile or polyurethane ESD safe cleanroom gloves.

¹ JPL approved ESD safe cleanroom gloves are:

Nitrile:

Ansell-Edmont Nitrilite

<http://www.ansellpro.com/ce/products3.asp?pid=87>

Ansell-Edmont Nitrilite Silky

<http://www.ansellpro.com/ce/products3.asp?pid=149>

Ansell-Edmont Silky Ultra-Clean

<http://www.ansellpro.com/ce/products3.asp?pid=150>

Safeskin Critical (white)

http://www.safeskin.com/crit_nt_glv.asp

Polyurethane:

Wilshire Technology DuraCLEAN call in US, 323-259-6469 for ordering information

2. **The JFET Module is ESD Sensitive:**

Please handle with appropriate ESD hardware handling procedures. Handle with grounding straps, ESD-safe gloves, ESD smocks at an ESD-safe workstation.

ESD: Handle with approved² wrist straps, ESD-safe gloves and ESD smocks at an approved ESD protected workstation³. All personnel within 1 meter of unprotected ESD sensitive hardware shall be certified for ESD awareness⁴. Maintain shorting plugs on the unit at all times, except when the unit is installed in the final assembly of the SPIRE instrument. JFET modules are shipped with two shorting plugs for ESD protection. Refer to attached electrical handling document for other important safety precautions. Follow all instructions for the use of wrist straps, ESD smocks, static protected work areas, ionizers, packing/unpacking and cable handling per JPL standard D-1348, rev. F (This document is available through the public domain by the following URL: http://acquisition.jpl.nasa.gov/rfp/miri/dewar/DL-2671-584331/JPL_D-1348.pdf).

ESD - Ionizer: Prior to mate or demate of any connector, turn on an ionizer approved⁵ for ESD sensitive components in clean room environment at least 5 minutes in advance and place/hold both sides of the connections in front of the ionized air stream for a minimum of 10 seconds before mating/demating operation. Position the ionizer near the hardware within the required distance per manufacturer's manual. Different makes and models of ionizers have different positioning requirements. During the mating/demating operations, it is necessary to follow the requirements for handling ESD sensitive hardware.

ESD - Connection to GSE: It is essential to ensure that all signal and bias lines of the GSE are grounded prior to mating the JFET hardware to the GSE. A save-to-mate check must be performed prior to connecting the JFET to the GSE. No excessive voltages and currents on all signal and bias lines shall be observed while the hardware is connected.

QA Oversight: Quality Assurance personnel should witness all handling, electrical testing, operation and integration of JFET flight hardware. At a minimum, a "two person" rule should be invoked at all times, where oversight by an independent party is provided to ensure hardware safety during handling, test and integration operations.

Humidity Sensitive: Place hardware in a humidity controlled ISO 14644 Class 7 (FED-STD 209 Class 10,000) cleanroom. Maintain humidity level at 35%-50% RH typical, for ESD safety.

3. **The JFET Module is Fragile:** Please do not drop or otherwise shock the unit including the shipping suitcase and container. Do not remove the cover of the JFET Module.

² JPL approved wrist straps are:

Speidel Twist-o-Flex™ brand metal expansion bracelet wrist straps
3M model 4600 adjustable molded thermoplastic wrist straps

³ All work areas shall be certified and operated in compliance with the requirements of the following subsections sections of JPL-STD D-1348 rev. F section 2.3: subsections: 6, 8-11, 14-19, 21, 23 – 27, 29 – 36, 38 – 43 and 45.

⁴ All personnel shall be trained and certified to the requirements of section 2.3.3 of JPL STD_D-1348 rev. F.

⁵ The ionizer performance shall be verified to comply with the requirements of JPL-STD-D-1348 rev. F, Table 1 for devices with human body model ESD sensitivity less than 50 volts. The ionizer shall discharge from ± 1000 volts to less than ± 20 volts in less than 20 seconds and have a float potential of less than ± 20 volts.

3. Power ON Procedure

D-26790

1. The JFET Module should be powered on **WITH the shorting plugs** (JPL Supplied Protection connectors) in place and with the **inputs shorted to ground**. Pins #9 and #15 on the 15-pin MDM connectors on the JFET Module are the bias grounds on the module. These pins should also be shorted to the power supply ground. The unit may be powered up without the shorting plug only when the inputs are connected to the detector system.

Under no circumstances the unit should be powered up without the inputs shorted to ground either via the shorting plug (JPL Supplied) or via the detector system.

2. Do not exceed a voltage of +5 V for the Vdd line and -5 V for the Vss line of the JFET Module.
3. When removing the shorting plugs from the unit for installation into the instrument, please use standard ESD precautions including grounding straps, ESD-safe gloves, ESD smocks at an ESD-safe workstation.

4. Electrical Check-out Test: Characteristic Offset Voltage Measurement

- 1) Verify that the gates of the JFET channels (Inputs) are shorted together and grounded.
- 2) Apply the power supply ground to the bias ground pins on the unit (Pins 9 and 15 on the 15-pin MDM connectors)
- 3) Power on the JFET modules with Vdd = +3 V and Vss = -1.5 V
- 4) Verify that the handheld multimeter is in calibration.
- 5) Connect one side of the handheld multimeter to ground (Power supply ground).
- 6) And measure the voltage with respect to ground of each side (V_{sa} and V_{sb}) of each channel.
- 7) Calculate the characteristic offset voltage (V_{offset}) for each channel ($V_{offset} = V_{sa} - V_{sb}$)
- 8) Compare the values for each of the channels with the specific datasheet provided with the unit.
The datasheets accompanying the unit also provides the values for the drain and source currents for a similar test performed at JPL.

REFER TO MEASURED SOURCE VOLTAGE DATA FOR ACTUAL HARDWARE. Here is an example of the source voltage values and the drain and the source currents obtained for such a test at room temperature are given in the Table 4-1

| | | |
|------------------|------------|------------------|
| T, JFET | rm T | |
| Vdd | 3 V | |
| Vss | -1.5 V | |
| Idd | 1.564 mA | |
| Iss | 1.5686 mA | |
| Channel # | (V) | DELTA (V) |
| 1 | 1.130 | 0 |
| | 1.130 | |
| 2 | 1.075 | 0.001 |
| | 1.074 | |
| 3 | 0.781 | 0.001 |
| | 0.780 | |
| 4 | 1.088 | 0.005 |
| | 1.093 | |
| 5 | 0.834 | 0.001 |

| | | |
|----|-------|-------|
| | 0.833 | |
| 6 | 1.012 | 0.003 |
| | 1.015 | |
| 7 | 0.785 | 0.002 |
| | 0.787 | |
| 8 | 1.148 | 0.004 |
| | 1.144 | |
| 9 | 0.753 | 0 |
| | 0.753 | |
| 10 | 0.693 | 0.008 |
| | 0.701 | |
| 11 | 1.110 | 0.004 |
| | 1.114 | |
| 12 | 0.758 | 0.001 |
| | 0.759 | |
| 13 | 0.832 | 0.002 |
| | 0.830 | |
| 14 | 1.264 | 0.001 |
| | 1.265 | |
| 15 | 1.206 | 0 |
| | 1.206 | |
| 16 | 0.818 | 0.001 |
| | 0.819 | |
| 17 | 0.526 | 0.005 |
| | 0.521 | |
| 18 | 1.423 | 0 |
| | 1.423 | |
| 19 | 0.773 | 0.002 |
| | 0.775 | |
| 20 | 0.873 | 0.004 |
| | 0.877 | |
| 21 | 1.387 | 0.006 |
| | 1.393 | |
| 22 | 1.417 | 0.003 |
| | 1.420 | |
| 23 | 0.887 | 0.002 |
| | 0.889 | |
| 24 | 0.888 | 0.003 |
| | 0.891 | |

- END OF -

**Attachment of HRCR Item # 11:
“JFET Module Handling Document D-26790”**

END OF
HRCR PACKAGE