



SUBJECT: SPIRE Data ICD

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Change Record

ISSUE	DATE	
Issue 1.0 Draft 1	15 th January 2002	Original Draft
Issue 1.0 Draft 2	15 th January 2003	<p>Updated Draft for DPU AVM Acceptance Test</p> <p>Section 1.1: Updated Scope description</p> <p>Section 1.3.2: Updated document references and added RD08</p> <p>Section 2.1.3: Added note about TIME contents</p> <p>Section 2.2: Renamed APID5</p> <p>Section 2.3: included details of which parts of the 1553 interface protocol are used</p> <p>Section 3.1: Updated Telecommand service usage</p> <p>Section 3.2.3: Defined both Housekeeping and Diagnostic reports. There are now 4 of each with 2 housekeeping and 1 diagnostic report pre-defined in the OBS</p> <p>Section 3.2.3.1: Updated definition of service (3,1) to send Table_ID as a parameter. This allows different SIDs for the same Table_ID</p> <p>Section 3.2.3.2: Service (3,2) set to Not Used</p> <p>Section 3.2.3.3: Service (3,3) now defined</p> <p>Section 3.2.3.4: Service (3,4) set to Not Used</p> <p>Section 3.2.3.5: Service (3,9) now defined</p> <p>Section 3.2.3.6: Service (3,11) set to Not Used</p> <p>Section 3.2.6.1: Memory addressing changed to use 8 bit Memory ID and 24 bit address</p> <p>Section 3.2.6.2: Memory addressing changed to use 8 bit Memory ID and 24 bit address</p> <p>Section 3.2.6.3: Memory addressing changed to use 8 bit Memory ID and 24 bit address</p> <p>Section 3.2.8.1.2-4: Deleted Cooler, SCAL and 300mk control commands – they are now implemented in software-driven VMs</p> <p>Section 3.2.8.2.2-4: Deleted Cooler, SCAL and 300mk control commands – they are now implemented in software-driven VMs</p> <p>Section 3.2.8.3.1: Changed Load_Table command to Set_Table, with consequent changes to parameters</p> <p>Section 3.2.8.3.2: Changed parameters</p> <p>Section 3.2.8.3.3: Changed parameters</p> <p>Section 3.2.8.3.6: Inserted commands to start and stop software-driven VMs</p> <p>Section 3.2.8.3.20: Deleted data packing command – data frames are packed into science packets until they are full (unless a flush command is received)</p> <p>Section 3.2.9.1: Change to packet definition to all Ack field to be changed</p> <p>Section 3.2.14.1: Service (14,1) now defined</p> <p>Section 3.2.14.2: Service (14,2) now defined</p> <p>Section 3.2.14.3: Service (14,3) now defined</p> <p>Section 3.2.17.1: Updated command description</p> <p>Section 3.2.20.4: This telecommand is no longer used – OTF and TSF provided by ground processing</p> <p>Section 3.2.22: Context Service not used</p> <p>Section 4.1: table updated to reflect changes to services</p> <p>Section 4.2.1.6: Updates Error code table</p> <p>Section 4.2.3.2: Added Critical Housekeeping Report definition</p> <p>Section 4.2.3.3: Updated Nominal Housekeeping Report definition</p> <p>Section 4.2.3.4: Added Detector Housekeeping Report definition</p> <p>Section 4.2.5.1: Removed OTF and TSF reports and added definition of</p>



		<p>report identified so far Section 4.2.5.2: Added definition of reports Section 4.3.5.3: Removed Error/Alarm report definition – they are not used as the ground does not remain in contact with the spacecraft Section 4.2.6: Defined Memory Dump reports Section 4.2.8: defined Function Activity Report Section 4.2.14: Defined Packet Generation Status Report Section 4.2.17: Defined Link connection Report Section 4.2.21: Science Data packet definition updated Section 4.2.22: Context Saving Service not used Section 5.1.1: Updated TC Parameter List Section 5.1.3: Updated TC Parameter Constraints</p> <p>Added commands to select science data Added Appendix D - description of science data processing</p>
<p>Issue 1.1 Draft 1</p>	<p>31st July 2003</p>	<p>Version issued for CQM Testing. This Version corresponds to the version 1.0 of the DRCU ICD. Section 1.3.1: Added IID-Part A to Applicable Documents Section 3.2.8.1: Added Launch Latch function to follow required implementation of arm-fire procedure for critical commands Added Booting Function Section 3.2.8.2: Added Launch Latch function to follow required implementation of arm-fire procedure for critical commands Added Booting Function Section 3.2.8.3: Added commands to engage/release Launch Latch Added Load_TC_and_Boot command Modified Force_Boot command Function and Activity IDs Defined Selection commands Section 3.2.20: Removed use of Information Distribution Service, 20 Section 4.1: Removed Diagnostic Housekeeping packets from table Section 4.2.1.2.1: Updated TM(1,2) error message format to conform to new PS_ICD Section 4.2.1.2.2: Added Packet Content Error code for Illegal Function and Activity IDs Section 4.2.1.6: Removed Illegal Function and Activity ID errors from the TC Failure report – they are now reported as TC Acceptance Failures Section 4.2.3.1: Removed Detector Housekeeping report from table Section 4.2.3.2: Updated Critical Housekeeping Report table to reflect Issue 1.0 of DRCU ICD Section 4.2.3.3: Updated Nominal Housekeeping Report table to reflect Issue 1.0 of the DRCU ICD Section 4.2.3.4: Deleted Detector Housekeeping Report – offsets are no longer able to be read as housekeeping parameters and can be obtained via a science data report Section 4.2.5.1: Updated event report format to conform to AD01 Updated DPU error packets to conform to User Manual description Section 4.2.5.1.2: Updated Peak-up Report format to comply with agreed interface (to be included in IID-A) Section 4.2.5.2: Updated to reflect new format for event packets in AD01 and consolidated TM(5,2) event packets into one format Added Boot ROM Telemetry event packet Section 4.2.5.3: updated to include all BOOT SW generated telemetry packets (ref RD10) Section 4.2.7: Defined Function Activity Reports Section 4.2.14: Modified format to conform to AD01 Section 4.2.16: Added Time to test service TM(17,2) packet Section 4.2.20: Removed use of Information Distribution Service, 20</p>



		<p>Section 4.2.21.1.3: Updated contents of SMEC Block Section 4.2.21.1.4: Updated contents of BSM Block Section 4.2.21.1.5: Defined contents of SCU Block Section 4.2.21.3: Defined New Test Pattern Blocks Defined MCU Engineering Block Appendix D: Replaced with Pixel Maps</p>
Issue 1.1 Draft 2	10 th August 2003	<p>Section 3.1: Removed HK packet definition commands from Table Section 3.2.3: Removed HK packet definition commands from Service 3 (moved to Service 8) Section 3.2.8.1.11: Added HK Function Section 3.2.8.1.11: Added HK Function Section 3.2.8.3: Added HK packet definition commands Section 3.2.8.3.31 & 32: updated Selection commands to use SELECTID Section 4.2.1.6: modified TM(1,8) error codes for housekeeping packet definition commands Section 4.1.5.1.6: Updated Frame ID Error event packet –removed spare parameter Section 4.1.5.1.7: Updated Frame Length Error event packet Section 4.2.5.1.16: Added new event for TC counter error Section 4.2.21.1.3: Modified SMEC Block to contain full frame. This Is doen to be consistant with the use of selected data for SMEC operations Section 4.2.21.1.6: Defined DPU Blocks Section 4.2.21.2.6: Defined Selected Data Block, including adding normal SMEC data block Section 4.2.21.3.11: Added Transparent Data Block definition Section 4.2.21.4: Added Housekeeping Packet Definition Report Section 4.2.21.4.3: Added Housekeeping Packet Definition Report Parameters Section 4.2.21.4.4: Added Table Report Parameters</p>
Issue 1.1 Draft 3	13 th August 2003	<p>Updated TM(8,4) section to conform to AD01 – added SID to commands</p>
Issue 1.1 Draft 4		<p>All TC Sections: Changed commands names to be identical to the short description in the MIB Section 3.1: Removed all service 12 TCs from table – this is handled with TC(8,4) commands Section 3.2.6: Added Boot S/W Memory ID = 4 for dumping and checking memory Section 3.2.6.1: noted maximum rate of sending Memory Load commands Section 3.2.8.3.4: added Garbage Collection command Section 3.2.8.3.7: corrected length field Section 3.2.8.3.9: corrected length field Section 3.2.8.3.11: corrected length field Section 3.2.8.3.13: corrected length field Section 3.2.8.3.14: corrected length field Section 3.2.8.3.15: corrected length field Section 3.2.8.3.16: Added possible Peak-up Mode definition Section 3.2.8.3.17: corrected length field Section 3.2.8.3.18: corrected length field Section 3.2.8.3.19: corrected length field Section 3.2.8.3.20: corrected length field Section 3.2.8.3.21: corrected length field Section 3.2.8.3.22: corrected length field Section 3.2.8.3.23: corrected length field Section 3.2.8.3.24: corrected length field Section 3.2.8.3.25: corrected length field</p>



	<p>Section 3.2.8.3.26: corrected length field Section 3.2.8.3.27: corrected length field Section 3.2.8.3.28: corrected length field Section 3.2.8.3.29: corrected length field Section 3.2.8.3.30: corrected length field Section 3.2.8.3.31: Corrected length field Modified explanatory text, removed SELECTID from input parameters Section 3.2.8.3.32: Corrected length field Replaced SELECTID by FRAMEID in input parameters Section 3.2.8.3.33: corrected length field Section 3.2.8.3.34: corrected length field Section 3.2.8.3.35: corrected length field Section 3.2.8.3.36: corrected length field Section 3.2.12: Defined Service 12 as Not Used Section 3.2.14.1: Defined Packet ID as the parameter to select which packets are to be enabled Section 3.2.14.2: Defined Packet ID as the parameter to select which packets are to be disabled Section 4.1: Updated table to show TM(5,4) is used, TM(12, 9) is not used and TM(22,*) is not used Section 4.2.1.6: Deleted illegal Packet error from table as it referred to Service 20 , which is no longer used Section 4.2.3.1: Updated APID for Critical Housekeeping Packet Section 4.2.3.2: Added DPUSTAT to Critical HK Section 4.2.3.3: Added SCU25V, SCUREF and SCUGND to HK TM packet Increased LSLOAD length to 32 bits – compensated by removing DPU Spare Renumbered table entries Various further name changes Section 4.2.5.1.5: Modified TM packet to include full response from DRCU Section 4.2.5.1.9: Modified TM packet to include full response from DRCU plus the interface status Section 4.2.5.1.10: Modified TM packet to include the interface status Section 4.2.5.1.11: Modified TM packet SID Section 4.2.5.1.19: Added Out of Limits Event Packet Section 4.2.5.3: Updated Boot SW error Packets definitions Section 4.2.8.1: Added SID to TM Packet Section 4.2.8.1: Corrected Parameter Table Section 4.2.21.4: Added DPU Science Data Packet</p>
<p>Issue 1.2j</p>	<p>Section 2.2: Updated APIDs Section 3.2.3: Changed Housekeeping Packet IDs Section 3.2.8.3.32: Changed description of selection command, updated command error list Section 3.2.8.3.34: Added Error codes 0x0817 – 0x0819 Section 3.2.8.3.35: Added Error code 0x0829 Section 3.2.8.3.36: Added Error code 0x0829 Section 4.2.1.2.2: Deleted Failure code 5 (not sent in TM(1,2) but in TM(1,8)) Section 4.2.1.6: Updated Error codes Section 4.2.3.2: Changed OBSVER parameter Section 4.2.3.3: Updated Parameters Section 4.2.5.1: Made SIDs unique Updated parameter names</p>



		<p>Section 4.2.5.2.1: Changed SID from 0x0520 to 0x5200</p> <p>Section 4.2.8.3: Introduced SELSID parameter and indicated that the parameters are repeated for each Frame type</p>
Issue 1.2k		<p>Section 3.2.8.3.37: Added FORCE_WRONG_CRC command</p> <p>Section 4.2.3.3: Added 5 lost TC/TM packets counters to nominal housekeeping packet</p>
Issue 2.0		<p>Section 3.2.6.4: Inserted ABORT_MEMORY_DUMP command</p> <p>Section 3.2.8.2.1.12: Inserted Start Monitoring command</p> <p>Section 3.2.8.2.2.12: Inserted Stop Monitoring command</p> <p>Section 3.2.8.3.4: confirmed COLLECT_GARBAGE command structure</p> <p>Section 3.2.8.3.16: Updated Peak-up Mode command to reflect Issue 1.1 of Peak-Up mode document</p> <p>Section 3.2.8.3.25: Added Override parameter to SEND_DRCU_COMMAND</p> <p>Section 3.2.8.3.26: Added RESETFLAGS parameter to RESET_FIFOS</p> <p>Section 3.2.8.3.29: Inserted FORCE_BOOT command taking PARTITION Parameter</p> <p>Section 3.2.8.3.31: Inserted CALL_BOOT command</p> <p>Section 3.2.8.3.35: Inserted ENABLE_SS_TC command</p> <p>Section 3.2.8.3.36: Inserted DISABLE_SS_TC command</p> <p>Section 3.2.8.3.39: Inserted SUSPEND_MONITORING command</p> <p>Section 3.2.8.3.40: Inserted RESUME_MONITORING command</p> <p>Section 3.2.8.3.34: Removed Monitor Table ID</p> <p>Section 4.2.1.6: Remove table of TM(1,8) failure codes – now in OBS User Manual</p> <p>Section 4.2.3.2: Updated table according to new version of RD07</p> <p>Section 4.2.3.2: Updated table according to new version of RD07</p> <p>Section 4.2.21.1: Removed DPU Science Packet - now defined as a VM science packet (see 4.2.21.4)</p> <p>Section 4.2.21.1: Added Selected Data packets to table and defined them in 4.2.21.1.6-8</p> <p>Section 4.2.21.2: Removed selected data packets (now in section 4.2.21.1)</p> <p>Section 4.2.21.1.3: Updated SMEC Science Packet contents</p> <p>Section 4.2.21.1.4: Updated BSM Science Packet contents</p> <p>Section 4.2.1.6: Remove table of TM(1,8) failure codes – now in OBS User Manual</p> <p>Section 4.2.21.2.6.1: Updated SMEC Selected Science Packet Contents</p> <p>Section 4.2.21.3.8: Updated MCU Engineering TM Packet contents</p> <p>Section 4.2.21.3.9: Updated MCU Test Pattern TM Packet Contents</p> <p>Section 4.2.3.2 and 4.2.3.3: Updated housekeeping table definitions based on contents of HK Reports and latest ICD (DRCU and MCU)</p> <p>Section 4.2.5.1 Updated TM(5,1) event reports according to user manual</p> <p>Section 5.2 Removed</p> <p>Appendix A Updated List of Tables</p> <p>Appendix B & C Removed</p>
Issue 2.2		
Issue 3.0	2 nd August 2010	<p>Major update: For all TCs ACK field bits now set to '1001'b (previously '0001'b) to indicate that the acknowledgement of command completion as well as TC acceptance by the application is required.</p> <p>Section 3.2.6: Corrected Memory IDs table added</p> <p>Sections 3.2.8.1.12 and 3.2.8.2.12: Added TC labels START_MONITORING and STOP_MONITORING. Also added possible errors for START_MONITORING.</p>



		<p>Updated parameters and possible errors for PERFORM_PEAKUP TC. Added new Autonomy Function VM TCs: RUN_VMAFX and HALT_VMAFX.</p> <p>Updated parameters and possible errors for SEND_DRCU_COMMAND TC.</p> <p>Section 3.2.8.3.31: Added new GO_TO_SAFEMODE TC</p> <p>Sections 3.2.8.3.33 and 3.2.8.3.34: Replaced the FORCE_BOOT TC with two TCs, viz. FORCE_BOOT_PRIMARY and FORCE_BOOT_SECONDARY.</p> <p>Removed LOAD_TC_AND_WAIT TC.</p> <p>Sections 3.2.8.3.37 and 3.2.8.3.38: New TCs CLONE_OBS and COMMIT_OBS_AND_REBOOT added.</p> <p>Added Frame IDs table to the ENABLE_SELECTION TC.</p> <p>Section 3.2.8.3.41: Corrected the structure and description of ENABLE_SS_TC and included some example parameter values.</p> <p>Section 3.2.8.3.42: Corrected the structure and description of DISABLE_SS_TC.</p> <p>Sections 3.2.3.43 to 3.2.3.46: Added new TCs CHECK_PM, CHECK_DM, FORCE_WRONG_SS_RESP and FORCE_WRONG_CRC.</p> <p>Sections 3.2.8.3.47 and 3.2.8.3.48: Added parameter descriptions for TCs DEFINE_NEW_HK_REPORT and CLEAR_HK_REPORT.</p> <p>Sections 3.2.8.3.50 and 3.2.8.3.51: Included possible errors in response to execution of SUSPEND_MONITORING and RESUME_MONITORING TC.</p> <p>Section 4.2.3.2: Updated the contents of Critical HK Reports for OBS 4.0.0:</p> <ul style="list-style-type: none">• Replaced EVENTSTAT_C with SCUDCDCSTAT_C• Removed DCUIFSTAT_C – parameter not implemented for DCU• Corrected CMD for LIASTAT_C• Updated OBSVER_C to 4.0.0 <p>Section 4.2.3.3: Updated the contents of Critical HK and Nominal HK Reports for OBS 4.0.0:</p> <ul style="list-style-type: none">• THSK1renamed to THSK• Swapped the locations of TCRECN and TCRECV• Swapped the locations of TCEXEN and TCEXEC• Clarified that the MEMSTAT memory check flags parameter is not implemented in the OBS – set to 0• New parameter AUTO_SEQ_STATUS – includes on-board monitoring status parameter HK_MON_STATUS• New parameters SD_VALUE<n> and SD_ADDRESS<n> <n>= 0-3• New parameters LS_HP_FIFOSTAT and LS_LP_FIFOSTAT• New parameter CHOPJIGG_DCOUPLE• Updated OBSVER to 4.0.0• Spare parameters HK_02 to HK_22• Removed obsolete parameters MCULOADWORD, MCULOADPC, SDEX0, SDEX1, SDEX2 AND SDEX3• Corrected CMD for SMECSELECTTABLE• New VM parameters CREC_STEP, PTC_STAGE, SCAL_STAGE, JIGGLE_STEP, SMECLOSTCOUNT, LIAFAILCOUNT, SCANRES, VM_SMECSIG1OFF and VM_SMECSIG2OFF, PTC_GET_COMMAND and SCAL_GET_COMMAND
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		<ul style="list-style-type: none">• Added new table 7 parameters TABLE7_09_LWORD and TABLE7_12• Added more description for parameters pre-fixed with MCUTM and MCUPCKT• Corrected CMD for LOSTNTBLOCK• Added missing parameter LOSTRPBLOCK <p>Deleted the Unallocated Block Report (obsolete with OBS 4.0.0) Updated contents of Boot ROM Memory Check Report</p> <p>Sections 4.2.21.1.3 and 4.2.21.1.4: Updated the contents of the SMEC science frame Section 4.2.21.1.6: Updated the contents of SMEC Selected Data</p> <p>Sections 4.2.21.3 and 4.2.21.4: Moved the Transparent Data Report from TM(21,3) Diagnostic Science Reports to TM(21,4) Auxiliary Science Data Reports. Corrected the SIDs for DCU, MCU and SCU transparent data.</p> <p>Section 4.2.21.3.8: Updated the contents of MCU Engineering frame</p> <p>Section 4.2.21.3.9: Corrected typo in the MCU Test Pattern frame</p> <p>Sections 4.2.21.4.5.1 and 4.2.21.4.5.2: Added the definitions of PTC and SCAL VM science frames</p> <p>Section 5: Corrected the sections on TC parameters and conversion curves but the information presented in this section is not exhaustive. The complete list is in the SPIRE MIB and parameter tables.</p> <p>Sections 6: Added appendix on OBS tables</p> <p>Section 7: Added appendix on TM data rates</p> <p>Sections 8-13: Added appendices on pixel maps for each bolometer array</p>
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TABLE OF CONTENTS

- 1. INTRODUCTION.....15**
 - 1.1 SCOPE15
 - 1.2 STRUCTURE OF THE DOCUMENT.....15
 - 1.3 DOCUMENTS16
 - 1.3.1 *Applicable Documents*.....16
 - 1.3.2 *Reference Documents*.....16
- 2. THE PACKET INTERFACE.....17**
 - 2.1 PACKET STRUCTURES17
 - 2.1.1 *Fields*.....17
 - 2.1.2 *Telecommand Packets*.....17
 - 2.1.3 *Telemetry Packets*18
 - 2.2 APIDS18
 - 2.3 PACKET TRANSFER PROTOCOL18
- 3. SPIRE TELECOMMAND PACKETS.....20**
 - 3.1 TELECOMMAND PACKET TYPES20
 - 3.2 TELECOMMAND PACKET DEFINITION21
 - 3.2.1 *Telecommand Verification Service*.....21
 - 3.2.2 *Device Command Distribution*.....21
 - 3.2.3 *Housekeeping and Diagnostic Data Reporting*.....21
 - 3.2.3.1 Define New Housekeeping Parameter Report (Service 3,1).....21
 - 3.2.3.2 Define New Diagnostic Parameter Report (Service 3,2)21
 - 3.2.3.3 Clear Housekeeping Parameter Report Definitions (Service 3,3).....21
 - 3.2.3.4 Clear Diagnostic Parameter Report Definitions (Service 3,4)21
 - 3.2.3.5 Report Housekeeping Parameter Report Definitions (Service 3,9)21
 - 3.2.3.6 Report Diagnostic Parameter Report Definitions (Service 3,11)21
 - 3.2.422
 - 3.2.5 *Event Reporting*.....22
 - 3.2.6 *Memory Management*.....23
 - 3.2.6.1 Load Memory Using Absolute Addresses (Service 6,2): LOAD_MEMORY23
 - 3.2.6.2 Dump Memory Using Absolute Addresses (Service 6,5): DUMP_MEMORY24
 - 3.2.6.3 Check Memory Using Absolute Addresses (Service 6,9): CHECK_MEMORY24
 - 3.2.6.4 Abort Memory Dump (Service 6,11): ABORT_MEMORY_DUMP24
 - 3.2.724
 - 3.2.8 *Function Management*25
 - 3.2.8.1 Start Function (Service 8,1)25
 - 3.2.8.2 Stop Function (Service 8,2)26
 - 3.2.8.3 Perform Activity of a Function (Service 8,4).....28
 - portFunction Status (Service 8,5) REPORT_FUNCTION57
 - 3.2.9 *Time Management*.....58
 - 3.2.9.1 Enable Time Verification (Service 9,7) ENABLE_TIME_VERIFICATION58
 - 3.2.10 *Unused Service*.....59
 - 3.2.11 *On-Board Scheduling*.....59
 - 3.2.12 *On-Board Monitoring*59
 - 3.2.13 *Unused Service*.....59
 - 3.2.14 *Packet Transmission Control*.....60
 - 3.2.14.1 Enable Generation of Telemetry Packets (Service 14,1) ENABLE_TM_GENERATION60
 - 3.2.14.2 Disable Generation of Telemetry Packets (Service 14,2) DISABLE_TM_GENERATION ...61
 - 3.2.14.3 Report Enabled Telemetry Packets (Service 14,3) REPORT_ENABLED_TM61
 - 3.2.15 *On-Board Storage and Retrieval*.....62
 - 3.2.16 *On-Board Traffic Management*.....62
 - 3.2.17 *Test Service*63
 - 3.2.17.1 Perform Connection Test (Service 17,1) TEST_CONNECTION63



3.2.18	On-Board Control Procedures.....	63
3.2.19	Action/Event Service	63
3.2.20	Information Distribution Service	64
3.2.21	Science Data.....	64
3.2.22	Context Saving Service.....	64
4.	SPIRE TELEMETRY PACKETS.....	65
4.1	TELEMETRY PACKET TYPES	65
4.2	TELEMETRY PACKET DEFINITIONS	66
4.2.1	TC Verification Service	66
4.2.1.1	Telecommand Acceptance Report - Success (1,1).....	66
4.2.1.2	Telecommand Acceptance Report - Failure (1,2).....	66
4.2.1.3	Telecommand Execution Report - Started (1,3)	68
4.2.1.4	Telecommand Execution Report - Progress (1,5).....	68
4.2.1.5	Telecommand Execution Report - Completion (1,7).....	68
4.2.1.6	Telecommand Execution Report - Failure (1,8)	69
4.2.2	Device Command Distribution.....	69
4.2.3	Housekeeping and Diagnostic Data Reporting.....	70
4.2.3.1	Housekeeping Parameter Report (Service 3,25)	70
4.2.3.2	Critical Housekeeping Report (SID=0x0300).....	71
4.2.3.3	Nominal Housekeeping Report (SID=0x0301).....	73
4.2.4	Unused Service.....	84
4.2.5	Event Reporting.....	84
4.2.5.1	Event Report (5,1).....	84
4.2.5.2	Exception Report (5,2).....	103
4.2.5.3	Error/Alarm Report (5,4)	105
4.2.6	Memory Management.....	109
4.2.6.1	Memory Dump, Absolute Addresses	109
4.2.6.2	Memory Check Report, Absolute Addresses	109
4.2.7	109
4.2.8	Function Management	110
4.2.8.1	Normal Functions Report.....	110
4.2.8.2	VM Functions Report	110
4.2.8.3	DPU Functions Report.....	111
4.2.9	Time Management.....	112
4.2.9.1	Time Verification Report.....	112
4.2.10	112
4.2.11	On Board Scheduling	112
4.2.12	On Board Monitoring.....	112
4.2.13	112
4.2.14	Packet Transmission Control.....	112
4.2.15	On Board Storage and Retrieval.....	113
4.2.16	On Board Traffic Management	113
4.2.17	Test Service	113
4.2.18	On Board Control Procedures	113
4.2.19	Action/Event Service	113
4.2.20	Information Distribution Service	113
4.2.21	Science Data.....	114
4.2.21.1	Nominal Science Data Report (21,1)	114
4.2.21.2	Science Type B Data Report (21,2)	120
4.2.21.3	Diagnostic Science Report (21,3)	123
4.2.21.4	Auxiliary Science Data Report (21,4).....	129
4.2.22	Context Saving Service.....	135
5.	PARAMETERS.....	136
5.1	TC PARAMETERS	136
5.1.1	Parameter Definition	136



5.1.2	Conversion Curves	139
5.1.3	Constraints	139
5.1.4	Conversion Curves	140
6.	APPENDIX A – OBS TABLES.....	143
7.	APPENDIX B – TELEMETRY DATA RATES	145
8.	APPENDIX C – PSW ARRAY	147
9.	APPENDIX D – PMW ARRAY.....	150
10.	APPENDIX E – PLW ARRAY	153
11.	APPENDIX F – PTC CHANNELS (ON PMW ARRAY).....	156
12.	APPENDIX G – SSW ARRAY	158
13.	APPENDIX H – SLW ARRAY.....	162

FIGURES

TABLES



Glossary

APID	Application ID
CDMS	Command and Data Management System
DPU	Digital Processing Unit
OBS	On-Board Software
SID	Structure ID
SPIRE	Spectral and Photometric Imaging REceiver
SVM	Service Module
VM	Virtual Machine



1. INTRODUCTION

Control of the SPIRE instrument is handled by the Digital Processing Unit (DPU) part of the instrument electronics, which contains the On-Board Software (OBS). This unit is mounted on the spacecraft Service Module (SVM) and interfaces directly to the CDMS bus of the Herschel spacecraft for the purpose of transferring commands to, and collection of telemetry data from the instrument.

All data passing between the instrument and the spacecraft is transferred in the form of telemetry and telecommand packets conforming to the ESA packet standards (RD01 and RD02). The ESA Packet Utilisation Standard (RD03) defines the types of service that may be provided by units on board ESA spacecraft, but the set of supported packet types within the Herschel project is restricted. This restricted set is defined in the Herschel Packet Structure ICD (AD01) and is the minimum set necessary to meet the satellite operational requirements given in AD02.

1.1 Scope

This document defines the packet types and their contents that will be accepted and generated by the SPIRE instrument during all operations. These packets conform to the formats given in the Packet Structure ICD (AD01) and the Ground Segment to Instruments ICD (AD03). They also provide for the instrument functionality described in the instrument Operating Modes document (RD04) and elaborated in the instrument operating document (RD04).

The document does not describe the use of the commands (to be given in the OBS User Manual) or the way in which the commands are handled by the OBS (to be found in the OBS Architectural Design document).

1.2 Structure of the Document

Section 2 describes the packet interface between the instrument and the spacecraft. This includes the general format of the packets used by the SPIRE instrument for telecommanding and telemetry (from AD01), the allocation of Application IDs used by the instrument and the functionality of the packet transfer protocol of the instrument/spacecraft interface (from AD01, appendix 9) that is used by the instrument.

Section 3 defines the format and content of each of the telecommand packets accepted by the instrument. Section 4 defines the corresponding information for the telemetry packets generated by the instrument. A description of how these packets are handled by the instrument is given in RD05.

Section 5 defines, in detail, the parameters used in the telecommand and telemetry packets.



1.3 Documents

1.3.1 Applicable Documents

- AD01 Herschel/Planck Packet Structure Interface Control Document. (SCI-PT-ICD-07527) Issue 6.0
- AD02 Herschel/Planck Operations Interface Requirements Document (SCI-PT-RS-07360), Issue 2.2
- AD03 Herschel Science Ground Segment to Instruments Interface Control Document (FIRST-FSC-DOC-0200), Issue 2.3
- AD04 Herschel/Planck Instrument Interface Document Part A (SCI-PT-IIDA-04624), Issue 3.5

1.3.2 Reference Documents

- RD01 Packet Telemetry Standard (ESA PSS-04-106), Issue 1, 1998
- RD02 Packet Telecommand Standard (ESA PSS-04-107), Issue 2, 1992
- RD03 Telemetry and Telecommand Packet Utilisation Standard (ECSS-E-70/41) Draft 04, April 1999
- RD04 Operating Modes of the SPIRE Instrument (SPIRE-RAL-PRJ-000320), Issue 3.0, 4th January 2002
- RD05 Operating the SPIRE Instrument (SPIRE-RAL-DOC-000768), Issue 0.4, 29th January 2002
- RD06 DRCU/DPU Interface Control Document (SAP-SPIRE-CCa-076-02) Issue 1.3, 19th July 2006
- RD07 MCU/DPU Command List Interface Control Document and User Manual (LAM/ELE/SPI/011011), Issue 5.2, 17th March 2009
- RD08 SPIRE On-Board Software User Manual (SPIRE-IFS-PRJ-001391), Issue 4.0, 2nd November 2009 (SPIRE_OBS_User_Manual_v4.0.0.08_RAL)
- RD09 Herschel SPIRE DPU Hardware User Manual (SPIRE-IFS-PRJ-001390), Issue 1, 7th October 2002
- RD10 DPU Switch-On Procedure Telemetry Packets User Manual (HERS-GEN-MA-CGS-001), Issue 2, 10th January 2006
- RD11 SPIRE Failure Detection Isolation and Recovery (SPIRE-RAL-PRJ-001978), Issue 1.1, 6th April 2009
- RD12 SPIRE Pixel Maps (SPIRE-RAL-NOT-001541), Issue 1.21, 14th July 2008



2. THE PACKET INTERFACE

2.1 Packet Structures

The following packet structures are shown as a set of 16 bit words, contained in two consecutive octets in the packet structure (all packets are composed of an even number of octets). The most significant octet of each word comes before the least significant in the packet. The least significant bit of each word is on right of each field:



2.1.1 Fields

Within a field (of any length) the most significant bit is designated bit (0), the least significant bit is bit (length-1).

2.1.2 Telecommand Packets

The following figure gives the general structure of a SPIRE TC Packet (after AD01)

Packet Header	Packet ID	0 0 0 1 1	APID
	Sequence Control	1 1 Src	Count
	Length	Length	
Data Field	Data Field Header	0 0 0 0 Ack 1	Type
		Sub-Type	0 0 0 0 0 0 0 0
	Source Data	D A T A	
	Error Control	Checksum	

Src, Count, Length, TIME and Checksum are defined in AD01

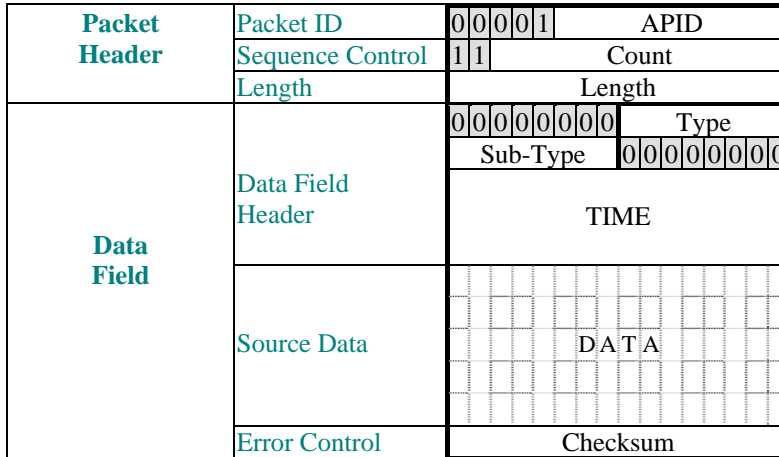
Ack is the most significant 3 bits of Ack as defined in AD01 (set to 0x100)

Type and Sub-Type define the packet type and are also defined in AD01



2.1.3 Telemetry Packets

The following figure gives the general structure of a SPIRE TM Packet (after AD01)



Count, Length, TIME and Checksum are defined in AD01
 Type and Sub-Type define the packet type and are also defined in AD01

Note: the TIME field contains the DPU time of the construction of the packet, not the time of collection of the data.

2.2 APIDs

The Application ID is used to identify the source or destination of a telemetry packet. Herschel uses different APIDs for different types of packet (see AD1) as well as for different instruments. The APIDS to be used by SPIRE are given in the following table:

ID	Telemetry types	APID (hex)
APID1	SPIRE Telecommands, Telecommand Verification and Events	500
APID2	SPIRE Periodic Housekeeping	502
APID3	SPIRE Photometer Science Data	504
APID4	SPIRE Spectrometer Science Data	506
APID5	SPIRE Subsystem Science Data	508

2.3 Packet Transfer Protocol

At the low-level the Packet Transfer Protocol provides a series of sub-address messages to control and transfer data between subsystems. Some of these implement the packet transfer itself, others provide alternative methods of transferring data and controlling the transfer. This section identifies the sub-addresses used/accepted by the SPIRE instrument.

Description	Sub-address(es)	Comments
Mode Command	SA 0R	Used to identify the RT addressed in this subframe. The instrument responds only to its own address. For burst mode this is only set when the instrument has indicated that it has data to transfer
	SA 0T, 31T, 31R	Not Used
Unit Control	SA 1R	Not Used
	SA 1T	Contains Subframe counter and BIT word of 1553 i/f
Data Send	SA 2T, 3T, 4T, 7T, 9T, 29T	Not Used



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078

Issue: Issue 3.0

Date: 2nd August 2010

Page: 19 of 163

Data Receive	SA 2R, 7R, 9R, 15R-26R, 29R	Not Used
Asynchronous Short Commands	SA 3R, 4R	Not used
Event Messages	SA 5R, 5T, 6R, 6T	Not Used
Time Messages	SA 8T	Not used
	SA 8R	Used to transfer spacecraft time from CDMU to instrument (in subframe 33) rather than use packet service (9,5)
Packet Transfer	TM Transfer Request	SA 10T Used by instrument to indicate to CDMU that a TM packet is ready to transfer
	TM Transfer Confirmation	SA 10R Used to implement retry at packet level
	TC Transfer Confirmation	SA 27T Instrument sends a copy of TC Transfer Descriptor to indicate reception of TC
	TC Transfer Descriptor	SA 27R Used by the instrument to prepare for TC transfer
TM Data Send	SA 11T-26T	Used to transfer TM packets from instrument to CDMU
TC Data Receive	SA 11R-14R	Used to transfer TC packets from CDMU to instrument
Low-level Commands	SA 28T, 28R	Not Used
Data Wrap	SA 30T, 30R	Not Used by instrument, but made available for future use



3. SPIRE TELECOMMAND PACKETS

This section defines all the telecommand packets accepted by the SPIRE instrument

3.1 Telecommand Packet Types

The Packet Structure ICD (AD1) defines many types of service that can be provided by an Application. The following table shows the telecommand packet types that will be accepted by the SPIRE instrument.

Description	Service Type	Service Sub-Type	Comments
Telecommand Verification Service	1		N/A
Device Command Distribution	2		Not Used
Housekeeping and Diagnostic Data Reporting	3		Not Used
Event Reporting	5		N/A
Memory Management			
Load Memory Using Absolute Addresses	6	2	
Dump Memory Using Absolute Addresses	6	5	
Check Memory Using Absolute Addresses	6	9	
Function Management			
Start Function	8	1	
Stop Function	8	2	
Perform Activity of Function	8	4	
Report Function Status	8	5	
Time Management			
Synchronise User	9	3	Not Used
Enable Time Synchronisation	9	4	Not Used
Time Code	9	5	Not Used
Verify User Time	9	6	Not Used
Enable Time Verification	9	7	
Synchronise Central Time Reference	9	10	Not Used
On-Board Scheduling	11		Not Used
On-Board Monitoring	12		Not Used
Packet Transmission Control			
Enable Generation of Telemetry Packets	14	1	
Disable Generation of Telemetry Packets	14	2	
Report Enabled Telemetry Packets	14	3	
On-Board Storage and Retrieval	15		Not Used
On-Board Traffic Management	16		Not Used
Test Service			
Perform Connection Test	17	1	
On-Board Control procedures	18		Not Used
Action/Event Service	19		Not Used
Information Distribution Service	20		Not Used
Science Data	21		N/A
Context Saving Service	22		Not Used



3.2 Telecommand Packet Definition

3.2.1 Telecommand Verification Service

Not Applicable

3.2.2 Device Command Distribution

Not Used

3.2.3 Housekeeping and Diagnostic Data Reporting

The periodic Housekeeping and Diagnostic Data is reported, at fixed time intervals, in packets with a fixed format. A maximum of 4 different reports are available for use at the same time, each allocated a different HK_Packet_ID, in the range 0 to 3. Associated with each HK_Packet_ID is a sampling interval and an on-board table, which contains the definition of the contents of the report.

The 4 reports are defined in the following way in the OBS by default:

HK_Packet_ID	Report	Table_ID	Sampling Interval	HKSID
0x300	Critical Housekeeping Report	0	2000m sec	0x0300
0x301	Nominal Housekeeping Report	1	1000 msec	0x0301
0x302	--- Undefined ----	2	---- Not sampled ----	--- Undefined -- --
0x303	--- Undefined ----	3	---- Not sampled ----	--- Undefined---

The contents of each report are described in the Housekeeping Parameter Report (Services 3,25).

Maintenance of the housekeeping report is made using TM(8,4)

3.2.3.1 Define New Housekeeping Parameter Report (Service 3,1)

Not Used

3.2.3.2 Define New Diagnostic Parameter Report (Service 3,2)

Not Used

3.2.3.3 Clear Housekeeping Parameter Report Definitions (Service 3,3)

Not Used

3.2.3.4 Clear Diagnostic Parameter Report Definitions (Service 3,4)

Not Used

3.2.3.5 Report Housekeeping Parameter Report Definitions (Service 3,9)

Not Used

3.2.3.6 Report Diagnostic Parameter Report Definitions (Service 3,11)

Not Used



3.2.4

Not Available

3.2.5 Event Reporting

Not Applicable



3.2.6 Memory Management

These commands allow access to the contents of memory locations. Five areas of memory have been identified, with the following MEMORYID:

Memory ID	Memory Name	SAU size (bits)
0	Program Memory (RAM)	48
1	Data Memory (RAM)	32
2	EEPROM	32
3	1553 I/F DPRAM	16
4	Boot S/W PROM	48

When accessing memory the address is specified in terms of the number of Single Addressable Units (SAUs) from the start of the memory area. The SPIRE SAU is always 16bit words.

Note: This packet format does not strictly follow AD01 – The MEMORYID field is 8bits and the STARTADDR field is 24 bits.

3.2.6.1 Load Memory Using Absolute Addresses (Service 6,2): *LOAD_MEMORY*

This command should be sent at a maximum rate of 2 per second (unless TC verification is disabled).

00011	APID1
11 Src	Count
Length	
0000100100000110	
0000000100000000	
MEMORYID	
STARTADDR	
00000000	NSAU
Data	
CRC	
Checksum	

Parameters

Name	Comments
MEMORYID	Memory Area to be addressed Value = 0 to 3 (cannot be 4)
STARTADDR	Start Address in SAUs
NSAU	Number of SAUs to be loaded
DATA	Data to be loaded
CRC	CRC Checksum of data field

Note: The DATA field will contain the words to be written into DPU memory. 48 or 32bit words will be split into 3 or 2 16bit words and written into the DATA field of the telecommand starting from the MSB.

Note: There are restrictions on which memory areas can be directly loaded. Areas of memory which can be loaded in this way are Program Memory(RAM) and Data Memory (RAM).



3.2.6.2 Dump Memory Using Absolute Addresses (Service 6,5): DUMP_MEMORY

Note: This packet format does not strictly follow AD01 – The MEMORYID field is 8bits and the STARTADDR field is 24 bits.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
MEMORYID						STARTADDR									
NSAU						Checksum									

Parameters

Name	Value and Comments
MEMORYID	Memory Area to be addressed
STARTADDR	Start Address in SAUs
NSAU	Number of SAUs to be dumped

Note: Not all memory areas can be directly dumped (for example the PROM cannot be dumped – only a copy of the PROM held in RAM). Areas of memory which are routinely dumped are Program Memory(RAM), Data Memory (RAM) and EEPROM.

3.2.6.3 Check Memory Using Absolute Addresses (Service 6,9): CHECK_MEMORY

Note: This packet format does not strictly follow AD01 – The MEMORYID field is 8bits and the STARTADDR field is 24 bits.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
MEMORYID						STARTADDR									
NSAU						Checksum									

Parameters

Name	Value and Comments
MEMORYID	Memory Area to be addressed
STARTADDR	Start Address in SAUs
NSAU	Number of SAUs to be checked

3.2.6.4 Abort Memory Dump (Service 6,11): ABORT_MEMORY_DUMP

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Checksum															

Parameters

Name	Value and Comments

3.2.7

Not Available



3.2.8 Function Management

All command packets of this type may give rise to the following Errors:

Error	TM Service	Error Code	Description
Illegal_Function_ID	(1,2)	0x0801	Function_ID not known

3.2.8.1 Start Function (Service 8,1)

These commands allow functions that are not started automatically when the OBS runs to be started.

3.2.8.1.1 Function 0x01: Table Management

Always available - cannot be started

3.2.8.1.2 Function 0x02: Interrupt-driven VM

Always Available - cannot be started

3.2.8.1.3 Function 0x03: Software-driven VM1

Always Available - cannot be started

3.2.8.1.4 Function 0x04: Software-driven VM2

Always Available - cannot be started

3.2.8.1.5 Function 0x05: Software-driven VM3

Always Available - cannot be started

3.2.8.1.6 Function 0x10: ENABLE_SMEC_LATCH

This telecommand enables execution of the SMEC Launch Latch movement commands. If this function is not activated then commands to the SMEC launch latch will be rejected by the OBS.

0	0	0	1	1	APID1											
1	1	Src			Count											
Length =9																
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
FUNCTIONID		0000000000														
SID=0x0000																
Checksum																

Parameters

Name	Value and Comments
FUNCTIONID	0x10



3.2.8.1.7 Function 0x70: Booting

Always Available - cannot be started

3.2.8.1.8 Function 0xC0: Operations

Always Available - cannot be started

3.2.8.1.9 Function 0xC1: Observations

Always Available - cannot be started

3.2.8.1.10 Function 0xCA: DPU

Always Available - cannot be started

3.2.8.1.11 Function 0xCC: HK

Always Available - cannot be started

3.2.8.1.12 Function 0xCD: Monitoring (START_MONITORING)

This telecommand starts the on-board monitoring functions

0	0	0	1	1						APID1					
1	1	Src								Count					
Length =9															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
FUNCTIONID		SPARE													
SID=0x0001															
TABLEID															
Checksum															

Parameters

Name	Value and Comments
FUNCTIONID	0xCD
SPARE	Spare
SID	0x0001
TABEID	ID of monitoring table (Usually 5)

Possible Errors

Error	TM Service	Error Code	Description
Undefined_Monitoring_Table	(1,8)	0x0826	The specified Monitoring Table is not defined
HK_Nominal_not_Running	(1,8)	0x082A	The nominal HK packet collection task is not running; in this condition monitoring cannot start

3.2.8.2 Stop Function (Service 8,2)

These commands allow functions that are not started automatically when the OBS runs to be stopped

3.2.8.2.1 Function 0x01: Table Management

Always available - cannot be stopped

3.2.8.2.2 Function 0x02: Interrupt-driven VM

Always Available - cannot be stopped

3.2.8.2.3 Function 0x03: Software-driven VM1

Always Available - cannot be stopped



3.2.8.2.4 Function 0x04: Software-driven VM2

Always Available - cannot be stopped

3.2.8.2.5 Function 0x05: Software-driven VM3

Always Available - cannot be stopped

3.2.8.2.6 Function 0x10: DISABLE_SMEC_LATCH

This telecommand disables execution of the SMEC Launch Latch movement commands. If this function is not activated then commands to the SMEC launch latch will be rejected by the OBS.

Note: normally this function is stopped automatically by execution of a Launch Latch command

0	0	0	1	1	APID1				
1	1	Src		Count					
Length =7									
0	0	0	0	0	0	0	1	0	
0	0	0	0	0	0	1	0	0	
0	0	0	0	0	1	0	0	0	
0	0	0	0	0	1	0	0	0	
FUNCTIONID		00000000							
Checksum									

Parameters

Name	Value and Comments
FUNCTIONID	0x10

3.2.8.2.7 Function 0x70: Booting

Always Available - cannot be stopped

3.2.8.2.8 Function 0xC0: Operations

Always Available - cannot be stopped

3.2.8.2.9 Function 0xC1: Observations

Always Available - cannot be stopped

3.2.8.2.10 Function 0xCA: DPU

Always Available - cannot be stopped

3.2.8.2.11 Function 0xCC: HK

Always Available - cannot be stopped

3.2.8.2.12 Function 0xCD: Monitoring (STOP_MONITORING)

This telecommand stops the monitoring functions

0	0	0	1	1	APID1				
1	1	Src		Count					
Length =7									
0	0	0	0	1	0	0	1	0	
0	0	0	0	0	1	0	0	0	
0	0	0	0	0	1	0	0	0	
FUNCTIONID		SPARE							
Checksum									

Parameters

Name	Value and Comments
FUNCTIONID	0xCD
SPARE	Spare



3.2.8.3 Perform Activity of a Function (Service 8,4)

All command packets of this type and subtype may give rise to the following Errors:

Error	TM Service	Error Code	Description
Illegal_Function_ID	(1,2)	0x0801	Function_ID not known
Illegal_Activity_ID	(1,2)	0x0802	Activity_ID not known

3.2.8.3.1 Function 0x01 Table Management, Activity 0x01: SET_TABLE

This telecommand allocates space for a table. The previous space allocated to the table is lost.

00011	APID1
11 Src	Count
Length = 11	
000010010000001000	
000001000000000000	
FUNCTIONID	ACTIVITYID
SID=0x0001	
TABLEID	
TABLESIZE	
Checksum	

Parameters

Name	Value and Comments
FUNCTIONID	0x01
ACTIVITYID	0x01
SID	0x0001
TABLEID	
TABLESIZE	Number of 32 bit words allocated to table

This telecommand shall be expected to issue a Telecommand Execution Report - Completed, TM(1,7) on successful completion.



3.2.8.3.2 Function 0x01 Table Management, Activity 0x02: REPORT_TABLE

Requests telemetry packets reporting the contents of a table starting with the word at offset INDEX (32 bit words) from the start of the table and reporting COUNT words. The contents are reported in as many TM(21,4) packets as necessary to complete the request.

0	0	0	1	1	APID1										
1	1	Src			Count										
Length = 13															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID					ACTIVITYID										
SID=0x0002															
TABLEID															
INDEX															
COUNT															
Checksum															

Parameter

Name	Value and Comments
FUNCTIONID	0x01
ACTIVITYID	0x02
SID	0x0002
TABLEID	
INDEX	Starting offset to first word to report
COUNT	Number of (32 bit) words to report



3.2.8.3.3 Function 0x01 Table Management, Activity 0x03: UPDATE_TABLE

This command is used to load data into a table. The table should have had sufficient space allocated previously using the Set_Table command

0	0	0	1	1	APID1										
1	1	Src			Count										
Length															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID					ACTIVITYID										
SID=0x0003															
TABLEID															
INDEX															
N															
Data															
Checksum															

Parameters

Name	Value and Comments
FUNCTIONID	0x01
ACTIVITYID	0x03
SID	0x0003
TABLEID	
INDEX	Start location at which to place Data
N	Number of 32bit words to place in table
Data	N (32 bit) words to be placed in the table

3.2.8.3.4 This telecommand shall be expected to issue a Telecommand Execution Report - Completed, TM(1,7) on successful completion.



Function 0x01 Table Management, Activity 0x04: COLLECT_GARBAGE

This command is used to run the garbage collector.

Note: the garbage collector also runs automatically if there is not enough free contiguous space available for the creation of new table.

0	0	0	1	1	APID1										
1	1	Src		Count											
Length=9															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID					ACTIVITYID										
SID=0x0004															
Checksum															

Parameters

Name	Value and Comments
FUNCTIONID	0x01
ACTIVITYID	0x04
SID	0x0004

This telecommand shall be expected to issue a Telecommand Execution Report - Completed, TM(1,7) on successful completion.



3.2.8.3.5 Function 0x02 Interrupt-driven VM, Activity 0x01: EXECUTE_COMMAND_LIST

Execute the command list held in the telecommand packet. According to RD08, Table ID 253 (0xFD) is used to temporarily store the VM code to be executed by this command.

The Command list being executed is responsible for issuing all the necessary telecommand execution reports

0	0	0	1	1	APID1										
1	1	Src	Count												
Length															
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
SID=0x0004						N									
Data						Checksum									

Parameters

Name	Value and Comments
FUNCTIONID	0x02
ACTIVITYID	0x01
SID	0x0004
N	Number of 32bit words in the command List
Data	N * 32 bit data words containing the command list to execute

3.2.8.3.6 Function 0x02 Interrupt-driven VM, Activity 0x02: RUN_VM

Execute a command list held in a table by the Interrupt-driven VM. If the VM is already active the telecommand is rejected with an error packet (see below).

The Command list being executed is responsible for issuing all the necessary telecommand execution reports

0	0	0	1	1	APID1										
1	1	Src	Count												
Length															
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
SID=0x0005						TABLEID									
INDEX						N									
Data						Checksum									

Parameters

Name	Value and Comments
FUNCTIONID	0x02
ACTIVITYID	0x02
SID	0x0005
TABLEID	Table_ID of list to execute
INDEX	Index within Table at which to start
N	Number of data words
Data	N * 32 bit data words. These are the parameters passed to the VM in registers R(00) to R(N-1)

3.2.8.3.7 Function 0x02 Interrupt-driven VM, Activity 0x03: HALT_VM

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 9															
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
SID=0x0000						Checksum									

Parameters

Name	Value
FUNCTIONID	0x02
ACTIVITYID	0x03
SID	0x0000



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078
Issue: Issue 3.0
Date: 2nd August 2010
Page: 33 of 163



3.2.8.3.8 Function 0x03 Software-driven VM1, Activity 0x02: RUN_VM1

Start execution of a command list held in a table by the software-driven VM1. If the VM is already active the telecommand is rejected with an error packet (see below).

The Command list being executed is responsible for issuing all the necessary telecommand execution reports

0	0	0	1	1	APID1												
1	1	Src	Count														
Length																	
0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
FUNCTIONID				ACTIVITYID													
SID=0x0007																	
TABLEID																	
INDEX																	
N																	
Data																	
Checksum																	

Parameters

Name	Value and Comments
FUNCTIONID	0x03
ACTIVITYID	0x02
SID	0x0007
TABLEID	Table_ID of list to execute
INDEX	Index within Table at which to start
N	Number of data words
Data	N * 32 bit data words. These are the parameters passed to the VM in registers R(00) to R(N-1)

Possible Errors

Error	TM Service	Error Code	Description
Illegal_Table_ID	(1,8)	0x0805	Not a valid table ID
Illegal_Table_Index	(1,8)	0x0806	Index outside valid range
Bad_Data	(1,8)	0x0808	N does not agree with length of data field
VM_Active	(1,8)	0x080b	The VM is already executing a command list
Undefined_Table_Error	(1,8)	0x080d	Table is not defined

3.2.8.3.9 Function 0x03 Software-driven VM1, Activity 0x03: HALT_VM1

0	0	0	1	1	APID1											
1	1	Src	Count													
Length = 7																
0	0	0	0	1	0	0	0	0	1	0	0	0				
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
FUNCTIONID				ACTIVITYID												
SID=0x0000																
Checksum																

Parameters

Name	Value
FUNCTIONID	0x03
ACTIVITYID	0x03
SID	0x0000

Possible Errors

Error	TM Service	Error Code	Description
VM_Inactive	(1,8)	0x080a	VM Not Running



3.2.8.3.10 Function 0x04 Software-driven VM2, Activity 0x02: RUN_VM2

Start execution of a command list held in a table by the software-driven VM2. If the VM is already active the telecommand is rejected with an error packet (see below).

The Command list being executed is responsible for issuing all the necessary telecommand execution reports

0	0	0	1	1	APID1									
1	1	Src	Count											
Length														
0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID								
SID=0x0009						TABLEID								
INDEX						N								
Data						Checksum								

Parameters

Name	Value and Comments
FUNCTIONID	0x04
ACTIVITYID	0x02
SID	0x0009
TABLEID	Table_ID of list to execute
INDEX	Index within Table at which to start
N	Number of data words
Data	N * 32 bit data words. These are the parameters passed to the VM in registers R(00) to R(N-1)

Possible Errors

Error	TM Service	Error Code	Description
Illegal_Table_ID	(1,8)	0x0805	Not a valid table ID
Illegal_Table_Index	(1,8)	0x0806	Index outside valid range
Bad_Data	(1,8)	0x0808	N does not agree with length of data field
VM_Active	(1,8)	0x080b	The VM is already executing a command list
Undefined_Table_Error	(1,8)	0x080d	Table is not defined

3.2.8.3.11 Function 0x04 Software-driven VM2, Activity 0x03: HALT_VM2

0	0	0	1	1	APID1								
1	1	Src	Count										
Length = 9													
0	0	0	0	1	0	0	1	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID							
SID=0x0000						Checksum							

Parameters

Name	Value
FUNCTIONID	0x04
ACTIVITYID	0x03
SID	0x0000

Possible Errors

Error	TM Service	Error Code	Description
VM_Inactive	(1,8)	0x080a	VM Not Running



3.2.8.3.12 Function 0x05 Software-driven VM3, Activity 0x02: RUN_VM3

Start execution of a command list held in a table by the software-driven VM3. If the VM is already active the telecommand is rejected with an error packet (see below).

The Command list being executed is responsible for issuing all the necessary telecommand execution reports

0	0	0	1	1	APID1										
1	1	Src	Count												
Length															
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
SID=0x000B						TABLEID									
INDEX						N									
Data															
Checksum															

Parameters

Name	Value and Comments
FUNCTIONID	0x05
ACTIVITYID	0x02
SID	0x000B
TABLEID	Table_ID of list to execute
INDEX	Index within Table at which to start
N	Number of data words
Data	N * 32 bit data words. These are the parameters passed to the VM in registers R(00) to R(N-1)

Possible Errors

Error	TM Service	Error Code	Description
Illegal_Table_ID	(1,8)	0x0805	Not a valid table ID
Illegal_Table_Index	(1,8)	0x0806	Index outside valid range
Bad_Data	(1,8)	0x0808	N does not agree with length of data field
VM_Active	(1,8)	0x080b	The VM is already executing a command list
Undefined_Table_Error	(1,8)	0x080d	Table is not defined

3.2.8.3.13 Function 0x05 Software-driven VM3, Activity 0x03: HALT_VM3

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 9															
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
SID=0x0000						Checksum									

Parameters

Name	Value
FUNCTIONID	0x05
ACTIVITYID	0x03
SID	0x0000

Possible Errors

Error	TM Service	Error Code	Description
VM_Inactive	(1,8)	0x080a	VM Not Running

3.2.8.3.14 Function 0x6 Software-driven VMAFX, Activity 0x02: RUN_VMAFX

Start execution of a command list held in a table by the software-driven Autonomy Function VM. If the VM is already active the telecommand is rejected with an error packet (see below).

The Command list being executed is responsible for issuing all the necessary telecommand execution reports



0	0	0	1	1	APID1										
1	1	Src	Count												
Length															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
SID=0x000D															
TABLEID															
INDEX															
N															
Data															
Checksum															

Parameters

Name	Value and Comments
FUNCTIONID	0x06
ACTIVITYID	0x02
SID	0x000D
TABLEID	Table_ID of list to execute
INDEX	Index within Table at which to start
N	Number of data words
Data	N * 32 bit data words. These are the parameters passed to the VM in registers R(00) to R(N-1)

Possible Errors

Error	TM Service	Error Code	Description
Illegal_Table_ID	(1,8)	0x0805	Not a valid table ID
Illegal_Table_Index	(1,8)	0x0806	Index outside valid range
Bad_Data	(1,8)	0x0808	N does not agree with length of data field
VM_Active	(1,8)	0x080b	The VM is already executing a command list
Undefined_Table_Error	(1,8)	0x080d	Table is not defined

3.2.8.3.15 Function 0x06 Software-driven VM3, Activity 0x03: HALT_VMAFX

0	0	0	1	1	APID1							
1	1	Src	Count									
Length = 9												
0	0	0	0	1	0	0	0	1	0	0	0	
0	0	0	0	0	1	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID						
SID=0x0000												
Checksum												

Parameters

Name	Value
FUNCTIONID	0x06
ACTIVITYID	0x03
SID	0x0000

Possible Errors

Error	TM Service	Error Code	Description
VM_Inactive	(1,8)	0x080a	VM Not Running



3.2.8.3.16 Function 0x10 SMEC Launch Latch, Activity 0x01: ENGAGE_LATCH

This telecommand sends the SetSLaunchLatch (engage) command (0x90430001) to the DRCU, provided the function is active. The function is then stopped.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 9															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID		ACTIVITYID				SID=0x0000									
Checksum															

Parameters

Name	Value
FUNCTIONID	0x10
ACTIVITYID	0x01
SID	0x0000

Possible Errors

Error	TM Service	Error Code	Description
Function_Stopped	(1,8)	0x0831	The function is stopped – the command cannot be executed. An event TM(5,2) is also generated
Function_Unarmed	(5,2)	0x0832	The function has not been started prior to issuing this command

3.2.8.3.17 Function 0x10 SMEC Launch Latch, Activity 0xFF: RELEASE_LATCH

This telecommand sends the SetSLaunchLatch (disengage) command (0x90430002) to the DRCU, provided the function is active. The function is then stopped.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 9															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID		ACTIVITYID				SID=0x0000									
Checksum															

Parameters

Name	Value
FUNCTIONID	0x10
ACTIVITYID	0xFF
SID	0x0000

Possible Errors

Error	TM Service	Error Code	Description
Function_Stopped	(1,8)	0x0831	The function is stopped – the command cannot be executed. An event TM(5,2) is also generated
Function_Unarmed	(5,2)	0x0832	The function has not been started prior to issuing this command



3.2.8.3.18 Function 0xC0 Operations, Activity 0x40: PERFORM_PEAKUP

A Peak-up Report TM(5,1, EventID=0x0504) may be generated as a result of this command.

This command always produces an event if peak-up fails or a peak-up position is not found. The calculated BSM offsets with respect to the start chop and jiggle positions are always reported in the 2nd and 3rd words of Table 6, whether the OUTPUT flag is set to 0 or 1.

A Peak-up Report TM(5,1, EventID=0x0504) is only sent to the S/C if the OUTPUT flag is set to 0.

0	0	0	1	1	APID1										
1	1	Src			Count										
Length = 45															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID					ACTIVITYID										
SID=0x000F															
DCUDATAMODE															
PIXEL															
TABLEID															
TABLEINDEX															
STARTCHOPPOSN															
CHOPPOSNINCR															
NCHOPPOSNS															
STARTJIGGPOSN															
JIGGPOSNINCR															
NJIGGPOSNS															
CHOPOFFSET															
JIGGOFFSET															
NCHOPCYCLES															
CHOPCYCLEPERIOD															
NBSMFRAMES															
NDCUFRAMES															
DCUFRAMESDELAY															
CHOPSCALE															
JIGGSCALE															
OUTPUT															
Checksum															

Parameters

Name	Value
FUNCTIONID	0xC0
ACTIVITYID	0x40
SID	0x000F
DCUDATAMODE	DCU Data Mode (Photometer (0) or Spectrometer (4))
PIXEL	Location of reference pixel in DCU Frame
TABLEID	Chop Table ID
TABLEINDEX	Chop Table Index
STARTCHOPPOSN	Initial Chop position
CHOPPOSNINCR	Increment in Chop position
NCHOPPOSNS	Number of Chop positions
STARTJIGGPOSN	Initial JigglePosition
JIGGPOSNINCR	Increment in Jiggle position
NJIGGPOSNS	Number of Jiggle positions
CHOPOFFSET	Offset from positioning chop axis to off-source
JIGGOFFSET	Offset in jiggle axis to off source
NCHOPCYCLES	Number of Chop cycles
CHOPCYCLEPERIOD	Period of the Chop cycle
NBSMFRAMES	Number of BSM frames per Chop position
NDCUFRAMES	Number of DCU frames per Chop position
DCUFRAMESDELAY	Delay to first DCU frame
CHOPSCALE	Conversion from BSM chop units to output units
JIGGSCALE	Conversion from BSM jiggle units to output units
OUTPUT	Flag indicating if Peak-Up event is sent to the S/C (0) or only BSM offsets are (1) required



Possible Errors

Error	TM Service	Error Code or Event ID/SID	Description
No_Peak	(1,8)	0x0804	Unable to find Peak
Illegal_Table_ID	(1,8)	0x0805	The Table specified is not in the valid 0-255 range
Illegal_Table_Index	(1,8)	0x0806	The INDEX in the <i>Update Table</i> TC is larger than the table length specified in the <i>Set Table</i> TC
PEAKUP_NOT_FOUND_ID	(5,1)	0x0506/0x5101	Peak-Up procedure didn't found a Peak-Value in the requested range
DPU_DEBUG_EVENT_ID	(5,1)	0x7FFF/0x51FF	Flexible Debug Event Container Now used for Peak-UP (see RD08)
EXCP_PEAK_UP_ERROR_ID	(5,2)	0x0503/0x5203	Event Exception Report from Peak-Up Procedure

3.2.8.3.19 Function 0xC0 Operations, Activity 0x41: ABORT_PEAKUP

This command aborts a peak-up which may be in operation.

0	0	0	1	1	APID1
1	1	Src	Count		
Length = 7					
0	0	0	0	1	0
0	0	0	0	1	0
0	0	0	0	1	0
0	0	0	0	1	0
0	0	0	0	1	0
0	0	0	0	1	0
0	0	0	0	1	0
0	0	0	0	1	0
FUNCTIONID		ACTIVITYID			
SID=0x0000					
Checksum					

Parameters

Name	Value
FUNCTIONID	0xC0
ACTIVITYID	0x41
SID	0x0000

Possible Errors

Error	TM Service	Error Code or Event ID/SID	Description
PEAKUP_ABORT_ID	(5,1)	0x0507/0x5101	Peak-Up procedure didn't found a Peak-Value in the requested range



3.2.8.3.20 Function 0xC1 Observations, Activity 0x01: SET_OBSID

Set the observation ID, and set the Building Block ID to zero. The value of these two parameters is reported in the instrument housekeeping packets and all science data packets.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 13															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID		ACTIVITYID				SID=0x0010									
OBSID															
Checksum															

Parameters

Name	Value and Comments
FUNCTIONID	0xC1
ACTIVITYID	0x01
SID	0x0010
OBSID	Observation ID (32 bits)

3.2.8.3.21 Function 0xC1 Observations, Activity 0x02: SET_BBID

Set the Building Block ID. This is reported in the instrument housekeeping packets and all science data packets.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 13															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID		ACTIVITYID				SID=0x0011									
BBID															
Checksum															

Parameters

Name	Value and Comments
FUNCTIONID	0xC1
ACTIVITYID	0x02
SID	0x0011
BBID	Building Block ID (32 bits)



3.2.8.3.22 Function 0xC1 Observations, Activity 0x03: SET_OBS_MODE

This value may be set by the command system in order to notify processing software of the observing mode. It is reported in the housekeeping packets. A New Step Report event packet TM(5,1) is issued as a result of this command.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
SID=0x0012						MODE									
Checksum															

Parameters

Name	Value and Comments
FUNCTIONID	0xC1
ACTIVITYID	0x03
SID	0x0012
MODE	Observing Mode

3.2.8.3.23 Function 0xC1 Observations, Activity 0x04: SET_OBS_STEP

This value may be set by the command system in order to notify processing software of the current step in the observing mode. It is reported in the housekeeping packets. A New Step Report event packet TM(5,1) is issued as a result of this command.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
SID=0x0013						STEP									
Checksum															

Parameters

Name	Value and Comments
FUNCTIONID	0xC1
ACTIVITYID	0x04
SID	0x0013
STEP	Observation Step



3.2.8.3.24 Function 0xCA DPU, Activity 0x01: RESET_DRCU_COUNTERS

This telecommand sends a broadcast command to the DRCU to reset the time counters in the DCU, SCU and MCU interfaces

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 9															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
SID=0x0000															
Checksum															

Parameters

Name	Value
FUNCTIONID	0xCA
ACTIVITYID	0x01
SID	0x0000

This telecommand shall be expected to issue a Telecommand Execution Report - Completed, TM(1,7) on successful completion.

3.2.8.3.25 Function 0xCA DPU, Activity 0x02: FLUSH_FIFO

This telecommand forces the DPU to read any remaining science data from the FIFOs place them into science data packets and transmit the packets. I.e. it completely empties the DPU of science data. It typically takes ~2.5 seconds to execute this TC.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
SID=0x0015															
FIFOFLAGS															
Checksum															

Parameters

Name	Value
FUNCTIONID	0xCA
ACTIVITYID	0x02
SID	0x0015
FIFOFLAGS	0x1000 flushes channel 0 (DCU) FIFO 0x2000 flushes channel 1 (MCU) FIFO 0x4000 flushes channel 2 (SCU) FIFO (values may be OR-ed to flush more than one FIFO)

Note: This command **must** not be sent if the DRCU is generating science data

This telecommand shall be expected to issue a Telecommand Execution Report - Completed, TM(1,7) on successful completion.

Possible Errors

Error	TM Service	Error Code	Description
Invalid_FIFOFLAGS	(1,8)	0x080f	Incorrect FIFOFLAGS (TBD)



3.2.8.3.26 Function 0xCA DPU, Activity 0x03: SET_TM_NOMINAL_MODE

This telecommand sets the telemetry interface to the CDMS to operate in Nominal Mode.

0	0	0	1	1	APID1											
1	1	Src	Count													
Length = 9																
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
FUNCTIONID				ACTIVITYID												
SID=0x0000																
Checksum																

Parameters

Name	Value
FUNCTIONID	0xCA
ACTIVITYID	0x03
SID	0x0000

This telecommand shall be expected to issue a Telecommand Execution Report - Completed, TM(1,7) on successful completion.

3.2.8.3.27 Function 0xCA DPU, Activity 0x04: SET_TM_BURST_MODE

This telecommand sets the telemetry interface to the CDMS to operate in Burst Mode.

0	0	0	1	1	APID1											
1	1	Src	Count													
Length = 9																
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
FUNCTIONID				ACTIVITYID												
SID=0x0000																
Checksum																

Parameters

Name	Value
FUNCTIONID	0xCA
ACTIVITYID	0x04
SID	0x0000

This telecommand shall be expected to issue a Telecommand Execution Report - Completed, TM(1,7) on successful completion.

3.2.8.3.28 Function 0xCA DPU, Activity 0x05: SEND_DRCU_COMMAND

This telecommand allows sending a single command to the DRCU.

0	0	0	1	1	APID1											
1	1	Src	Count													
Length = 13																
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
FUNCTIONID				ACTIVITYID												
SID=0x0018																
DRCU Command MSW																
DRCU Command LSW																
Override																

Parameters

Name	Value
FUNCTIONID	0xCA
ACTIVITYID	0x05
SID	0x0018
DRCU Command MSW	Most Significant Word of DRCU command
DRCU Command LSW	Least Significant Word of DRCU command
Override	0 = do not override 1 = override

Possible Errors

Error	TM Service	Error Code	Description
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LS_RECEPTION_ERROR	(1,8)	0x080E	If a <i>Send DRCU Command</i> TC was received but the command could not be successfully dispatched to the DRCU because of an LS transmission error, this error code notifies that no DRCU sync was done
LS_INHIBITED_CMD_ERROR	(1,8)	0x081C	The S/S command sent is inhibited

3.2.8.3.29 Function 0xCA DPU, Activity 0x06: RESET_FIFOS

This telecommand is used to reset all FIFOs. All data currently in the FIFOs is lost. It typically takes ~2.5 seconds to execute this TC.

0	0	0	1	1	APID1
1	1	Src	Count		
Length = 9					
0	0	0	0	1	0
0	0	0	0	1	0
0	0	0	0	1	0
0	0	0	0	1	0
FUNCTIONID			ACTIVITYID		
SID=0x0000					
RESETFLAGS					
Checksum					

Parameters

Name	Value
FUNCTIONID	0xCA
ACTIVITYID	0x06
SID	0x0000
RESETFLAGS	0x1000 resets channel 0 (DCU) FIFO 0x2000 resets channel 1 (MCU) FIFO 0x4000 resets channel 2 (SCU) FIFO (values may be OR-ed to reset more than one FIFO)

3.2.8.3.30 Function 0xCA DPU, Activity 0x07: WRITE2EEPROM

This telecommand is used to copy PM into EEPROM.

This copies the block of Program Memory to the EEPROM and formats it such that the boot software can copy it back to Program Memory and start execution of it.

0	0	0	1	1	APID1
1	1	Src	Count		
Length = 17					
0	0	0	0	1	0
0	0	0	0	1	0
0	0	0	0	1	0
0	0	0	0	1	0
FUNCTIONID			ACTIVITYID		
SID=0x001A					
Start_Address MSW					
Start_Address LSW					
End_Address MSW					
End_Address LSW					
PARTITION_FLAG					
JUMP_NPAGES					
Jump_PageIds					
Checksum					

Parameters

Name	Value
FUNCTIONID	0xCA
ACTIVITYID	0x07
SID	0x001A
Start_Address	Starting address in PM (32 bits)
End_Address	End address in PM (32bits)
PARTITION_FLAG	0 = Primary Partition 1 = Secondary Partition
JUMP_NPAGES	Number of pages to jump (may be zero)
Jump_PageIds	List of IDs of pages to jump. Number of entries = JUMP_NPAGES. If JUMP_NPAGES = zero no list is needed

Possible Errors



Error	TM Service	Error Code	Description
EEPROM_Failed	(1,8)	0x0812	PM to EEPROM copy failed

3.2.8.3.31 Function 0xCA DPU, Activity 0x0A: GO_TO_SAFEMODE

This telecommand activates an OBS function to put SPIRE in SAFE mode (see RD11).

00011	APID1
11	Src Count
Length = 17	
0000100100001000	
0000010000000000	
FUNCTIONID	ACTIVITYID
SID=0x0000	
Checksum	

Parameters

Name	Value
FUNCTIONID	0xCA
ACTIVITYID	0x0A
SID	0x0

Function 0x70 DPU, Activity 0x02: LOAD_TC_AND_BOOT

After upload of a new OBS image into Data Memory using TC(6,2) commands, it is necessary to send this command to copy the full image from DM to Program Memory and start the OBS.

00011	APID1
11	Src Count
Length = 9	
0000100100001000	
0000010000000000	
FUNCTIONID	ACTIVITYID
SID=0x0000	
Checksum	

Parameters

Name	Value
FUNCTIONID	0x70
ACTIVITYID	0x02
SID	0x0000

3.2.8.3.33 Function 0x70 DPU, Activity 0x03: FORCE_BOOT_PRIMARY

This telecommand is used to copy the OBS image from the primary partition of the EEPROM to Program Memory and jumps to the start location of the OBS causing it to start running.

00011	APID1
11	Src Count
Length = 11	
0000100100001000	
0000010000000000	
FUNCTIONID	ACTIVITYID
PAR1=0x0001	
PAR2=0x0001	
Checksum	

Parameters

Name	Value
FUNCTIONID	0x70
ACTIVITYID	0x03
PAR1	0x0001
PAR2	0x0001

3.2.8.3.34 Function 0x70 DPU, Activity 0x03: FORCE_BOOT_SECONDARY



This telecommand is used to copy the OBS image from the secondary partition of the EEPROM to Program Memory and jumps to the start location of the OBS causing it to start running.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID									
PAR1=0x0001						PAR2=0x0002									
Checksum															

Parameters

Name	Value
FUNCTIONID	0x70
ACTIVITYID	0x03
PAR1	0x0001
PAR2	0x0002

Function 0xCA DPU, Activity 0x08: CALL_BOOT

Restarts the Boot Software without having to switch off the DPU

0	0	0	1	1	APID1												
1	1	Src	Count														
Length = 9																	
0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID											
SID=0x0000						Checksum											

Parameters

Name	Value
FUNCTIONID	0xCA
ACTIVITYID	0x08
SID	0x0000

3.2.8.3.36 Function 0xCA DPU, Activity 0x09: RESET_DPU

This telecommand performs a warm reset of the DPU by executing the Boot software resident in Program memory

0	0	0	1	1	APID1												
1	1	Src	Count														
Length = 9																	
0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
FUNCTIONID						ACTIVITYID											
SID=0x0000						Checksum											

Parameters

Name	Value
FUNCTIONID	0xCA
ACTIVITYID	0x09
SID	0x0000

3.2.8.3.37 Function 0xCE DPU, Activity 0x02: CLONE_OBS

This telecommand clones or copies the SPIRE OBS into another area of Program Memory. This command is typically used as a precursor to loading a new image into high PM.



0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 19															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID				ACTIVITYID											
SID=0x0000															
DIRECTION															
DEST_ADDR															
N_PM_WORDS															
Checksum															

Parameters

Name	Value
FUNCTIONID	0xCE
ACTIVITYID	0x02
SID	0x0000
DIRECTION	0x0001 (Clone)
DEST_ADDR	Destination address in PM (start value)
N_PM_WORDS	Number of PM words to be cloned



3.2.8.3.38 Function 0xCE DPU, Activity 0x02: COMMIT_OBS_AND_REBOOT

This telecommand commits or copies the SPIRE OBS into the low area of Program Memory and then restarts the application . This command is typically used after a new image has been loaded into high PM.

0	0	0	1	1	APID1											
1	1	Src	Count													
Length = 19																
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
FUNCTIONID			ACTIVITYID													
SID=0x0000																
DIRECTION																
FROM_ADDR																
N_PM_WORDS																
Checksum																

Parameters

Name	Value
FUNCTIONID	0xCE
ACTIVITYID	0x02
SID	0x0000
DIRECTION	0x0002 (Commit)
FROM_ADDR	Source address in PM (start value)
N_PM_WORDS	Number of PM words to be committed

3.2.8.3.39 Function 0xCA DPU, Activity 0x10: ENABLE_SELECTION

It may be necessary to reduce the instrument TM data rate (for example during parallel mode). Enable data selection from a science data frame. The DPU will use the contents of a table to define which words are extracted from the data frame into the telemetry packet (the table contains set of flags indicating the data required – 0 = not selected, 1= selected). The data is transmitted in a Selected Data Packet, TM(21,2) with the SID identifying the data structure.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 15															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID			ACTIVITYID												
SID=0x001F															
FRAMEID															
SELECTEDSID															
TABLEID															
Checksum															

Parameters

Name	Value and Comments
FUNCTIONID	0xCA
ACTIVITYID	0x10
SID	0x001F
FRAMEID	Science frame to extract data from
SELECTEDSID	Structure ID to use for this Selected Data Packet
TABLEID	Table containing the selection

Possible Frame IDs

Frame Type	Frame ID	Block Length
Photometer Full	0x00	294
Spectrometer Full	0x01	78
PSW	0x02	150
PMW	0x03	102
PLW	0x04	54
SSW	0x05	54
SLW	0x06	30
Photometer Offsets	0x07	294
Spectrometer Offsets	0x08	78
Photometer Full Test Pattern	0x09	294



PSW Test Pattern	0x0A	150
PMW Test Pattern	0x0B	102
PLW Test Pattern	0x0C	54
Spectrometer Full Test Pattern	0x0D	78
SSW Test Pattern	0x0E	54
SLW Test Pattern	0x0F	30
SMEC	0x10	12
BSM	0x12	13
MCU Engineering	0x14	21
MCU Test Pattern	0x15	21
SCU	0x20	30
SCU Test Pattern	0x21	30

Possible Errors

Error	TM Service	Error Code	Description
Illegal_Frame_ID	(1,8)	0x0815	Not a valid frame ID
Illegal_Table_ID	(1,8)	0x0823	Not a valid table ID

3.2.8.3.40 Function 0xCA DPU, Activity 0x11: DISABLE_SELECTION

Disable selection for a science data frame. The complete data frame will now be placed into the science telemetry packets

0	0	0	1	1	APID1						
1	1	Src		Count							
Length = 11											
0	0	0	0	1	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0
FUNCTIONID		ACTIVITYID									
SID=0x0020											
FRAMEID											
Checksum											

Parameters

Name	Value and Comments
FUNCTIONID	0xCA
ACTIVITYID	0x11
SID	0x0020
FRAMEID	Selection to be disabled

Possible Errors

Error	TM Service	Error Code	Description
Illegal_Selection_ID	(1,8)	0x0816	Not a valid Selection ID
Illegal_Frame_ID	(1,8)	0x0815	Not a valid frame ID
Undefined_Sel_Table	(1,8)	0x0817	Table ID is not defined
Invalid_Len_Sel_Table	(1,8)	0x0818	Length of Table does not match the selected Frame ID's Length
Invalid_Content_Sel_Table	(1,8)	0x0819	Content of Table doesn't contain a valid Boolean value



3.2.8.3.41 Function 0xCA DPU, Activity 0x13:ENABLE_SS_TC

Enable subsystem telecommands. Note that it is only possible to enable the 16 MSBs of the command ID. The 16 LSBs, which correspond to the parameter field of the DRCU command, cannot be specified. So the 16LSBs of the input parameters to the TC should be set to zero.

0	0	0	1	1	APID1														
1	1	Src			Count														
Length = 25																			
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FUNCTIONID					ACTIVITYID														
SID=0x0000																			
CMD_MIN																			
CMD_MAX																			
CMD_MASK																			
CMD_PATTERN																			
Checksum																			

Parameters

Name	Value and Comments
FUNCTIONID	0xCA
ACTIVITYID	0x13
SID	0x0000
CMD_MIN	Minimum value of SS command
CMD_MAX	Maximum value of SS command
CMD_MASK	Mask to be applied
CMD_PATTERN	Command Pattern

Example 1:

Name	Value	Notes
CMD_MIN	0xA0CC0000	Enable the SCU command to apply current to SCAL4
CMD_MAX	0xA0CC0000	
CMD_MASK	0xFFFFFFFF	
CMD_PATTERN	0xA0CC0000	

Example 2:

Name	Value	Notes
CMD_MIN	0x90000000	Enable all MCU commands
CMD_MAX	0x9FFF0000	
CMD_MASK	0xF0000000	
CMD_PATTERN	0x90000000	

Possible Errors

Error	TM Service	Error Code	Description
Illegal_Selection_ID	(1,8)	0x0816	Not a valid Selection ID

3.2.8.3.42 Function 0xCA DPU, Activity 0x14:DISABLE_SS_TC



Enable subsystem telecommands

0	0	0	1	1	APID1											
1	1	Src	Count													
Length = 25																
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
FUNCTIONID					ACTIVITYYID											
SID=0x0000					MIN_CMD											
MAX_CMD					MASK_CMD											
PATTERN_CMD					Checksum											

Parameters

Name	Value and Comments
FUNCTIONID	0xCA
ACTIVITYYID	0x14
SID	0x0000
CMD_MIN	Minimum value of SS command
CMD_MAX	Maximum value of SS command
CMD_MASK	Mask to be applied
CMD_PATTERN	Command Pattern

Possible Errors

Error	TM Service	Error Code	Description
TBD			

3.2.8.3.43 Function 0xCA HK, Activity 0x15: CHECK_PM

This command, which is not being used in flight, provides a means of checking the PM with the TC(8,4) service.

For flight operations the CHECK_MEMORY TC(6,9) is used instead (see section 3.2.6.3).

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 15															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID					ACTIVITYYID										
SID=0x0000					STARTADDR										
LENGTH					EXPECTEDCRC										
FLAG					Checksum										

Parameters

Name	Comments
FUNCTIONID	0xCA
ACTIVITYYID	0x15
SID	0x0000
STARTADDR	Start address in PM
LENGTH	Number of PM words
EXPECTEDCRC	Expected CRC
FLAG	

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros.



Possible Errors

Error	TM Service	Error Code	Description

3.2.8.3.44 Function 0xCA HK, Activity 0x16: CHECK_DM

This command, which is not being used in flight, provides a means of checking the DM with the TC(8,4) service.

For flight operations the CHECK_MEMORY TC(6,9) is used instead (see section 3.2.6.3).

00011	APID1
11 Src	Count
Length = 15	
0000100100001000	
0000010000000000	
FUNCTIONID	ACTIVITYID
SID=0x0000	
Checksum	

Parameters

Name	Comments
FUNCTIONID	0xCA
ACTIVITYID	0x16
SID	0x0000

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros.

Possible Errors

Error	TM Service	Error Code	Description

3.2.8.3.45 Function 0xCA HK, Activity 0x16: FORCE_WRONG_SS_RESP

This command is used to force the wrong subsystem response.

This is used for diagnostic purposes only. Not intended for flight operations.

00011	APID1
11 Src	Count
Length = 15	
0000100100001000	
0000010000000000	
FUNCTIONID	ACTIVITYID
SID=0x0001	
ERR	
NUM	
Checksum	

Parameters

Name	Comments
FUNCTIONID	0xCA
ACTIVITYID	0x16
SID	0x0000
ERR	Forced error code
NUM	Number of forced errors

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros.



Possible Errors

Error	TM Service	Error Code	Description

3.2.8.3.46 Function 0xCB HK, Activity 0x01: FORCE_WRONG_CRC

This command is used to force the OBS to generate the wrong CRC for the next TM packet

This is used for diagnostic purposes only.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID		ACTIVITYID				SID=0x0001									
Checksum															

Parameters

Name	Comments
FUNCTIONID	0xCB
ACTIVITYID	0x01
SID	0x0001

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros.

Possible Errors

Error	TM Service	Error Code	Description

3.2.8.3.47 Function 0xCC HK, Activity 0x01: DEFINE_NEW_HK_REPORT

This command is used to define/redefine housekeeping reports. The following procedure is used

1. An on-board table is loaded with the definition of the report using one or more 'Update_Table' commands. The format of the table contents is given in RD08.
2. An on-board table is loaded with monitoring information
3. A 'Define New Housekeeping Parameter Report' is used to associate the table containing the report definition and the corresponding monitoring table with a HK_Packet_ID, a sampling interval (in msec) and a structure ID (SID). In this case:



0	0	0	1	1						APID1									
1	1	Src								Count									
Length = 21																			
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FUNCTIONID					ACTIVITYID														
SID=0x0021																			
HKPCKTID																			
HKSID																			
HKINTERVAL																			
HKREPEAT																			
TABLEID																			
Checksum																			

Parameters

Name	Comments
FUNCTIONID	0xCC
ACTIVITYID	0x01
SID	0x0021
HKPCKTID	HK_Packet_ID 0x0300 for CHK 0x0301 for NHK
HKSID	0x0300 for CHK 0x0301 for NHK
HKINTERVAL	msec
HKREPEAT	Number of repeat HK frames per packet = 0
TABLEID	Table_ID 0 for CHK 1 for NHK

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros.

Notes:

In order to redefine a report, the report must first be 'cleared' using a 'Clear Housekeeping Parameter Report' command, which has the effect of stopping report generation in order that the table containing the definition of the report and the corresponding monitor table contents may be modified. Report generation restarts with the execution of this service.

Currently we assume that only one housekeeping report (frame) will be sent in each packet. In the event that we need more than one (e.g. to increase the efficiency of reporting critical housekeeping) HKREPEAT will be increased to specify the number of HK frames per packet.

Possible Errors

Error	TM Service	Error Code	Description
Illegal_HK_Packet_ID	(1,8)	0x0821	HK_Packet_ID Out of Range
Illegal_HK_SID	(1,8)	0x0822	HK_SID MSB not 0x03
Illegal_Table_ID	(1,8)	0x0823	TABLEID is out of range of possible table numbers
Illegal_HK_Sampling Interval	(1,8)	0x0824	HK_Sampling Interval is less than the absolute limit (10, TBC)
Undefined_HK_Table	(1,8)	0x0825	Table given by TABLEID is not defined
Report_in_Use	(1,8)	0x0827	An attempt is being made to modify a report without first 'clearing' it.

3.2.8.3.48 Function 0xCC HK, Activity 0x02: CLEAR_HK_REPORT

This command is used to clear the definition of a housekeeping report. It is usually used prior to redefining the report with TM(8,4):Funct-Act 0xCC-01 and has the effect of stopping report generation within the OBS.

This command should not be used for disabling reporting (use service (14,2) for this) as the definition of the report contents and sampling interval is lost.



0	0	0	1	1	APID1									
1	1	Src	Count											
Length = 11														
0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
FUNCTIONID		ACTIVITYID												
SID=0x0022														
HKSID														
Checksum														

Parameters

Name	Comments
FUNCTIONID	0xCC
ACTIVITYID	0x02
SID	0x0022
HK	HK_Packet_ID 0x0300 for CHK 0x0301 for NHK

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros.

Possible Errors

Error	TM Service	Error Code	Description
Illegal_HK_Packet_ID	(1,8)	0x0821	HK_Packet_ID Out of Range
Undefined_HK_Packet_ID	(1,8)	0x0829	HK Packet ID not associated with a table
Monitoring_Active	(1,8)	0x082F	HK report cannot be stopped because on-board monitoring is active

3.2.8.3.49 Function 0xCC HK, Activity 0x03: REPORT_HK_REPORT

This command is used to report the definition of a housekeeping report.

The information requested by this command is reported in TM service (21,4). This contains only the information provided in the report definition telecommand. The actual definition of the report contents may be obtained by dumping the appropriate table using the REPORT_TABLE TC.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID		ACTIVITYID													
SID=0x0023															
HKPCKTID															
Checksum															

Parameters

Name	Comments
FUNCTIONID	0xCC
ACTIVITYID	0x03
SID	0x0023
HKPCKTID	HK_Packet_ID

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros.

Possible Errors

Error	TM Service	Error Code	Description
Illegal_HK_Packet_ID	(1,8)	0x0821	HK_Packet_ID Out of Range
Undefined_HK_Packet_ID	(1,8)	0x0829	HK Packet ID not associated with a table

unction 0xCD HK, Activity 0x01: SUSPEND_MONITORING

This command is used to suspend monitoring activities



0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID		ACTIVITYID													
SID=0x0000															
Checksum															

Parameters

Name	Comments
FUNCTIONID	0xCD
ACTIVITYID	0x01
SID	0x0000

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros.

Possible Errors

Error	TM Service	Error Code	Description
Monitoring_Suspended	(1,8)	0x082D	On-board monitoring is already suspended

3.2.8.3.51 Function 0xCD HK, Activity 0x02: RESUME_MONITORING

This command is used to resume monitoring activities

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 11															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
FUNCTIONID		ACTIVITYID													
SID=0x0000															
Checksum															

Parameters

Name	Comments
FUNCTIONID	0xCD
ACTIVITYID	0x02
SID	0x0000

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros.

Possible Errors

Error	TM Service	Error Code	Description
Monitoring_Resumed	(1,8)	0x082E	Monitoring is already resumed

portFunction Status (Service 8,5) REPORT_FUNCTION

This telecommand requests a report on the status of a function. The instrument should respond with a TM(8,6) report.

0	0	0	1	1	APID1								
1	1	Src	Count										
Length = 7													
0	0	0	0	1	0	0	0	0	1	0	0	0	
0	0	0	0	0	0	1	0	0	0	0	0	0	0
FUNCTIONID		00000000											
Checksum													

Parameter

Name	Comment
FUNCTIONID	Function to report on



3.2.9 Time Management

3.2.9.1 Enable Time Verification (Service 9,7) ENABLE_TIME_VERIFICATION

On receipt of this telecommand the instrument shall issue a Time Verification Report, TM(9,9).

0	0	0	1	1	APID1										
1	1	0	0	0	Count										
Length = 5															
0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1
0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Checksum															



3.2.10 Unused Service

Not Available

3.2.11 On-Board Scheduling

Not Used

3.2.12 On-Board Monitoring

Not Used

3.2.13 Unused Service

Not Available



3.2.14 Packet Transmission Control

3.2.14.1 *Enable Generation of Telemetry Packets (Service 14,1)*

ENABLE_TM_GENERATION

This telecommand enables the transmission of instrument telemetry packets. By default all packets are enabled for transmission when the OBS starts. This telecommand is therefore only needed to restart transmission after transmission has been disabled.

0	0	0	1	1						APID1					
1	1	Src			Count										
Length															
0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
NPCKTS															
TYPE					SUBTYPE										
PACKETID															
Repeat Type, Subtype and SID NPCKTS-1 times															
Checksum															

Parameters

Name	Value and Comments
NPCKTS	Number of packets to enable
TYPE	Packet Type to enable
SUBTYPE	Packet Subtype to enable
PACKETID	Packet ID to enable

Possible Errors

Error	TM Service	Error Code	Description
Illegal_Type	(1,8)	0x0e01	Not a valid packet type for this APID
Illegal_Subtype	(1,8)	0x0e02	Not a valid subtype for packet with type TYPE
Illegal_PacketID	(1,8)	0x0e03	Not a valid Packet ID for packet with type TYPE and subtype SUBTYPE
Bad_NPCKTS	(1,8)	0x0e04	Number of packets to be enabled is not correct for telecommand length



3.2.14.2 Disable Generation of Telemetry Packets (Service 14,2)

DISABLE_TM_GENERATION

This telecommand disables the transmission of instrument telemetry packets. By default all packets are enabled for transmission when the OBS starts.

Note: Disabling TM generation does not stop generation of the TM packets within the OBS. These are created and processed as normal, but the packet is not passed to the 1553 interface to be sent to the CDMU. This is necessary to ensure that Housekeeping Monitoring continues to function even if the housekeeping TM is disabled, for example.

0	0	0	1	1	APID1										
1	1	Src	Count												
Length															
0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
NPCKTS															
TYPE			SUBTYPE												
PACKETID															
Repeat Type, Subtype and Packet ID NPCKTS-1 times															
Checksum															

Parameters

Name	Value and Comments
NPCKTS	Number of packets to enable
TYPE	Packet Type to enable
SUBTYPE	Packet Subtype to enable
PACKETID	Packet ID to enable

Possible Errors

Error	TM Service	Error Code	Description
Illegal_Type	(1,8)	0x0E01	Not a valid packet type for this APID
Illegal_Subtype	(1,8)	0x0E02	Not a valid subtype for packet with type TYPE
Illegal_PacketID	(1,8)	0x0E03	Not a valid Packet ID for packet with type TYPE and subtype SUBTYPE
Bad_NPCKTS	(1,8)	0x0E04	Number of packets to be enabled is not correct for telecommand length

3.2.14.3 Report Enabled Telemetry Packets (Service 14,3) REPORT_ENABLED_TM

This telecommand requests a list of telemetry packet types and subtypes that are enabled for transmission. The list is reported in TM service (14,4)

0	0	0	1	1	APID1										
1	1	Src	Count												
Length = 5															
0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	0
0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Checksum															

Parameters

Name	Value and Comments



3.2.15 On-Board Storage and Retrieval

Not Used

3.2.16 On-Board Traffic Management

Not Used



3.2.17 Test Service

3.2.17.1 Perform Connection Test (Service 17,1) TEST_CONNECTION

This test is used to check the End-to-End connection to the instrument. The instrument shall respond with a Successful Command Acceptance Report, TM(1,1), followed by a Link Connection Report, TM(17,2).

0	0	0	1	1	APID1										
1	1	0	0	0	Count										
Length = 5															
0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Checksum															

3.2.18 On-Board Control Procedures

Not Used

3.2.19 Action/Event Service

Not Used



3.2.20 Information Distribution Service

Not Used

3.2.21 Science Data

Not Applicable

3.2.22 Context Saving Service

Not Used



4. SPIRE TELEMETRY PACKETS

This section defines all the TM packets that will be produced by SPIRE.

4.1 Telemetry Packet Types

The Packet Structure ICD (AD1) defines many types of service that can be provided by an Application. The following table shows the telemetry packet types that will be produced by the SPIRE.

Description	Service Type	Service Sub-Type	Comments
Telecommand Verification Service			
Telecommand Acceptance Report - Success	1	1	
Telecommand Acceptance Report - Failure	1	2	
Telecommand Execution Report - Started	1	3	
Telecommand Execution Report - Progress	1	5	
Telecommand Execution Report - Completed	1	7	
Telecommand Execution Report - Failure	1	8	
Telecommand Contents Report	1	9	Not Used
Device Command Distribution	2		N/A
Housekeeping and Diagnostic Data Reporting			
HK Parameter Report Definitions Report	3	10	Not Used
Diagnostic Parameter Definitions Report	3	12	Not Used
Housekeeping Parameter Report	3	25	
Diagnostic Parameter Report	3	26	Not Used
Event Reporting			
Event Report	5	1	
Exception Report	5	2	
Error/Alarm Report	5	4	
Memory Management			
Memory Dump, Absolute Addresses	6	6	
Memory Check Report, Absolute Addresses	6	10	
Function Management			
Function Status Report	8	6	
Time Management			
Central Time Reference	9	8	Not Used
Time Verification Report	9	9	
On-Board Scheduling	11		Not Used
On-Board Monitoring			
Current Monitoring List Report	12	9	Not Used
Packet Transmission Control			
Enabled Telemetry Packets Report	14	4	
On-Board Storage and Retrieval	15		Not Used
Test Service			
Connection Test Report	17	2	
On-Board Control procedures	18		Not Used
Action/Event Service	19		Not Used
Information Distribution Service	20		Not Used
Science Data			
Nominal Science Data Report	21	1	
Science Type B Data Report	21	2	
Diagnostic Science Data Report	21	3	
Auxiliary Science Data Report	21	4	
Context Saving Service	22		Not Used



4.2 Telemetry Packet definitions

4.2.1 TC Verification Service

4.2.1.1 Telecommand Acceptance Report - Success (1,1)

000001	APID1
11	Count
	Length = 15
00000000000000000000000000000001	
000000000001000000000000	
	TIME
	TC_Packet_ID
	TC_Packet_Sequence_Control
	Checksum

4.2.1.2 Telecommand Acceptance Report - Failure (1,2)

The structure of this packet depends on the type of error found.

4.2.1.2.1 Packet Control Errors

000001	APID1
11	Count
	Length
00000000000000000000000000000001	
000000000001000000000000	
	TIME
	TC_Packet_ID
	TC_Packet_Sequence_Control
	Failure Code
	TC_Packet_Length
	Data_Field_Header
	Data_Field_Error_Control
	Parameter
	Checksum

Error	Failure Code	Parameter
Illegal APID	0	None
Incomplete Packet or invalid Length	1	Actual length of received packet
Incorrect Checksum	2	Calculated Checksum from received packet
Illegal Packet Type	3	None
Illegal Packet Sub-Type	4	None

Note: The parameter is placed in the least significant bits of the 16 bit 'parameter' field and the most significant bits are padded with zeros



4.2.1.2.2 Packet Content Error

0	0	0	0	1	APID1										
1	1	Count													
Length=57															
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
TIME															
TC_Packet_ID															
TC_Packet_Sequence_Control															
Failure Code															
Parameters															
Checksum															

Error	Failure Code	Parameters
Illegal Function ID	0x0801	See Note
Illegal Activity ID	0x0802	See Note

Note: The parameters field should contain the first 20 words from the 'source data' field of the received telecommand packet, unless this field is less than 20 words in length, in which case all words from the 'source data' field will be included and padded with zeros.



4.2.1.3 Telecommand Execution Report - Started (1,3)

This report is generated at the start of execution of a telecommand. It is only transmitted in telemetry if the corresponding bit of the Ack field is set.

0	0	0	0	1	APID1								
1	1	Count											
Length = 15													
0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	1	1	0	0	0	0	0	0	0
TIME													
TC_Packet_ID													
TC_Packet_Sequence_Control													
Checksum													

4.2.1.4 Telecommand Execution Report - Progress (1,5)

These reports may be generated by an executing telecommand. They are only transmitted in telemetry if the corresponding bit of the Ack field is set.

0	0	0	0	1	APID1								
1	1	Count											
Length = 17													
0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	1	0	1	0	0	0	0	0	0
TIME													
TC_Packet_ID													
TC_Packet_Sequence_Control													
Step_Number													
Checksum													

4.2.1.5 Telecommand Execution Report - Completion (1,7)

This report is generated at the successful completion of execution of a telecommand. It is only transmitted in telemetry if the corresponding bit of the Ack field is set.

0	0	0	0	1	APID1							
1	1	Count										
Length = 15												
0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	1	1	1	0	0	0	0	0	0
TIME												
TC_Packet_ID												
TC_Packet_Sequence_Control												
Checksum												



4.2.1.6 Telecommand Execution Report - Failure (1,8)

This report is generated at the unsuccessful completion of execution of a telecommand

The structure of this packet depends on the type of error found., but follows the general form:

0	0	0	0	1	APID1														
1	1	Count																	
Length																			
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TIME																			
TC_Packet_ID																			
TC_Packet_Sequence_Control																			
<i>Failure Code</i>																			
<i>Parameters</i>																			
Checksum																			

Failure Codes and their meanings are described in the OBS User Manual (RD08)

4.2.2 Device Command Distribution

Not Used



4.2.3 Housekeeping and Diagnostic Data Reporting

4.2.3.1 Housekeeping Parameter Report (Service 3,25)

The general packet structure is shown below. The Structure ID identifies the housekeeping packet type.

0	0	0	0	1	APID										
1	1	Count													
Length															
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
TIME															
<i>SID</i>															
<i>Parameters</i>															
Checksum															

<i>APID</i>	Packet type
APID1	Critical Housekeeping Report
APID2	Nominal Housekeeping Report

<i>SID</i>	Packet type	Default Period (msec)
0x0300	Critical Housekeeping Report	2000
0x0301	Nominal Housekeeping Report	1000



4.2.3.2 Critical Housekeeping Report (SID=0x0300)

Location (octet)	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
18	0	32	OBSID_C	20010000	AD03	Observation ID
22	0	32	BBID_C	20020000	AD03	Building Block ID
	16	16	BBTYPE_C			
26	0	16	MODE_C	40060000	RD08	Observing Mode – set by command
28	0	16	STEP_C	10040000	RD08	Observation Step – set by command
30	0	16	TCRECV_C	100D0000	RD08	Count of Telecommands Received
32	0	16	TCEXEC_C	100F0000	RD08	Count of Telecommands Executed
34	0	48	MEMSTAT_C	30130000	RD08	Not used – set to 0
40	0	16	MONSTAT_C	04140000	RD08	Status of subsystems monitoring
42	0	16	SCUDCDCSTAT_C	A8870000		Status of events
44						
46	0	16	MCUIFSTAT_C	98000000	RDO6	CmdIfStat
	0	1	MCUIFOLAPERR_C			Command Overlapped
	1	1	MCUIFBCASTERR_C			Forbidden Broadcast
	2	1	MCUIFREADERR_C			Forbidden Read
	3	1	MCUIFTOUTERR_C			SubSystem Timeout
	4	2	MCUIFCMDSTAT_C			LastCmdStatus
48	0	16	SCUIFSTAT_C	A8000000	RDO6	CmdIfStat
	0	1	SCUIFOLAPERR_C			Command Overlapped
	1	1	SCUIFBCASTERR_C			Forbidden Broadcast
	2	1	SCUIFREADERR_C			Forbidden Read
	3	1	SCUIFTOUTERR_C			SubSystem Timeout
	4	2	SCUIFCMDSTAT_C			LastCmdStatus
50	0	16	PSWJFETSTAT_C	8C120000	RD06	
	0	1	PSWJFETPWR1_C			PSW_JFET_1
	1	1	PSWJFETPWR2_C			PSW_JFET_2
	2	1	PSWJFETPWR3_C			PSW_JFET_3
	3	1	PSWJFETPWR4_C			PSW_JFET_4
	4	1	PSWJFETPWR5_C			PSW_JFET_5
	5	1	PSWJFETPWR6_C			PSW_JFET_6
52	0	16	PMLWJFETSTAT_C	8C130000	RDO6	
	0	1	PMWJFETPWR1_C			PMW_JFET_1
	1	1	PMWJFETPWR2_C			PMW_JFET_2
	2	1	PMWJFETPWR3_C			PMW_JFET_3
	3	1	PMWJFETPWR4_C			PMW_JFET_4
	4	1	PLWJFETPWR1_C			PLW_JFET_1
	5	1	PLWJFETPWR2_C			PLW_JFET_2
	6	1	TCJFETPWR_C			TC_JFET
54	0	16	SPECJFETSTAT_C	8C370000	RD06	
	0	1	SLWJFETPWR1_C			SLW_JFET1
	1	1	SSWJFETPWR1_C			SSW_JFET1
	2	1	SSWJFETPWR2_C			SSW_JFET2



Location (octet)	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
56	0	16	LIAS _T AT_C	8C3F0017	RD06	PWR_STATUS, LIA 1 to LIA 12
	0	1	LIA01STAT_C			LIA 1 +5V/+9V/-9V status
	1	1	LIA02STAT_C			LIA 2 +5V/+9V/-9V status
	2	1	LIA03STAT_C			LIA 3 +5V/+9V/-9V status
	3	1	LIA04STAT_C			LIA 4 +5V/+9V/-9V status
	4	1	LIA05STAT_C			LIA 5 +5V/+9V/-9V status
	5	1	LIA06STAT_C			LIA 6 +5V/+9V/-9V status
	6	1	LIA07STAT_C			LIA 7 +5V/+9V/-9V status
	7	1	LIA08STAT_C			LIA 8 +5V/+9V/-9V status
	8	1	LIA09STAT_C			LIA 9 +5V/+9V/-9V status
	9	1	LIA10STAT_C			LIA 10 +5V/+9V/-9V status
	10	1	LIA11STAT_C			LIA 11 +5V/+9V/-9V status
	11	1	LIA12STAT_C			LIA 12 +5V/+9V/-9V status
58	0	16	MCUERR_C	99E90000	RD06	ErrorCode
60	0	16	SMECSTAT_C	98600000	RD06	SMECStatus
62	0	16	BSMSTAT_C	99000000	RD06	BSMStatus
64						
66	0	16	SCUSTAT_C	A8800000	RD06	ScuStatus
68	0	16	SUBKTEMP_C	A8F00000	RD06	CEVTemp
70	0	16	OBSVER_C	10600000	RD08	
	0	7	'0'			SubVersion
	8	11	'0'			Version
	12	15	'4'			Issue



4.2.3.3 Nominal Housekeeping Report (SID=0x0301)

The following table lists the field to be found in this report

Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
18	0	32	OBSID	20010000	AD03	Observation ID
22	0	32	BBID	20020000	AD03	Building Block ID
	16	16	BBTYPE			
26	0	16	MODE	40060000	RD08	Observing Mode – set by command
28	0	16	STEP	10040000	RD08	Observation Step – set by command
30	0	48	THSK	30090000	RD08	Time of start of HK collection
36	0	48	TRESET	30050000	RD08	Time of last reset command to the DRCU
42	0	16	TCRECN	100D0000	RD08	Count of Telecommands Received
44	0	16	TCRECV	100E0000	AD01	Sequence count of latest received telecommand
46	0	16	TCEXEN	100F0000		Count of Telecommands Executed
48	0	16	TCEXEC	10100000	AD01	Sequence count of latest executed telecommand
50	0	16	TM1N	04180000	RD08	Count of TM Packets for APID1
52	0	16	TM2N	04190000	RD08	Count of TM Packets for APID2
54	0	16	TM3N	041A0000	RD08	Count of TM Packets for APID3
56	0	16	TM4N	041B0000	RD08	Count of TM Packets for APID4
58	0	16	TM5N	041C0000	RD08	Count of TM Packets for APID5
60	0	16	DCUFRAMECNT	102A0000	RD08	No of frames read from DCU FIFO
62	0	16	MCUFRAMECNT	102B0000	RD08	No of frames read from MCU FIFO
64	0	16	SCUFRAMECNT	102C0000	RD08	No of frames read from SCU FIFO
66	0	48	TSYNC	30060000	RD08	Time of last sync with CDMS
72	0	48	TDIFF	30070000	RD08	Difference between current DPU time and CDMS Time at last sync
	0	32	DIFFS			
78	0	48	MEMSTAT	30130000	RD08	Not used - all set to 0
	0	16	MEMSTAT_1			
	16	16	MEMSTAT_2			
	32	16	MEMSTAT_3			
84	0	16	MONSTAT	04140000	RD08	Status of subsystems monitoring
86	0	16	AUTO_SEQ_STATUS	0429 0000	RD08	Get Autonomy Functions status
	14	2	HK_MON_STATUS			Status of on-board monitoring 0 – STOPPED 1 – RUNNING 3 - SUSPENDED
88	0	16	VMSTAT	04300000	RD08	Status of VM (table ID being executed)
90	0	16	VM1STAT	04310000	RD08	Status of VM1 (table ID being executed)
92	0	16	VM2STAT	04320000	RD08	Status of VM2 (table ID being executed)
94	0	16	VM3STAT	04330000	RD08	Status of VM3 (table ID being executed)
96	0	16	VMSTATAFX	04340000	RD08	Status of AFX VM (table ID being executed)
98	0	16	SD_VALUE0	40060020	RD08	VM extracted value from a science data frame: Get the 16 LSB in table 6 index 32
100	0	16	SD_ADDRESS0	50060020	RD08	Address of VM extracted value in science data frame: Get the 16 MSB in table 6 index 32



Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
102	0	16	SD_VALUE1	40060021	RD08	VM extracted value from a science data frame: Get the 16 LSB in table 6 index 33
104	0	16	SD_ADDRESS1	50060021	RD08	Address of VM extracted value in science data frame: Get the 16 MSB in table 6 index 33
106	0	16	SD_VALUE2	40060022	RD08	VM extracted value from a science data frame: Get the 16 LSB in table 6 index 34
108	0	16	SD_ADDRESS2	50060022	RD08	Address of VM extracted value in science data frame: Get the 16 MSB in table 6 index 34
110	0	16	SD_VALUE3	40060023	RD08	VM extracted value from a science data frame: Get the 16 LSB in table 6 index 34
112	0	16	SD_ADDRESS3	50060023	RD08	Address of VM extracted value in science data frame: Get the 16 MSB in table 6 index 34
114	0	16	DPUP5V	04210000	RD09	DPU monitored +5V voltage line
116	0	16	DPUP15V	04220000	RD09	DPU monitored +15V voltage line
118	0	16	DPUM15V	04230000	RD09	DPU monitored -15V voltage line
120	0	16	DPUTEMP	04240000	RD09	DPU monitored temperature
122	0	16	CPULOAD	04280000	RD09	DPU Processor Workload
124	0	32	LSLOAD	082F0000	RD09	DPU LS Workload
128	0	16	DPUP2.5V	04270000	RD09	DPU monitored +2.5V Reference voltage line
130	0	16	LS_HP_FIFOSTAT	04760000	RD09	Get_FifoStat_LS_HP – changes when a VM is running
132	0	16	LS_LP_FIFOSTAT	04770000	RD09	Get_FifoStat_LS_LP
134	0	16	CHOPJIGG_DCOUPLE	98DA0000	RD07	GetC2JDCrosscoupling
136	0	16	DCUDATAMODE	8C3C0000	RD06	DataMode
138	0	16	DCUDATAFRMS	8C3D0000	RD06	FrameCount
140	0	16	DCUDATASTAT	8C3E0000	RD06	StartFrame
142	0	16	PHOTBIASDIV	8C180000	RD06	PhotoBiasDiv
144	0	16	PHOTBIASMODE	8C000000	RD06	PhotoBiasMode
146	0	16	PHOTMCLKDIV	8C190000	RD06	PhotoMClkDiv
148	0	16	PSWBIAS	8C010000	RD06	PhotoBiasAmpl for Photo SW Channels
150	0	16	PMWBIAS	8C020000	RD06	PhotoBiasAmpl for Photo MW Channels
152	0	16	PLWBIAS	8C030000	RD06	PhotoBiasAmpl for Photo LW Channels
154	0	16	TCBIAS	8C040000	RD06	PhotoBiasAmpl for Photo TC Channels
156	0	16	PSWPHASE	8C1A0000	RD06	PhaseShift for Photo SW Channels
158	0	16	PMWPHASE	8C1B0000	RD06	PhaseShift for Photo MW Channels
160	0	16	PLWPHASE	8C1C0000	RD06	PhaseShift for Photo LW Channels
162	0	16	TCPHASE	8C1D0000	RD06	PhaseShift for Photo TCChannels
164	0	16	PSWJFETSTAT	8C120000	RD06	<i>PSW_JFET_1</i> <i>PSW_JFET_2</i> <i>PSW_JFET_3</i> <i>PSW_JFET_4</i> <i>PSW_JFET_5</i> <i>PSW_JFET_6</i>
	0	1	<i>PSWJFETPWR1</i>			
	1	1	<i>PSWJFETPWR2</i>			
	2	1	<i>PSWJFETPWR3</i>			
	3	1	<i>PSWJFETPWR4</i>			
	4	1	<i>PSWJFETPWR5</i>			
	5	1	<i>PSWJFETPWR6</i>			



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078

Issue: Issue 3.0

Date: 2nd August 2010

Page: 75 of 163

Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
166	0	16	PMLWJFETSTAT	8C130000	RD06	<i>PMW_JFET_1</i> <i>PMW_JFET_2</i> <i>PMW_JFET_3</i> <i>PMW_JFET_4</i> <i>PLW_JFET_1</i> <i>PLW_JFET_2</i> <i>TC_JFET</i>
	0	1	<i>PMWJFETPWR1</i>			
	1	1	<i>PMWJFETPWR2</i>			
	2	1	<i>PMWJFETPWR3</i>			
	3	1	<i>PMWJFETPWR4</i>			
	4	1	<i>PLWJFETPWR1</i>			
	5	1	<i>PLWJFETPWR2</i>			
6	1	<i>TCJFETPWR</i>				
168	0	16	PSWJFET1V	8C050000	RD06	PSW JFET Source Voltage for Channel 1
170	0	16	PSWJFET2V	8C060000	RD06	PSW JFET Source Voltage for Channel 2
172	0	16	PSWJFET3V	8C070000	RD06	PSW JFET Source Voltage for Channel 3
174	0	16	PSWJFET4V	8C080000	RD06	PSW JFET Source Voltage for Channel 4
176	0	16	PSWJFET5V	8C090000	RD06	PSW JFET Source Voltage for Channel 5
178	0	16	PSWJFET6V	8C0A0000	RD06	PSW JFET Source Voltage for Channel 6
180	0	16	PMWJFET1V	8C0B0000	RD06	PMW JFET Source Voltage for Channel 1
182	0	16	PMWJFET2V	8C0C0000	RD06	PMW JFET Source Voltage for Channel 2
184	0	16	PMWJFET3V	8C0D0000	RD06	PMW JFET Source Voltage for Channel 3
186	0	16	PMWJFET4V	8C0E0000	RD06	PMW JFET Source Voltage for Channel 4
188	0	16	PLWJFET1V	8C0F0000	RD06	PLW JFET Source Voltage for Channel 1
190	0	16	PLWJFET2V	8C100000	RD06	PLW JFET Source Voltage for Channel 2
192	0	16	PHOTHTRV	8C110000	RD06	PhotoHeaterBias
194	0	16	TCJFETV	8C140000	RD06	TC JFET Source Voltage
196	0	16	SPECBIASDIV	8C380000	RD06	SpectroBiasDiv
198	0	16	SPECBIASMODE	8C300000	RD06	SpectroBiasMode
200	0	16	SPECMCLKDIV	8C390000	RD06	SpectroMClkDiv
202	0	16	SSWBIAS	8C310000	RD06	SpectroBiasAmpl for Spectro SW Channels
204	0	16	SLWBIAS	8C320000	RD06	SpectroBiasAmpl for Spectro MW Channels
206	0	16	SSWPHASE	8C3A0000	RD06	PhaseShift for Spectro SW Channels
208	0	16	SLWPHASE	8C3B0000	RD06	PhaseShift for Spectro LW Channels
210	0	16	SPECJFETSTAT	8C370000	RD06	<i>SLW_JFET1</i> <i>SSW_JFET1</i> <i>SSW_JFET2</i>
	0	1	<i>SLWJFETPWR1</i>			
	1	1	<i>SSWJFETPWR1</i>			
2	1	<i>SSWJFETPWR2</i>				
212	0	16	SSWJFET1V	8C350000	RD06	SSW JFET Source Voltage for Channel 1 ^b
214	0	16	SSWJFET2V	8C360000	RD06	SSW JFET Source Voltage for Channel 2 ^c
216	0	16	SLWJFETV	8C340000	RD06	SLW JFET Source Voltage
218	0	16	SPECHTRV	8C330000	RD06	Spectro Heater Bias
220	0	16	TC1TEMP	8C3F001A	RD06	T/C 1
222	0	16	TC2TEMP	8C3F001C	RD06	T/C 2
224	0	16	TC3TEMP	8C3F001E	RD06	T/C 3
226	0	16	BIASP5V	8C3F000E	RD06	BIAS/DAQ_IF +5V Voltage (before post regulator)
228	0	16	BIASP9V	8C3F000F	RD06	BIAS/DAQ_IF +9V Voltage (before post regulator)
230	0	16	BIASM9V	8C3F0010	RD06	BIAS/DAQ_IF -9V Voltage (before post regulator)
232	0	16	<i>OBSVER</i>	10600000		SubVersion Version Issue
	0	7	'0'			
	8	11	'0'			
	12	15	'4'			
234	0	16	TMMODE	10610000	RD08	Telemetry Mode (Normal/Burst)



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078

Issue: Issue 3.0

Date: 2nd August 2010

Page: 76 of 163

Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
236	0	16	FIFO_DF_FLAG	10350000		
238	0	16	HK_02	10FF0000		Spare
240	0	16	HK_03	10FF0000		Spare
242	0	16	PLIAP5V	8C3F0011	RD06	LIAP +5V Voltage (before post regulator)
244	0	16	PLIAP9V	8C3F0012	RD06	LIAP +9V Voltage (before post regulator)
246	0	16	PLIAM9V	8C3F0013	RD06	LIAP -9V Voltage (before post regulator)
248	0	16	SLIAP5V	8C3F0014	RD06	LIAS +5V Voltage (before post regulator)
250	0	16	SLIAP9V	8C3F0015	RD06	LIAS +9V Voltage (before post regulator)
252	0	16	SLIAM9V	8C3F0016	RD06	LIAS -9V Voltage (before post regulator)
254	0	16	HK_04	10FF0000		Spare
256	0	16	HK_05	10FF0000		Spare
258	0	16	LIAP9TEMP	8C3F0004	RD06	LIA_B1_TEMP, LIA board 1 temperature
260	0	16	LIAP8TEMP	8C3F0005	RD06	LIA_B2_TEMP, LIA board 2 temperature
262	0	16	LIAP7TEMP	8C3F0006	RD06	LIA_B3_TEMP, LIA board 3 temperature
264	0	16	LIAP6TEMP	8C3F0007	RD06	LIA_B4_TEMP, LIA board 4 temperature
266	0	16	LIAP5TEMP	8C3F0008	RD06	LIA_B5_TEMP, LIA board 5 temperature
268	0	16	LIAP4TEMP	8C3F0009	RD06	LIA_B6_TEMP, LIA board 6 temperature
270	0	16	LIAP3TEMP	8C3F000A	RD06	LIA_B7_TEMP, LIA board 7 temperature
272	0	16	LIAP2TEMP	8C3F000B	RD06	LIA_B8_TEMP, LIA board 8 temperature
274	0	16	LIAP1TEMP	8C3F000C	RD06	LIA_B9_TEMP, LIA board 9 temperature
276	0	16	LIAS1TEMP	8C3F0001	RD06	LIA_B10_TEMP, LIA board 10 temperature
278	0	16	LIAS2TEMP	8C3F0002	RD06	LIA_B11_TEMP, LIA board 11 temperature
280	0	16	LIAS3TEMP	8C3F0003	RD06	LIA_B12_TEMP, LIA board 12 temperature
282	0	16	BIASTEMP	8C3F0000	RD06	BIAS_TEMP, Bias board temperature
284	0	16	DAQTEMP	8C3F000D	RD06	DAQ_IF_TEMP, DAQ IF board temperature
286	0 4 5 6 7 8 9 10 11 12 13 14 15	16 1 1 1 1 1 1 1 1 1 1 1 1 1 1	LIAS1STAT LIAS2STAT LIAS3STAT LIAP1STAT LIAP2STAT LIAP3STAT LIAP4STAT LIAP5STAT LIAP6STAT LIAP7STAT LIAP8STAT LIAP9STAT LIAS1STAT LIAS2STAT LIAS3STAT	8C3F0017	RD06	PWR_STATUS, LIA 1 to LIA 12 LIA 1 +5V/+9V/-9V status (0=OK) LIA 2 +5V/+9V/-9V status (0=OK) LIA 3 +5V/+9V/-9V status (0=OK) LIA 4 +5V/+9V/-9V status (0=OK) LIA 5 +5V/+9V/-9V status (0=OK) LIA 6 +5V/+9V/-9V status (0=OK) LIA 7 +5V/+9V/-9V status (0=OK) LIA 8 +5V/+9V/-9V status (0=OK) LIA 9 +5V/+9V/-9V status (0=OK) LIA 10 +5V/+9V/-9V status (0=OK) LIA 11 +5V/+9V/-9V status (0=OK) LIA 12 +5V/+9V/-9V status (0=OK)
288	0 0 1 2 3 4	16 1 1 1 1 2	MCUIFSTAT MCUIFOLAPERR MCUIFBCASTERR MCUIFREADERR MCUIFTOUTERR MCUIFCMDSTAT	98000000	RD06	CmdIfStat Command Overlapped Forbidden Broadcast Forbidden Read SubSystem Timeout LastCmdStatus
290	0 0 1 2	16 1 1 1	MCUIFCTRL MCUDATIFRESET MCUSSRESET MCUIFSTATRESET	98010000	RD06	CmdIfCtrl DataIfReset SubSystemRst StatusRst
292	0	16	MCUSSDEL	98020000	RD06	Subsystem Delay
294	0	16	MCUP5V	99E00000	RD07	P5V



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078

Issue: Issue 3.0

Date: 2nd August 2010

Page: 77 of 163

Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
296	0	16	MCUP14V	99E10000	RD07	P14V
298	0	16	MCUM14V	99E20000	RD07	M14V
300	0	16	MCUP15V	99E30000	RD06	P15V
302	0	16	MCUM15V	99E40000	RD06	M15V
304	0	16	MCUMACTEMP	99E50000	RD07	MACTemp
306	0	16	MCUSMECTEMP	99E60000	RD07	SMECTemp
308	0	16	MCUBSMTEMP	99E70000	RD07	BSMTemp
310	0	16	HK_06	10FF0000		Spare
312	0	16	MCUERR	99E90000	RD06	ErrorCode
314	0	16	MCUSCHEDCNTLSW	99EA0000	RD06	SchedCntLSW
316	0	16	MCUSCHEDCNTMSW	99EB0000	RD06	SchedCntMSW
318	0	16	MCUTM10TSAMPLE	99C00000	RD06	TP10SampFreq (SMEC frame sampling interval)
320	0	16	MCUFRAMESTART	99C10000	RD07	FrameStart
322	0	16	MCUTM12TSAMPLE	99C20000	RD06	TP12SampFreq (BSM frame sampling interval)
324	0	16	MCUFRAMES	99C30000	RD07	FrameNumber
326	0	16	MCUTM14TSAMPLE	99C40000	RD06	TP14SampFreq (MCU Eng frame sampling interval)
328	0	16	MCUTM15TSAMPLE	99C50000	RD06	TP15SampFreq (MCU Test frame sampling interval)
330	0	16	MCUTMSTATUS	99DF0000	RD06	TelemetryStatus
332	0	16	HK_07	10FF0000		Spare
334	0	16	MCUBOOTSTAT	98200000	RD06	Boot Status Register
336	0	16	MCUDLOADCONF	98210000	RD06	DownloadParam
338	0	16		10FF0000		Spare
340	0	16		10FF0000		Spare
342	0	16		10FF0000		Spare
344	0	16		10FF0000		Spare
346	0	16		10FF0000		Spare
348	0	16		10FF0000		Spare
350	0	16	HK_08	10FF0000		Spare
352	0	16	SMECENCPWR	98400000	RD06	SEncoderPwr
354	0	16	SMECLVDTPWR	98410000	RD06	SLVDTPwr
356	0	16	HK_09	10FF0000		Spare
358	0	16	SMECLATCHSTAT	98430000	RD06	SlaunchLatch (commanded latch status) – not implemented – always set to 0.
360	0	16	SMECLOOPMODE	98440000	RD06	SLoopMode
362	0	16	SCANSTART	98460000	RD06	STrajStartPos
364	0	16	SCANEND	98450000	RD06	STrajEndPos
366	0	16	SCANFSPEED	98470000	RD06	SScanFwdSpeed
368	0	16	SCANS	98480000	RD06	SScanNumber
370	0	16	SCANMODE	98490000	RD06	STrajMode
372	0	16	HK_10	10FF0000		Spare
374	0	16	HK_11	10FF0000		Spare
376	0	16	SMECKP	984A0000	RD06	SKp



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078

Issue: Issue 3.0

Date: 2nd August 2010

Page: 78 of 163

Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
378	0	16	SMECKD	984B0000	RD06	SKd
380	0	16	SMECDFILT	984C0000	RD06	SDerivFilter
382	0	16	SMECKI	984D0000	RD06	SKi
384	0	16	SMECINTLIMIT	984E0000	RD06	SIntegrationLimit
386	0	16	SMECINTTHRESH	984F0000	RD06	SIntegration Threshold
388	0	16	HK_12	10FF0000		Spare
390	0	16	SMECRATELIMIT	98510000	RD06	SRateLimit
392	0	16	SMECDFILT2	98520000	RD06	SDerivFilter2
394	0	16	HK_13	10FF0000		Spare
396	0	16	SMECFFGAIN	98540000	RD06	SFeedFwdGain
398	0	16	SMECFFOFFSET	98550000	RD06	SFeedFwdOffset
400	0	16	SCANRSPEED	98560000	RD06	SScanRevSpeed
402	0	16	SMECBEMFGAIN	98900000	RD06	SMotorBEMFGain
404	0	16	SMECMOTORRES	98910000	RD06	SMotorResistance
406	0	16	SMECMOTORBEMF	98920000	RD07	MotorBEMF
408	0	16	SMECRATESCALE	98930000	RD06	SRateScaleFactor
410	0	16	HK_14	10FF0000		Spare
412	0	16	HK_15	10FF0000		Spare
414	0	16	HK_16	10FF0000		Spare
416	0	16	SMECLVDTOFFSET	985E0000	RD06	LVDTOffset
418	0	16	SMECLVDTSCALE	985F0000	RD06	LVDTSCALE
420	0	16	SMECSTAT	98600000	RD06	SMECStatus
422	0	16	SMECENCPOSN	98610000	RD06	SEncoder IncrPosition
424	0	16	SMECENCSIG1	98620000	RD06	SEncoderSignal1
426	0	16	SMECENCSIG2	98630000	RD06	SEncoderSignal2
428	0	16	SMECENCSIG3	98640000	RD06	SEncoderSignal3
430	0	16	SMECLVDTPOSN	98650000	RD06	LVDT position
432	0	16	SMECLVDTACSIG	98660000	RD06	LVDTAC
434	0	16	SMEVLVDTDCSIG	98670000	RD06	LVDTDC
436	0	16	SMECTRAJPOSN	98680000	RD06	TrajectoryPosition
438	0	16	SMECDACVAL	98690000	RD06 RD07	SMECDACValue
440	0	16	SMECPOSNDELTA	986A0000	RD06	EncLVDTPosDelta Position difference encoder/lvdt home
442	0	16	SMECENCFINEPOSN	986B0000	RD06	EncoderFinePosition
444	0	16	HK_17	10FF0000		Spare
446	0	16	HK_18	10FF0000		Spare
448	0	16	SMECMEANSPEED	986E0000	RD06	MeanSpeed
450	0	16	SMECSCANPOSNERR	986F0000	RD06	MeanPositionError
452	0	16	SMECMOTORCURR	98700000	RD06	SMotorCurrent
454	0	16	SMECMOTORVOLT	98710000	RD07	SMotorVoltage
456	0	16	SMECENCSIG1AMP	98570000	RD06	EncoderSignal1Amp
458	0	16	SMECENCSIG1OFF	98580000	RD06	EncoderSignal1Offset
460	0	16	SMECENCSIG2AMP	98590000	RD06	EncoderSignal2Amp
462	0	16	SMECENCSIG2OFF	985A0000	RD06	EncoderSignal2Offset
464	0	16	SMECENCSIG3AMP	985B0000	RD06	EncoderSignal4Amp
466	0	16	SMECENCSIG3OFF	985C0000	RD06	EncoderSignal3Offset
468	0	16	SMECSELECTTABLE	04900000	RD08	SMEC TM Selection Table ID



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078

Issue: Issue 3.0

Date: 2nd August 2010

Page: 79 of 163

Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
470	0	16	CREC_STEP	40070000	RD08	Cooler Recycle VM step number
472	0	16	PTC_STAGE	40070001	RD08	PTC PID VM step number
474	0	16	SCAL_STAGE	40070002	RD08	SCAL PID VM step number
476	0	16	JIGGLE_STEP	40070003	RD08	Jiggle Map step number
478	0	16	SMECLOSTCOUNT	40070004	RD08	Number of times the SMEC has got lost
480	0	16	LIAFAILCOUNT	40070005	RD08	Number of LIAs that have failed
482	0	16	SCANRES	40070006	RD08	Resolution of current SMEC scan)
484	0	16	VM_SMECSIG1OFF	40070007	RD08	SMEC encoder signal 1 offset as determined by the SMEC VM during initialisation
486	0	16	VM_SMECSIG2OFF	40070008	RD08	SMEC encoder signal 2 offset as determined by the SMEC VM during initialisation
488	0	16	TABLE7_09_LWORD	40070009	RD08	Word reserved for monitor table tests on the FS. Not used in flight operations.
490	0	16	CHOPSENSPWR	98C00000	RD06	CSensorPwr
492	0	16	HK_19	10FF0000		Spare
494	0	16	CHOPLOOPMODE	98C20000	RD06	ChopLoopMode
496	0	16	CHOPPOSN	98C30000	RD06	Chop Target Position
498	0	16	CHOPPOSN2	98C40000	RD06	Chop Position 2
500	0	16	HK_20	10FF0000		Spare
502	0	16	BSMMODE	98C60000	RD06	BSMMove ^a
504	0	16	CHOPDERIVGAIN	98C70000	RD07	CKdNed
506	0	16	CHOPKP	98C80000	RD06	CKp
508	0	16	CHOPKD	98C90000	RD06	CKd
510	0	16	CHOPKI	98CA0000	RD06	CKi
512	0	16	CHOPINTREF	98CB0000	RD07	CIntegrationRef
514	0	16	CHOPINTLIMIT	98CC0000	RD06	CIntegLimit
516	0	16	CHOPFFGAIN	98CD0000	RD06	CFeedFwdGain
518	0	16	CHOPFFGAINLARGE	98CE0000	RD07	CFeedForward GainLarge
520	0	16	CHOPDIFFTC1	98CF0000	RD06	DiffFilterTC1
522	0	16	CHOPDIFFTC2	98D00000	RD06	DiffFilterTC2
524	0	16	CHOPRATELIMIT	98D10000	RD06	CRateLimit
526	0	16	CHOPMOTBEMFGAIN	98D20000	RD06	CMotorBEMFGain
528	0	16	CHOPMOTRES	98D30000	RD06	CMotorResistance
530	0	16	CHOPMOTIND	98D40000	RD06	CMotorInductance
532	0	16	CHOPRATESCALE	98D50000	RD07	CRateScaleFactor (NYI)
534	0	16	CHOPPOSNSCALE	98D60000	RD07	ChopPositionScaleFactor
536	0	16	CHOPBEMFRATEFILT1	98D70000	RD06	CBEMFRateFilter1
538	0	16	CHOPBEMFRATEFILT2	98D80000	RD06	CBEMFRateFilter2
540	0	16	CHOPJIGGCCOUPLE	98D90000	RD07	C2JCcrosscoupling
542	0	16	BSMSTAT	99000000	RD07	BSMStatus
544	0	16		10FF0000	RD08	Spare
546	0	16	CHOPPOSNERR	99020000	RD06	CMeanPosError
548	0	16	CHOPSENSSIG	99030000	RD06	CMagResSignal
550	0	16	CHOPDACVAL	99040000	RD06	CDACValue
552	0	16	CHOPMOTORCURR	99050000	RD06	CMotorCurrent
554	0	16	CHOPMOTORVOLT	99060000	RD06	CVoltage
556	0	16	HK_21	10FF0000	RD08	Spare
558	0	16	JIGGSENSPWR	99400000	RD06	JSensorPwr



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078

Issue: Issue 3.0

Date: 2nd August 2010

Page: 80 of 163

Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
560	0	16	HK_22	10FF0000	RD08	Spare
562	0	16	JIGGLOOPMODE	99420000	RD06	JigLoopMode
564	0	16	JIGGPOSN	99430000	RD06	JigTargetPos
566	0	16	JIGGPOSN2	99440000	RD06	JigTargetPos2
568	0	32	PTC_GET_COMMAND 16 MSB	5007000A	RD08	Reports the PTC temperature command in use (or last used) by the PTC VM Null SUBKTEMP Thermistor1 Thermistor2 Thermistor3 PSW-T1 PSW-T2 PMW-T1 PMW-T2 PLW-T1 PLW-T2
			PTC_GET_COMMAND 16 LSB	4007000A		
572	0	16	JIGGDERIVGAIN	99470000	RD07	JKdNeg
574	0	16	JIGGKP	99480000	RD06	JKp
576	0	16	JIGGKD	99490000	RD06	JKd
578	0	16	JIGGKI	994A0000	RD06	JKi
580	0	16	JIGGINTREF	994B0000	RD06	JIntegrationRef
582	0	16	JIGGINTLIMIT	994C0000	RD06	JIntegLimint
584	0	16	JIGGFFGAIN	994D0000	RD06	JFeedForwardGain
586	0	16	JIGGFFGAINLARGE	994E0000	RD07	JFeedForwardGainLarge
588	0	16	JIGG DIFFTC1	994F0000	RD06	JDiffFilterTC1
590	0	16	JIGG DIFFTC2	99500000	RD06	JdiffFilterTC2
592	0	16	JIGGRATELIMIT	99510000	RD06	JRateLimit
594	0	16	JIGGMOTBEMFGAIN	99520000	RD06	JMotorBEMFGain
596	0	16	JIGGMOTRES	99530000	RD06	JMotorResistance
598	0	16	JIGGMOTIND	99540000	RD06	JMotorInductance
600	0	16	JIGGRATESCALE	99550000	RD07	JRateScaleFactor
602	0	16	JIGGPOSNSCALE	99560000	RD07	JigPositionScalefactor
604	0	16	JIGG BEMFRATEFIL1	99570000	RD06	JBEMFRateFilter1
606	0	16	JIGG BEMFRATEFIL2	99580000	RD06	JBENFRateFilter2
608	0	16	JIGGCHOPCOUPLE	99590000	RD07	J2CCrosscoupling
610	0	32	SCAL_GET_COMMAND 16 MSB	5007000B	RD08	Reports the SCAL temperature command in use (or last used) by the SCAL VM Null SCAL2 SCAL4
			SCAL_GET_COMMAND 16 LSB	4007000B		
614	0	16	JIGGPOSNERR	99820000	RD06	JMeanPosError
616	0	16	JIGGSENSSIG	99830000	RD06	JMagREsSignal
618	0	16	JIGGDACVAL	99840000	RD06	JDACValue
620	0	16	JIGGMOTORCURR	99850000	RD06	JMotorCurrent
622	0	16	JIGGMOTORVOLT	99860000	RD07	JVoltage
624	0	16	MCUPCKT10PARAM05	99C60000	RD07	Pack10Param5 (SMEC science frame Parameter 5)
626	0	16	MCUPCKT10PARAM01	99C70000	RD06	Pack10Param1 (SMEC science frame Parameter 1)



Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
628	0	16	MCUPCKT10PARAM02	99C80000	RD06	Pack10Param2 (SMEC science frame Parameter 2)
630	0	16	MCUPCKT10PARAM03	99C90000	RD06	Pack10Param3 (SMEC science frame Parameter 3)
632	0	16	MCUPCKT10PARAM04	99CA0000	RD06	Pack10Param4 (SMEC science frame Parameter 4)
634	0	16	MCUPCKT12PARAM01	99CB0000	RD06	Pack12Param1 (BSM science frame Parameter 1)
636	0	16	MCUPCKT12PARAM02	99CC0000	RD06	Pack12Param2 (BSM science frame Parameter 2)
638	0	16	MCUPCKT12PARAM03	99CD0000	RD06	Pack12Param3 (BSM science frame Parameter 3)
640	0	16	MCUPCKT12PARAM04	99CE0000	RD06	Pack12Param4 (BSM science frame Parameter 4)
642	0	16	MCUPCKT12PARAM05	99CF0000	RD06	Pack12Param5 (BSM science frame Parameter 5)
644	0	16	MCUPCKT12PARAM06	99D00000	RD06	Pack12Param6 (BSM science frame Parameter 6)
646	0	16	MCUPCKT14PARAM01	99D10000	RD06	Pack14Param1 (MCU eng frame Parameter 1)
648	0	16	MCUPCKT14PARAM02	99D20000	RD06	Pack14Param2 (MCU eng frame Parameter 2)
650	0	16	MCUPCKT14PARAM03	99D30000	RD06	Pack14Param3 (MCU eng frame Parameter 3)
652	0	16	MCUPCKT14PARAM04	99D40000	RD06	Pack14Param4 (MCU eng frame Parameter 4)
654	0	16	MCUPCKT14PARAM05	99D50000	RD06	Pack14Param5 (MCU eng frame Parameter 5)
656	0	16	MCUPCKT14PARAM06	99D60000	RD06	Pack14Param6 (MCU eng frame Parameter 6)
658	0	16	MCUPCKT14PARAM07	99D70000	RD06	Pack14Param7 (MCU eng frame Parameter 7)
660	0	16	MCUPCKT14PARAM08	99D80000	RD06	Pack14Param8 (MCU eng frame Parameter 8)
662	0	16	MCUPCKT14PARAM09	99D90000	RD06	Pack14Param9 (MCU eng frame Parameter 9)
664	0	16	MCUPCKT14PARAM10	99DA0000	RD06	Pack14Param10 (MCU eng frame Parameter 10)
666	0	16	MCUPCKT14PARAM11	99DB0000	RD06	Pack14Param11 (MCU test frame Parameter 11)
668	0	16	MCUPCKT14PARAM12	99DC0000	RD06	Pack14Param12 (MCU eng frame Parameter 12)
670	0	16	MCUPCKT14PARAM13	99DD0000	RD06	Pack14Param13 (MCU eng frame Parameter 13)
672	0	16	MCUPCKT14PARAM14	99DE0000	RD06	Pack14Param14 (MCU eng frame Parameter 14)
674	0	16	HK_23	10FF0000	RD08	Spare
676	0 0 1 1 2 3 4	1 1 1 1 1 2	SCUIFSTAT SCUIFOLAPERR SCUIFBCASTERR SCUIFREADERR SCUIFTOUTERR SCUIFCMDSTAT	A8000000	RD06	CmdIfStat Command Overlapped Forbidden Broadcast Forbidden Read SubSystem Timeout LastCmdStatus



Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
678	0 0 1 2	16 1 1 1	SCUIFCTRL SCUDATIFRESET SCUSSRESET SCUIFSTATRESET	A8010000	RD06	CmdIfCtrl DataIfReset SubSystemRst StatusRst
680	0	16	SCUSSDEL	A8020000	RD06	Subsystem Delay
682	0	16	SCUSTAT	A8800000	RD06	ScuStatus
684	0	16	SCUTEMPSTAT	A8850000	RD06	TempOnOff
686	0	16	SCUDCDCSTAT	A8870000	RD06	DRelOnOff
688	0	16	SCUP5V	A8D00000	RD06	ScuCHTp05
690	0	16	SCUP9V	A8CF0000	RD06	ScuCHTp09
692	0	16	SCUM9V	A8CE0000	RD06	ScuCHTn09
694	0	16	SPHSV	A8C50000	RD06	SPHSHeatB
696	0	16	EVHSV	A8C40000	RD06	EVHSHeatB
698	0	16	TCHTRV	A8C60000	RD06	TCHeaterB
700	0	16	SPHTRV	A8C70000	RD06	SPHeaterB
702	0	16	CCUTEMP	A8C00000	RD06	CsuTempRd
704	0	16	TCUTEMP	A8C10000	RD06	TsuTempRd
706	0	16	PSUTEMP1	A8C20000	RD06	PsuTmp1Rd
708	0 0 15	16 8 1	SCUFRAMECONF SCUFRAMERATE SCUFRAMETYPE	A8830000	RD06 RD06	FrameConf FrameRate
710	0	16	SCUFRAMES	A8840000	RD06	SeqLength
712	0	16	SCUFRAMESTAT	A8820000	RD06	FrameCtrl
714	0	16	SCUCTRL	A8810000	RD06	ScuContrl
716	0	16	PCALV	A8C90000	RD06	PhCalVolt
718	0	16	SCAL2V	A8CB0000	RD06	SCal2Volt
720	0	16	SCAL4V	A8CD0000	RD06	SCal4Volt
722	0	16	SCUCHT2.5V	A8D10000	RD06	ScuCHT25
724	0	16	SCUCHTREF	A8D20000	RD06	ScuCHTRef
726	0	16	SCUCHTGND	A8D30000	RD06	ScuCHTGnd
728	0	16	PCALCURR	A8C80000	RD06	PhCalBias
730	0	16	SCAL2CURR	A8CA0000	RD06	SCal2Bias
732	0	16	SCAL4CURR	A8CC0000	RD06	Scal4Bias
734	0	16	PSUTEMP2	A8C30000	RD06	PsuTmp2Rd
736	0	16	SUBKSTAT	A8860000	RD06	SubKpOnOff
738	0	32	TABLE7_12	5007000C 4007000C	RD08	Contents of 32-bit word in Table 7, Index 12
742	0	16	PUMPHTRTEMP	A8E00000	RD06	CPHPtemp
744	0	16	PUMPHSTEMP	A8E10000	RD06	CPHStemp
746	0	16	EVAPHSTEMP	A8E20000	RD06	CEHStemp
748	0	16	SHUNTTEMP	A8E30000	RD06	CSHTtemp
750	0	16	SOBTEMP	A8E40000	RD06	SOBtemp
752	0	16	SL0TEMP	A8E50000	RD06	SL0temp
754	0	16	PL0TEMP	A8E60000	RD06	PL0temp
756	0	16	OPTTEMP	A8E70000	RD06	SUBtemp
758	0	16	BAFTEMP	A8E80000	RD06	BAFtemp
760	0	16	BSMIFTEMP	A8E90000	RD06	BSMtemp
762	0	16	SCAL2TEMP	A8EA0000	RD06	SCL2temp
764	0	16	SCAL4TEMP	A8EB0000	RD06	SCL4temp
766	0	16	SCALTEMP	A8EC0000	RD06	SCSTtemp
768	0	16	SMECIFTEMP	A8ED0000	RD06	FTSStemp
770	0	16	SMECTEMP	A8EE0000	RD06	FTSMtemp



Location	Field Offset (bits)	Field Length (bits)	Parameter Name	CMD	Ref.	Description
772	0	16	BSMTEMP	A8EF0000	RD06	BSMMtemp
774	0	16	SUBKTEMP	A8F00000	RD06	CEVTemp
776	0	16	SCUTHTREF	A8F10000	RD06	ScuTHTRef
778	0	16	SCUTHTGND	A8F20000	RD06	ScuTHTGnd
780	0	16	LOSTTCBLOCK	10580000	RD08	Number of unallocated memory blocks for TC packets
782	0	16	LOSTEVBLOCK	10590000	RD08	Number of unallocated memory blocks for Event/Error/Alarm TM packets
784	0	16	LOSTHKBLOCK	105A0000	RD08	Number of unallocated memory blocks for HouseKeeping TM packets
786	0	16	LOSTSDBLOCK	105B0000	RD08	Number of unallocated memory blocks for Science TM packets
788	0	16	LOSTNTBLOCK	105C0000	RD08	Number of unallocated memory blocks for NON- TM temporary packet (IFSI use only)
790	0	16	LOSTRPBLOCK	105D0000	RD08	Number of unallocated memory blocks for Report TM packets

^a - When the BSM is commanded to move synchronously on both axes by sending the BSMMove command : 0x90C60001 the MCU BSMMODE HK parameter is set to 3 instead of 1. Although this setting is wrong as there is no such mode 3 (only modes 0,1 and 2 exist), the actual behaviour of the BSM is according to command , i.e., the BSM moves synchronously on both axis after sending of the command 0x90C60001. This behaviour is due to a bug in the MCU software but it has no consequences on BSM operation.

^b – Reports the commanded Vss for SSW-JFET2 which includes the bolometer SSW-E5 (see RD12)

^c – Reports the commanded Vss for SSW-JFET1 which includes the bolometer SSW-R1 (see RD12)



4.2.4 Unused Service

Not Available

4.2.5 Event Reporting

4.2.5.1 Event Report (5,1)

These reports provide information on events in the instrument which may impact on the scientific results, but which should have no impact on the health and safety of the instrument. These will include the reporting of anomalies which have been dealt with by the DPU. The following sub-sections cover the majority of the possible event reports but for the latest and complete list please refer to RD08.

4.2.5.1.1 New Step Report

Indicates a new step in the current operation Mode. This event is issued every time the MODE or STEP Number is changed

000001	APID1
11	Count
	Length = 29
00000000000000000101	
00000000010000000000	
TIME	
EVENTID_NSR = 0x0501	
SID_NSR = 0x5100	
OBSID_NSR	
BBID_NSR	
EVENTCOUNT_NSR	
MODE_NSR	
STEP_NSR	
Checksum	

Parameter	Comment
EVENTID_NSR	0x0501
SID_NSR	0x5100
OBSID_NSR	Observation ID
BBID_NSR	Building Block ID
EVENTCOUNT_NSR	Sequential counter for TM(5,1) events
MODE_NSR	Current Mode
STEP_NSR	Step Number



4.2.5.1.2 Peak Up Report

This report is issued at the end of a peak up operation (see AD04 for full definition of this report)

000001	APID1
11	Count
Length =31	
00000000000000000101	
00000000010000000000	
TIME	
EVENTID_PUR = 0x0504	
SID_PUR = 0x5101	
OBSID_PUR	
BBID_PUR	
EVENTCOUNT_PUR	
INSTRID_PUR	
THETAY_PUR	
THETAZ_PUR	
Checksum	

Parameter	Comment
EVENTID_PUR	0x0504
SID_PUR	0x5101
OBSID_PUR	Observation ID
BBID_PUR	Building Block ID
EVENTCOUNT_PUR	Sequential counter for TM(5,1) events
INSTRID_PUR	Instrument ID = 0x0002
THETAY_PUR	Rotation angle about Y axis
THETAZ_PUR	Rotation angle about Z axis

4.2.5.1.3 Peak Up Not Found

This report is issued at the end of a peak up operation if the peak up procedure failed to find a peak

000001	APID1
11	Count
Length =31	
00000000000000000101	
00000000010000000000	
TIME	
EVENTID_PNF = 0x0506	
SID_PNF = 0x5101	
OBSID_PNF	
BBID_PNF	
EVENTCOUNT_PNF	
Checksum	

Parameter	Comment
EVENTID_PNF	0x0506
SID_PNF	0x5101
OBSID_PNF	Observation ID
BBID_PNF	Building Block ID
EVENTCOUNT_PNF	Sequential counter for TM(5,1) events

4.2.5.1.4



4.2.5.1.5 Peak Up Procedure Aborted

This report is issued at the end of a peak up operation if the peak up procedure failed to find a peak

0	0	0	0	1	APID1									
1	1	Count												
Length =31														
0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME														
EVENTID_PUA= 0x0507														
SID_PUA= 0x5101														
OBSID_PUA														
BBID_PUA														
EVENTCOUNT_PUA														
Checksum														

Parameter	Comment
EVENTID_PUA	0x0507
SID_PUA	0x5101
OBSID_PUA	Observation ID
BBID_PUA	Building Block ID
EVENTCOUNT_PUA	Sequential counter for TM(5,1) events



4.2.5.1.6 Unknown Command Report

In response to a command the DRCU indicated that the Command ID was not known

0	0	0	0	1	APID1										
1	1	Count													
Length = 33															
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME															
EVENTID_UCR = 0x0509															
SID_UCR = 0x5103															
OBSID_UCR															
BBID_UCR															
EVENTCOUNT_UCR															
COMMAND_UCR															
ACK_UCR															
Checksum															

Parameter	Comment
EVENTID_UCR	0x0509 (MSB set when condition cleared)
SID_UCR	0x5103
OBSID_UCR	Observation ID
BBID_UCR	Building Block ID
EVENTCOUNT_UCR	Sequential counter for TM(5,1) events
COMMAND_UCR	copy of command sent to DRCU (32 bits)
ACK_UCR	Echo of command most significant word received by the DPU (32bits)

4.2.5.1.7 Forbidden Command Report

In response to a command the DRCU indicated that the Command ID was forbidden

0	0	0	0	1	APID1										
1	1	Count													
Length = 33															
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME															
EVENTID_FCR = 0x050A															
SID_FCR = 0x5104															
OBSID_FCR															
BBID_FCR															
EVENTCOUNT_FCR															
COMMAND_FCR															
RESPONSE_FCR															
Checksum															

Parameter	Comment
EVENTID_FCR	0x050A (MSB set when condition cleared)
SID_FCR	0x5104
OBSID_FCR	Observation ID
BBID_FCR	Building Block ID
EVENTCOUNT_FCR	Sequential counter for TM(5,1) events
COMMAND_FCR	copy of command sent to DRCU (32 bits)
RESPONSE_FCR	Copy of command echo returned by DRCU (32bits)



4.2.5.1.8 Frame ID Error

When copying data frames from the FIFO to the internal science data buffer, the frame ID is not correct. (The DPU should also execute a procedure to resynchronise with the science data in the FIFO).

0	0	0	0	1	APID1										
1	1	Count													
Length = 29															
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
TIME															
EVENTID															
SID_FIE = 0x5105															
OBSID															
BBID															
EVENTCOUNT															
FRAMEID															
FIFOID															
Checksum															

Parameter	Comment
EVENTID	0x2578 DCU 0x2579 MCU 0x257A SCU (MSB set when condition cleared)
SID	0x5105
OBSID	Observation ID
BBID	Building Block ID
EVENTCOUNT	Sequential counter for TM(5,1) events
FRAMEID	The Frame ID received from the DRCU
FIFOID	The ID of the FIFO where the frame has been received



4.2.5.1.9 Frame Length Error

When copying data frames from the FIFO to the internal science data buffer, the frame length is not correct (RD06).

0	0	0	0	1	APID1									
1	1	Count												
Length = 31														
0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME														
EVENTID														
SID = 0x5106														
OBSID														
BBID														
EVENTCOUNT														
FRAMEID														
LENGTHRD														
LENGTHEX														
Checksum														

Parameter	Comment
EVENTID	0x2540 PHOTF 0x2541 SPECF 0x2542 PSW 0x2543 PMW 0x2544 PLW 0x2545 SSW 0x2546 SLW 0x2547 PHOTOFF 0x2548 SPECOFF 0x2549 PHOTFTEST 0x254A PSWTEST 0x254B PMWTEST 0x254C PLWTEST 0x254D SPECFTTEST 0x254E SSWTEST 0x254F SLWTEST 0x2560 SMEC 0x2561 BSM 0x2563 MCUENG 0x2565 MCUTEST 0x2570 SCU 0x2571 SCUTEST (MSB set when condition cleared)
SID	0x5106
OBSID	Observation ID
BBID	Building Block ID
EVENTCOUNT	Sequential counter for TM(5,1) events
FRAMEID	The Frame ID received from the DRCU
LENGTHRD	Frame length as read from the DRCU frame
LENGTHEX	Expected frame length for that frame ID



4.2.5.1.10 Frame Checksum Error

When copying data frames from the FIFO to the internal science data buffer, the Checksum word at the end of the frame is not correct.

0	0	0	0	1	APID1									
1	1	Count												
Length = 31														
0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME														
EVENTID														
SID = 0x5107														
OBSID														
BBID														
EVENTCOUNT														
FIFOID														
CHKWORDEX														
CHKWORDRD														
Checksum														

Parameter	Comment
EVENTID	0x2550 PHOTF 0x2551 SPECFCF 0x2552 PSW 0x2553 PMW 0x2554 PLW 0x2555 SSW 0x2556 SLW 0x2557 PHOTOFF 0x2558 SPECOFF 0x2559 PHOTFTEST 0x255A PSWTEST 0x255B PMWTEST 0x255C PLWTEST 0x255D SPECFTTEST 0x255E SSWTEST 0x255F SLWTEST 0x2568 SMEC 0x2569 BSM 0x256B MCUENG 0x256D MCUTEST 0x2574 SCU 0x2575 SCUTEST (MSB set when condition cleared)
SID	0x5107
OBSID	Observation ID
BBID	Building Block ID
EVENTCOUNT	Sequential counter for TM(5,1) events
FIFOID	ID of the FIFO where the frame was read from
CHKWORDEX	XOR checksum computed on the read frame
CHKWORDRD	Checksum word read at the end of the received frame



4.2.5.1.11 Subsystem Timeout Error

This is issued when the DRCU responds with a timeout to a sent command.

000001	APID1
11	Count
Length = 33	
00000000000000000101	
00000000010000000000	
TIME	
EVENTID_STE = 0x050B	
SID_STE = 0x5108	
OBSID_STE	
BBID_STE	
EVENTCOUNT_STE	
COMMAND_STE	
RESPONSE_STE	
Checksum	

Parameter	Comment
EVENTID_STE	0x050B (MSB set when condition cleared)
SID_STE	0x5108
OBSID_STE	Observation ID
BBID_STE	Building Block ID
EVENTCOUNT_STE	Sequential counter for TM(5,1) events
COMMAND_STE	Copy of command sent to DRCU (32 bits)
RESPONSE_STE	Copy of command echo returned by DRCU (32bits)

4.2.5.1.12 Subsystem Response Error

This is issued when there is an error in the transmission of a GET command to the DRCU, i.e. when the CID returned by the DRCU is not identical to the CID sent.

000001	APID1
11	Count
Length = 37	
00000000000000000101	
00000000010000000000	
TIME	
EVENTID	
SID = 0x5109	
OBSID	
BBID	
EVENTCOUNT	
COMMAND	
RESPONSE	
Checksum	

Parameter	Comment
EVENTID	0x050C DCU 0x050D MCU 0x050E SCU (MSB set when condition cleared)
SID	0x5109
OBSID	Observation ID
BBID	Building Block ID
EVENTCOUNT	Sequential counter for TM(5,1) events
COMMAND	Copy of command sent to DRCU (32 bits)
RESPONSE	Copy of command echo returned by DRCU (32bits)



4.2.5.1.13 DPU Pool Error

This (a warning more than an error) is issued when the DPU internal memory pools (where the TM packets are stored before being sent to the 1553 I/F, it will be detailed in the ADD some time) reach a 80% occupation.

0	0	0	0	1	APID1									
1	1	Count												
Length = 37														
0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME														
EVENTID														
SID = 0x510A														
OBSID														
BBID														
EVENTCOUNT														
POOLID														
NPKT														
MAXPKT														
TERROR														
Checksum														

Parameter	Comment
EVENTID	0x1500 TC Pool 0x1501 Event Pool 0x1502 HK Pool 0x1503 Science Data Pool 0x1505 Report TM Pool (MSB set when condition cleared)
SID	0x510A
OBSID	Observation ID
BBID	Building Block ID
EVENTCOUNT	Sequential counter for TM(5,1) events
POOLID	ID of the VIRTUOSO Pool which failed to allocate block. IDs are defined in RD08
NPKT	Number of packets currently present in pool
MAXPKT	Maximum number of packets in pool
TERROR	Time When Error Occurred (48 bits)



4.2.5.1.14 DPU FIFO Error

This (a warning more than an error) is issued when the DPU internal VIRTUOSO FIFOs (used to exchange messages between OBS tasks, it will be detailed in the ADD some time) reach a 70% occupation.

0	0	0	0	1	APID1										
1	1	Count													
Length = 37															
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
TIME															
EVENTID															
SID = 0x510B															
OBSID															
BBID															
EVENTCOUNT															
FIFOID															
NMSG															
MAXMSG															
TERROR															
Checksum															

Parameter	Comment
EVENTID	0x1510 TC High Priority FIFO 0x1511 TC Low Priority FIFO 0x1512 Event TM FIFO 0x1513 HK TM FIFO 0x1514 Science Data TM FIFO 0x1515 Report TM FIFO 0x1516 LS High Priority FIFO 0x1517 LS Low Priority FIFO 0x1518 Autonomy Function FIFO 0x1519 VM TM FIFO 0x151A Memory Dump FIFO (MSB set when condition cleared)
SID	0x510B
OBSID	Observation ID
BBID	Building Block ID
EVENTCOUNT	Sequential counter for TM(5,1) events
FIFOID	ID of the VIRTUOSO FIFO
NMSG	Number of messages currently present in FIFO
MAXMSG	Maximum number of messages in FIFO
TERROR	Time When Error Occurred (48 bits)



4.2.5.1.15 LS Overflow Error

The number of commands send to the DRCU exceeds the maximum allowed rate.

0	0	0	0	1	APID1												
1	1	Count															
Length = 29																	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
TIME																	
EVENTID_LOE = 0x050F																	
SID_LOE = 0x510C																	
OBSID_LOE																	
BBID_LOE																	
EVENTCOUNT_LOE																	
LSLOAD_LOE																	
Checksum																	

Parameter	Comment
EVENTID_LOE	0x050F (MSB set when condition cleared)
SID_LOE	0x510C
OBSID_LOE	Observation ID
BBID_LOE	Building Block ID
EVENTCOUNT_LOE	Sequential counter for TM(5,1) events
LSLOAD_LOE	Number of microsecs that the LSL was busy during the last second



4.2.5.1.16 Unknown TM Packet Error

A TM packet ready to be sent has an unknown combination of Type/Subtype and SID

0	0	0	0	1	APID1											
1	1	Count														
Length = 31																
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
TIME																
EVENTID_UTPE = 0x0510																
SID_UTPE = 0x510D																
OBSID_UTPE																
BBID_UTPE																
EVENTCOUNT_UTPE																
														TYPE_UTPE		
SUBTYPE_UTPE																
SID_UTPE																
Checksum																

Parameter	Comment
EVENTID_UTPE	0x0510
SID_UTPE	0x510D
OBSID_UTPE	Observation ID
BBID_UTPE	Building Block ID
EVENTCOUNT_UTPE	Sequential counter for TM(5,1) events
TYPE_UTPE	Type and subtype of unknown TM packet (copy of part of TM packet Data Field Header)
SUBTYPE_UTPE	
SID_UTPE	SID of unknown TM packet

4.2.5.1.17 No DCU Response Error

The DCU does not respond to a "SET" or "GET" command in time.

0	0	0	0	1	APID1											
1	1	Count														
Length = 29																
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
TIME																
EVENTID_NDRE = 0x0520																
SID_NDRE = 0x510E																
OBSID_NDRE																
BBID_NDRE																
EVENTCOUNT_NDRE																
COMMAND_NDRE																
Checksum																

Parameter	Comment
EVENTID_NDRE	0x0520 (MSB set when condition cleared)
SID_NDRE	0x510E
OBSID_NDRE	Observation ID
BBID_NDRE	Building Block ID
EVENTCOUNT_NDRE	Sequential counter for TM(5,1) events
COMMAND_NDRE	Copy of command sent to DRCU (32bits)



4.2.5.1.18 No MCU Response Error

The MCU does not respond to a “SET” or “GET” command.

0	0	0	0	1	APID1										
1	1	Count													
Length = 29															
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
TIME															
EVENTID_NMRE = 0x0521															
SID_NMRE = 0x510F															
OBSID_NMRE															
BBID_NMRE															
EVENTCOUNT_NMRE															
COMMAND_NMRE															
Checksum															

Parameter	Comment
EVENTID_NMRE	0x0521 (MSB set when condition cleared)
SID_NMRE	0x510F
OBSID_NMRE	Observation ID
BBID_NMRE	Building Block ID
EVENTCOUNT_NMRE	Sequential counter for TM(5,1) events
COMMAND_NMRE	Copy of command sent to DRCU (32bits)

4.2.5.1.19 No SCU Response Error

The SCU does not respond to a “SET” or “GET” command.

0	0	0	0	1	APID1										
1	1	Count													
Length = 29															
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
TIME															
EVENTID_NSRE = 0x0522															
SID_NSRE = 0x5110															
OBSID_NSRE															
BBID_NSRE															
EVENTCOUNT_NSRE															
COMMAND_NSRE															
Checksum															

Parameter	Comment
EVENTID_NSRE	0x0522 (MSB set when condition cleared)
SID_NSRE	0x5110
OBSID_NSRE	Observation ID
BBID_NSRE	Building Block ID
EVENTCOUNT_NSRE	Sequential counter for TM(5,1) events
COMMAND_NSRE	Copy of command sent to DRCU (32bits)



4.2.5.1.20 TC Sequence Error

This event is issued when there is a gap in the TC sequence number.

0	0	0	0	1	APID1										
1	1	Count													
Length = 29															
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
TIME															
EVENTID_TSE = 0x0511															
SID_TSE = 0x5111															
OBSID_TSE															
BBID_TSE															
EVENTCOUNT_TSE															
LAST_TC_COUNT_TSE															
CURR_TC_COUNT_TSE															
Checksum															

Parameter	Comment
EVENTID_TSE	0x0511
SID_TSE	0x5111
OBSID_TSE	Observation ID
BBID_TSE	Building Block ID
EVENTCOUNT_TSE	Sequential counter for TM(5,1) events
LAST_TC_COUNT_TSE	Previous TC PTD Counter
CURR_TC_COUNT_TSE	Current TC PTD Counter



4.2.5.1.21 Parameter Limit Report

00001	APID1
11	Count
Length=25	
0000000000000000101	
0000000010000000000	
TIME	
EVENTID	
SID = 0x5112	
OBSID	
BBID	
EVENTCOUNT	
PARMCMD	
PARTMECHO	
PARMVALUE	
Checksum	

Parameter	Comment
EVENTID	0x7001 Nominal -> Warning 0x7002 Nominal -> Fail 0x7010 Warning -> Nominal 0x7012 Warning -> Fail 0x7020 Fail -> Nominal 0x7021 Fail -> Warning
SID	0x5112
OBSID	Observation ID
BBID	Building Block ID
EVENTCOUNT	Sequential counter of events of this type/subtype
PARMCMD	32 bit Get parameter command
PARMECHO	32 bit Echo word
PARMVALUE	Value of the Monitoring Parameter which was read



4.2.5.1.22 VM Event Report

This event is issued by VMs for information

0	0	0	0	1	APID1									
1	1	Count												
Length = 29														
0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME														
EVENTID														
SID_VM= 0x5113														
OBSID_VM														
BBID_VM														
EVENTCOUNT_VM														
Parameters.....														
Checksum														

Parameter	Comment
EVENTID	0501 Set CREC STEP 0520 ERROR_NO_DCU_RES 0521 ERROR_NO_MCU_RES 0522 ERROR_NO_SCU_RES 050C ERROR_LS_DCU_RX 050D ERROR_LS_MCU_RX 050E ERROR_LS_MCU_RX 0509 ERROR_LS_CID_UNKNOWN 050A ERROR_LS_CID_FORBIDDEN 050B ERROR_SS_TIMEOUT 7000 CHOP Input Parameter Error Td too short 7001 CHOP Input Parameter Error Td too long 7020 CREC General Timeout 7025 CREC Timeout sph 7021 CREC Timeout cptl 7022 CREC Timeout cpt 7023 CREC Timeout pc 7024 CREC Global Timeout 7030 StepAndChop Error 7700 Flash Bad Cycle Time 7701 Flash Bad Delay Time 7702 FnDrcu Input Parameter Error
SID_VM	0x5113
OBSID_VM	Observation ID
BBID_VM	Building Block ID
EVENTCOUNT_VM	Sequential counter for TM(5,1) events
Parameters	Variable list of parameters



4.2.5.1.23 Memory Dump Aborted

This event is issued when the memory dump procedure has been aborted by Telecommand

00001	APID1
11	Count
Length = 29	
00000000000000000101	
00000000100000000000	
TIME	
EVENTID_MDA= 0x0607	
SID_MDA= 0x5114	
OBSID_MDA	
BBID_MDA	
EVENTCOUNT_MDA	
Checksum	

Parameter	Comment
EVENTID_MDA	0x0607
SID_MDA	0x5114
OBSID_MDA	Observation ID
BBID_MDA	Building Block ID
EVENTCOUNT_MDA	Sequential counter for TM(5,1) events

4.2.5.1.24 Memory Dump Error

This event is issued when the memory dump is aborted because of failed memory block allocation

00001	APID1
11	Count
Length = 29	
00000000000000000101	
00000000100000000000	
TIME	
EVENTID_MDE= 0x0608	
SID_MDE= 0x5114	
OBSID_MDE	
BBID_MDE	
EVENTCOUNT_MDE	
Checksum	

Parameter	Comment
EVENTID_MDE	0x0608
SID_MDE	0x5114
OBSID_MDE	Observation ID
BBID_MDE	Building Block ID
EVENTCOUNT_MDE	Sequential counter for TM(5,1) events



4.2.5.1.25 PM CRC Error

This event is issued when the CRC computed over the specified PM range is different from what it should be.

00001	APID1
11	Count
Length = 29	
00000000000000000101	
00000000100000000000	
TIME	
EVENTID_PMCRC= 0x0513	
SID_PMCRC= 0x5115	
OBSID_PMCRC	
BBID_PMCRC	
EVENTCOUNT_PMCRC	
TRUE_CRC_PMCRC	
COMPUTED_CRC_PMCRC	
Checksum	

Parameter	Comment
EVENTID_PMCRC	0x0513
SID_PMCRC	0x5115
OBSID_PMCRC	Observation ID
BBID_PMCRC	Building Block ID
EVENTCOUNT_PMCRC	Sequential counter for TM(5,1) events
TRUE_CRC_PMCRC	Expected CRC (Uplinked)
COMPUTED_CRC_PMCRC	Computed CRC

4.2.5.1.26 DM CRC Error

This event is issued when at least one DM cell has erroneous behaviour

00001	APID1
11	Count
Length = 29	
00000000000000000101	
00000000100000000000	
TIME	
EVENTID_DMCRC= 0x0514	
SID_DMCRC= 0x5116	
OBSID_DMCRC	
BBID_DMCRC	
EVENTCOUNT_DMCRC	
ERRORSUM_DMCRC	
Checksum	

Parameter	Comment
EVENTID_DMCRC	0x0514
SID_DMCRC	0x5116
OBSID_DMCRC	Observation ID
BBID_DMCRC	Building Block ID
EVENTCOUNT_DMCRC	Sequential counter for TM(5,1) events
ERRORSUM_DMCRC_	32 bit sum of error pattern found on cell tested



4.2.5.1.27 Timesync ID error

This event is issued when there is no updated time information received from CDMS at start of frame sync

0	0	0	0	1	APID1									
1	1	Count												
Length = 29														
0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME														
EVENTID_TSY = 0x0512														
SID_TSY= 0x5117														
OBSID_TSY														
BBID_TSY														
EVENTCOUNT_TSY														
NEXT_SYNC_TIME_TSY														
CURR_HRES_TIME_TSY														
PREV_HRES_TIME_TSY														
Checksum														

Parameter	Comment
EVENTID_TSY	0x0512
SID_TSY	0x5117
OBSID_TSY	Observation ID
BBID_TSY	Building Block ID
EVENTCOUNT_TSY	Sequential counter for TM(5,1) events
NEXT_SYNC_TIME_TSY	Expected time at next Sync
CURR_HRES_TIME_TSY	High Resolution time at this sync
PREV_HRES_TIME_TSY	High Resolution time at previous sync



4.2.5.2 Exception Report (5,2)

These reports normally indicate an anomaly with the instrument that cannot be dealt with by the DPU and that action should be taken by the spacecraft.

Most are generated by the autonomy functions implementing the FDIR

4.2.5.2.1 Anomaly without parameters

0	0	0	0	1	APID1								
1	1	Count											
Length=25													
0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME													
EVENTID_AWP													
SID_AWP = 0x5200													
OBSID_AWP													
BBID_AWP													
EVENTCOUNT_AWP													
Checksum													

Parameter	Comment
EVENTID_AWP	Event ID – see table below
SID_AWP	0x5200
OBSID_AWP	Observation ID
BBID_AWP	Building Block ID
EVENTCOUNT_AWP	Sequential counter of events of this type/subtype

Error	EVENTID_AWP	Event ID – see table below
DRCU_Anomaly	0xC000	OBS has detected an unrecoverable anomaly in the DRCU. The expected action is for the CDMS to switch off the DRCU.
DPU_Anomaly	0xC010	OBS has detected an unrecoverable anomaly in the DPU. The expected action is for the CDMS to switch off the DPU and DRCU.
Observation_Anomaly	0xC100	OBS has detected a problem during an observation. The expected action is for the CDMS to suspend SPIRE commanding until the instrument is ready to resume.
Observation_Corrected	0xC110	The OBS has corrected and observation anomaly - Resume SPIRE Commanding with the next subschedule.
Function_Unarmed	0x0832	Attempt to engage or disengage the SMEC Launch Latch when the function is not active. Action by the CDMS is TBD



4.2.5.2.2 Boot ROM Memory Check

This packet is generated by the Boot ROM after checking the memory contents provided no errors are found.

Note: This packet does not conform to the format defined for Event Packets in AD01 and is TBC

0	0	0	0	1	APID1										
1	1	Count													
Length=25															
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
TIME (0x800000000000)															
EVENTID															
SID															
OBSID															
Event Type															
State															
Packet Counter															
Checksum															

Parameter	Comment/Value
TIME	This value has the msb set to indicate that the time is invalid
EVENTID	0x8008
SID	0x0003
OBSID	0xABABCDCD This value of OBSID is invalid for routine operations
Event Type	0x0051
State	0xAAAA - Test ok and wait TC
Packet Counter	(0x0000)

Here is a typical dump of this event packet:

```
0D00 C000 0019 0005 0100 8000 0000 0000 8008 0003 ABAB CDCD 0051
AAAA 0000 AE6C
```



4.2.5.3 Error/Alarm Report (5,4)

4.2.5.3.1 Memory Check Errors

Generated when the Boot Software memory check fails (ref RD10).

Note: This packet does not conform to the format defined for Event Packets in AD01

0	0	0	0	1	APID1								
1	1	Count											
Length													
0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	1	0	0	0	0	0	0	0	0	0
TIME (0x800000000000)													
EVENTID_MCE													
SID_MCE=0x00FF													
MEMID_MCE		NPAGES_MCE											
Page IDs													
Checksum													

Parameter	Comment
TIME	This value has the msb set to indicate that the time is invalid
EVENTID_MCE	Event ID - see table below
SID_MCE	0x00FF
MEMID_MCE	Memory type (2 bits)
NPAGES_MCE	Number of failed memory pages (14bits)
Page IDs	A list of the IDs of each failed page (16 bits per ID) For EEPROM the ID may also be interpreted as an error code

Error	EVENTID_MCE	MEMID_MCE	Event ID – see table below
PM_Error	0x8001	1	The Boot SW has detector one or more errors in the Program Memory
DM_Error	0x8002	2	The Boot SW has detector one or more errors in the Data Memory.
EEPROM_Error	0x8003	3	The Boot SW has detector one or more errors in the EEPROM



4.2.5.3.2 Telecommand Validation Errors

Generated when the Boot Software telecommand check fails (ref RD10).

Note: This packet does not conform to the format defined for Event Packets in AD01

0	0	0	0	1	APID1											
1	1	Count														
Length = 27																
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
TIME (0x800000000000)																
EVENTID_TVE																
SID_TVE																
INFO_TVE																
ERRCODE_TVE																
FCSCOMP_TVE																
FCSREAD_TVE																
CHKSUMID_TVE																
DMADDR_TVE																
Checksum																

Parameter	Comment
TIME	This value has the msb set to indicate that the time is invalid
EVENTID_TVE	0x8004
SID_TVE	0x0009
INFO_TVE	Information on the error – see table below
ERRCODE_TVE	Error code – see table below
FCSCOMP_TVE	Computed FCS – see table below
FCSREAD_TVE	Read FCS – see table below
CHKSUMID_TVE	Checksum error type – see table below
DMADDR_TVE	Start address in DM – see table below

Note: some parameters are not applicable for some Error Codes. In these cases the parameters are replaced by 0xAAAA

Error	ERRCODE_TVE	INFO_TVE	FCSCOMP_TVE	FCSREAD_TVE	CHKSUMID_TVE	DMADDR_TVE
Data_Memory_FCS_Error	0x0008	Options loading memory	Computed Value	Value Read	0x0001	Start Address of Overlapped Memory Page
TC_FCS_Error	0x0008	0xAAAA	Computed Value	Value Read	0x0002	0xAAAA
TC_APID_Error	0x000C	APID Received	0xAAAA	0xAAAA	0xAAAA	0xAAAA
TC_Wrong_Function_ID_Error	0x0010	Function ID Received	0xAAAA	0xAAAA	0xAAAA	0xAAAA
Data_Memory_Wrong_Function_Error	0x0010	TC options for loading memory	0xAAAA	0xAAAA	0xAAAA	0xAAAA
Packet_Type_Error	0x000E	Type & Subtype Received	0xAAAA	0xAAAA	0xAAAA	0xAAAA
Packet_Subtype_Error	0x000B	Type & Subtype Received	0xAAAA	0xAAAA	0xAAAA	0xAAAA
Data_Memory_Page_Overlap_Error	0x000A	0xAAAA	0xAAAA	0xAAAA	0xAAAA	Start Address of Overlapped Memory Page
Data_Memory_Page_Lost_Error	0x0009	TC options for loading memory	0xAAAA	0xAAAA	0xAAAA	Start Address of Overlapped Memory Page
Data_Memory_Wrong_Format_Error	0x0007	TC options for loading memory	0xAAAA	0xAAAA	0xAAAA	Start Address of Overlapped Memory Page
Data_Memory_Uploading_Boundaries_Error	0x0012	0xAAAA	0xAAAA	0xAAAA	0xAAAA	0xAAAA
Data_Memory_Wrong_Activity_Error	0x0011	TC options for loading memory	0xAAAA	0xAAAA	0xAAAA	0xAAAA



4.2.5.3.3 EEPROM to PM Loading Errors

Generated when the Boot Software data transfer from EEPROM or Data Memory to PM fails (ref RD10).

Note: This packet does not conform to the format defined for Event Packets in AD01

0	0	0	0	1	APID1									
1	1	Count												
Length = 19														
0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0														
TIME (0x800000000000)														
EVENTID_EPMLE														
SID_EPMLE														
MEMTYPE							NPAGES							
ERRCODE_EPMLE														
Checksum														

Parameter	Comment
TIME	This value has the msb set to indicate that the time is invalid
EVENTID_EPMLE	0x8005
SID_EPMLE	0x0001
MEMTYPE_EPLME (2 bits)	EEPROM Memory = 3
NPAGES_EPLME (14 bits)	Number of pages failed = 0x0001
ERRCODE_EPLME	0x1800 = Overlapping between two memory pages 0x0400 = No partition to boot 0x0800 = Total FCS Error 0x0C00 = PM FCS Error during page upload 0x1400 = Previous EEPROM test failed 0x1800 = Overlapping between two memory pages

4.2.5.3.4 DM to PM Loading Errors

Generated when the Boot Software data transfer from EEPROM or Data Memory to PM fails (ref RD10).

Note: This packet does not conform to the format defined for Event Packets in AD01

0	0	0	0	1	APID1									
1	1	Count												
Length = 19														
0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
TIME (0x800000000000)														
EVENTID_DPMLE														
SID_DPMLE														
MEMTYPE							NPAGES							
ERRCODE_DPMLE														
Checksum														

Parameter	Comment
TIME	This value has the msb set to indicate that the time is invalid
EVENTID_DPMLE	0x8006
SID_DPMLE	0x0001
MEMTYPE_DPLME (2 bits)	Data Memory = 2
NPAGES_DPLME (14 bits)	Number of pages failed = 0x0001
ERRCODE_DPLME	0x0C00 = PM FCS Error during page upload 0x1800 = Overlapping between two memory pages 0x1900 = PM Memory Page Boundaries Uploading error



4.2.5.3.5 PM Boot Errors

Generated when the Boot Software DM-to-PM Immediate Boot fails (ref RD10).

Note: This packet does not conform to the format defined for Event Packets in AD01

0	0	0	0	1	APID1										
1	1	Count													
Length = 19															
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
TIME (0x800000000000)															
EVENTID_PMBE															
SID_PMBE															
MEMTYPE						NPAGES									
ERRCODE_PMBE															
Checksum															

Parameter	Comment
TIME	This value has the msb set to indicate that the time is invalid
EVENTID_PMBE	0x8007
SID_PMBE	0x0001
MEMTYPE_PMBE (2 bits)	Program Memory = 1
NPAGES_PMBE (14 bits)	Number of pages failed = 0x0001
ERRCODE_PMBE	0x0800 = Program FCS error – the computed FCS on the whole program is wrong



4.2.8 Function Management

This report is issued in response to TC (8,5). Three report formats are defined

4.2.8.1 Normal Functions Report

These correspond to Function IDs 0x01, 0x10, 0x70, 0xC0 and 0xC1

000001	APID1
11	Count
Length = 15	
00000000000000010000	
00000011000000000000	
TIME	
FUNCTIONID	ACTIVITYID
SID	
Checksum	

Parameters

Name	Value and Comments
FUNCTIONID	ID of function to be reported
ACTIVITYID	Current Activity = 00 if function is stopped = FF if function is active and waiting
SID	= 0x0000 indicates no parameters

4.2.8.2 VM Functions Report

These correspond to Function IDs 0x02, 0x03, 0x04 and 0x05

000001	APID1
11	Count
Length	
00000000000000010000	
00000011000000000000	
TIME	
FUNCTIONID	ACTIVITYID
SID	
TABLEID	
INDEX	
N	
Data	
Checksum	

Parameters

Name	Value and Comments
FUNCTIONID	ID of function to be reported
ACTIVITYID	Current Activity = 01 when Executing a Command List = 02 when Running from a table = 03 when Halted
SID	0x0860
TABLEID	Table containing Command List Not applicable when ACTIVITYID = 01
INDEX	Index within Table to start executing Not applicable when ACTIVITYID = 01
N	Number of Data words
Data	N*32 bit data words



4.2.8.3 DPU Functions Report

These correspond to Function ID 0xCA

0	0	0	0	1	APID1												
1	1	Count															
Length =19																	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
TIME																	
FUNCTIONID									ACTIVITYID								
SID																	
N																	
FRAMEID																	
SELSID																	
TABLEID																	
.....																	
Checksum																	

Parameters

Name	Value and Comments
FUNCTIONID	ID of function to be reported
ACTIVITYID	Current Activity = 10 when selecting = 11 when not selecting
SID	0x0861
N	Number of times FRAMEID, SELSID and TABLEID are repeated
FRAMEID	Science Frame data is selected from
SELSID	SID for the Select TM Packets
TABLEID	Table containing the selection information (= 0xffff if not selected)

Note: the group FRAMID, SELSID, TABLEID are repeated 24 times in this packet



4.2.9 Time Management

4.2.9.1 Time Verification Report

This report is generated in response to TC(9,7)

0	0	0	0	1	APID1										
1	1	Count													
Length = 17															
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
TIME															
TDPU															
Checksum															

Parameters

Name	Value and Comments
TDPU	Copy of the On board time held by the DPU

4.2.10

Not Available

4.2.11 On Board Scheduling

Not Used

4.2.12 On Board Monitoring

Not Used

4.2.13

Not Available

4.2.14 Packet Transmission Control

This report is issued in response to TC (14,3) and lists all the enabled TM packets.

0	0	0	0	1	APID1										
1	1	Count													
Length															
0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
TIME															
NDEF															
Type			Subtype												
Packet ID															
Type			Subtype												
Packet ID															
Checksum															

Parameters

Name	Value and Comments
NDEF	Number of sets of (Type, Subtype, SID) to follow
Type	Packet Type
Subtype	Packet Subtype
Packet ID	Identifier of specific groups of packets: If all packets of the given type/subtype are enabled = 0x0000 For Type = 3: this field contains the HK_Packet_ID For Type = 5: this field contains the Event ID For Type = 21: this field contains the SID



4.2.15 On Board Storage and Retrieval

Not Used

4.2.16 On Board Traffic Management

Not Used

4.2.17 Test Service

This report is generated in response to TC (17,1)

0	0	0	0	1	APID1												
1	1	Count															
Length = 17																	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
TIME																	
Checksum																	

4.2.18 On Board Control Procedures

Not Used

4.2.19 Action/Event Service

Not Used

4.2.20 Information Distribution Service

Not Used



4.2.21 Science Data

4.2.21.1 Nominal Science Data Report (21,1)

0	0	0	0	1	APID									
1	1	Count												
Length														
0	0	0	0	0	0	0	0	0	0	1	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TIME														
<i>SID</i>														
OBSID														
BBID														
<i>Parameters</i>														
Checksum														

The reports available are identified by the APID (APID3 = Photometer, APID4 = Spectrometer and APID5 = Subsystem Data) and the SID (composed of the Frame Structure (MSByte) and FrameID (LSByte)):

APID	SID	Report
APID3	0x0200	Photometer Full Array
APID3	0x1200	Photometer Parallel Mode Selection
APID4	0x0201	Spectrometer Full Array
APID3	0x1201	Spectrometer Parallel Mode Selection
APID5	0x0410	SMEC
APID5	0x1410	SMEC Selection
APID5	0x0612	BSM
APID5	0x0A20	SCU

The *parameters* field contains one or more blocks of science data all of the same type. These blocks are the same as the science data frames issued by the DRCU, except for the DPU Block, which is created by the DPU. Normally the DPU fills the TM packet with the maximum number of blocks before the packet is made available for transmission. In the event of a **FLUSH_FIFO** telecommand the packet is transmitted immediately and will not be filled. The **length** field, with the APID and SID, allows the number of blocks in the packet to be calculated.

The possible block types are as follows:



4.2.21.1.1 Photometer Full Array Block

This block of data is inserted in the *Parameter* field once.

Block Length=294
FrameID=0x00
288 Detector Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The order of the detectors in the block is shown in Appendix D

4.2.21.1.2 Spectrometer Full Array Block

Block Length=78
FrameID=0x01
72 Detector Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The order of the detectors in the block is shown in Appendix D



4.2.21.1.3 SMEC Block

In order to meet the telemetry bit rate requirements, this block is normally selected (see TM(21,2)).

The following are the block contents since 19th June 2009 – note that they can be changed by command to the MCU.

These parameters are normally implemented in the MCU boot up procedure MCU_BOOT in the transition from SCU_ON to REDY mode.

Block Length=12
FrameID=0x10
Acquisition date MSW
Acquisition date LSW
SMECENCPOSN
SMECENCFINEPOSN
SMECLVDTPOSN
SMECMOTORCURR
SMECPOSNERROR
Transmission Time MSW
Transmission Time LSW
Checksum



4.2.21.1.4 BSM Block

These are the block contents – it may be changed by command to the MCU.

Block Length=13
FrameID=0x12
Acquisition date MSW
Acquisition date LSW
CHOPSENSSIG
CHOPMOTORCURR
CHOPMOTORVOLT
JIGGSENSSIG
JIGGMOTORCURR
JIGGMOTORVOLT
Transmission_Time MSW
Transmission_Time LSW
Checkword



4.2.21.1.5 SCU Block

Block Length=30
FrameID=0x20
PUMPHTRTEMP
PUMPHSTEMP
EVAPHSTEMP
SHUNTTEMP
EMCFILTEMP
SL0TEMP
PL0TEMP
OPTTEMP
BAFTEMP
BSMIFTEMP
SCAL2TEMP
SCAL4TEMP
SCALTEMP
SMECIFTEMP
SMECTEMP
BSMTEMP
SUBKTEMP
TCHTRV
PCALCURR
PCALV
SCAL2CURR
SCAL2V
SCAL4CURR
SCAL4V
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum



4.2.21.1.6 SID = 0x1410: SMEC Selected Data

These are contents of the SMEC selected block since before launch.

Acquisition Time MSW
Aquisition Time LSW
SMECENCPOSN
SMECENCFINEPOSN
SMECLVDTPOSN
SMECPOSNERROR

4.2.21.1.7 SID = 0x1200: Photometer Parallel Mode Selected Data

Not used

4.2.21.1.8 SID = 0x1201: Spectrometer Parallel Mode Selected Data

Not used



4.2.21.2 Science Type B Data Report (21,2)

000001	APID
11	Count
	Length
0000000000000001010101	
000000010000000000	
	TIME
	SID
	OBSID
	BBID
	Parameters
	Checksum

The reports available are identified by the APID (APID3 = Photometer, APID4 = Spectrometer) and the SID (composed of the Frame Structure (MSByte) and FrameID (LSByte)):

APID	SID	Report
APID3	0x0102	PSW Array
APID3	0x0103	PMW Array
APID3	0x0104	PLW Array
APID4	0x0105	SSW Array
APID4	0x0106	SLW Array

The *parameters* field contains one or more blocks of science data all of the same type.

These blocks are the same as the science data frames issued by the DRCU, except in the case of the Selected Data Report.

Normally the DPU fills the TM packet with the maximum number of blocks before the packet is made available for transmission. In the event of a **FLUSH_FIFO** telecommand the packet is transmitted immediately and will not be filled. The **length** field, with the APID and SID, allows the number of blocks in the packet to be calculated.

The possible block types are as follows:



4.2.21.2.1 PSW Array Block

Block Length=150
FrameID=0x02
144 Detector Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The order of the detectors in the block is shown in Appendix D

4.2.21.2.2 PMW Array Block

Block Length=102
FrameID=0x03
96 Detector Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The order of the detectors in the block is shown in Appendix D

4.2.21.2.3 PLW Array Block

Block Length=54
FrameID=0x04
48 Detector Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The order of the detectors in the block is shown in Appendix D



4.2.21.2.4 SSW Array Block

Block Length=54
FrameID=0x05
48 Detector Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The order of the detectors in the block is shown in Appendix D

4.2.21.2.5 SLW Array Block

Block Length=30
FrameID=0x06
24 Detector Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The order of the detectors in the block is shown in Appendix D



4.2.21.3 Diagnostic Science Report (21,3)

00001	APID
11	Count
	Length
00000000000010101	
0000001100000000	
	TIME
	SID
	OBSID
	BBID
	Parameters
	Checksum

The reports available are identified by the APID (APID3 = Photometer, APID4 = Spectrometer and APID5 = Subsystem Data) and the SID (composed of the Frame Structure (MSByte) and FrameID (LSByte)):

APID	SID	Report
APID3	0x0309	Photometer Test Pattern
APID3	0x030A	PSW Test Pattern
APID3	0x030B	PMW Test Pattern
APID3	0x030C	PLW Test Pattern
APID4	0x030D	Spectrometer Test Pattern
APID4	0x030E	SSW Test Pattern
APID4	0x030F	SLW Test Pattern
APID5	0x0814	MCU Engineering
APID5	0x0915	MCU Test Pattern
APID5	0x1121	SCU Test Pattern

The *parameters* field contains one or more blocks of science data all of the same type. These blocks are the same as the science data frames issued by the DRCU, with the exception of the Transparent Data

Normally the DPU fills the TM packet with the maximum number of blocks before the packet is made available for transmission. In the event of a **FLUSH_FIFO** telecommand the packet is transmitted immediately and will not be filled. The **length** field, with the APID and SID, allows the number of blocks in the packet to be calculated.

The possible block types are as follows:



4.2.21.3.1 Photometer Full Test Pattern Block

This block of data is inserted in the *Parameter* field once.

Block Length=294
FrameID=0x09
288 Test Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The content of the Test Values is fixed



4.2.21.3.2 Photometer SW Test Pattern Block

Block Length=150
FrameID=0x0A
144 Test Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The content of the Test Values is fixed

4.2.21.3.3 Photometer MW Test Pattern Block

Block Length=102
FrameID=0x0B
96 Test Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The content of the Test Values is fixed

4.2.21.3.4 Photometer LW Test Pattern Block

Block Length=54
FrameID=0x0C
48 Test Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The content of the Test Values is fixed



4.2.21.3.5 Spectrometer Full Test Pattern Block

Block Length=78
FrameID=0x0D
72 Test Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The content of the Test Values is fixed

4.2.21.3.6 Spectrometer SW Test Pattern Block

Block Length=54
FrameID=0x0E
48 Test Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The content of the Test Values is fixed

4.2.21.3.7 Spectrometer LW Test Pattern Block

Block Length=30
FrameID=0x0F
24 Test Values
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The content of the Test Values is fixed



4.2.21.3.8 MCU Engineering Block

This block is available to transmit any MCU parameters to the ground as science telemetry. The flight operations parameters are given in the table below. These parameters are normally implemented in the MCU boot up procedure MCU_BOOT in the transition from SCU_ON to REDY mode.

Any parameter may be replaced by command to the MCU.

Block Length=21
FrameID=0x14
Acquisition date MSW
Acquisition date LSW
SMECENCCOUNT
SMECENC SIG1
SMECENC SIG2
SMECENC FINE POSN
SMECLVDTDC SIG
SMECLVDTAC SIG
SMECMOTORCURRE
SMECMOTORVOLT
SMECENC SIG2AMP
SMECSCANPOSNERR
SMECENC SIG1AMP
SMECMEANSPEED
SMECDACVAL
SMECLVDTPOSN
Transmission_Time MSW
Transmission_Time LSW
Checksum



4.2.21.3.9 MCU Test Pattern Block

Block Length=21
FrameID=0x15
Acquisition date MSW
Acquisition date LSW
0x5555
0xAAAA
0x5554
0xAAA8
0x5550
0xAAA0
0x5541
0xAA82
0x5505
0xAA0A
0x5414
0xA828
0x5050
0xA0A0
Transmission_Time MSW
Transmission_Time LSW
Checksum

The content of the Test Values is fixed

4.2.21.3.10 SCU Test Pattern Block

Block Length=30
FrameID=0x21
Test Data (24 words)
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The content of the Test Data is fixed



4.2.21.4 Auxiliary Science Data Report (21,4)

000001	APID
11	Count
	Length
000000000000010101	
0000010000000000	
	TIME
	SID
	OBSID
	BBID
	Parameters
	Checksum

The reports available are identified by the APID (APID3 = Photometer, APID4 = Spectrometer) and the SID (composed of the Frame Structure (MSByte) and FrameID (LSByte)):

APID	SID	Report
APID3	0x0207	Photometer Offsets
APID4	0x0208	Spectrometer Offsets
APID5	0x0209	Housekeeping Packet Definition
APID5	0x020A	Report Table Report
APID5	0x020B	VM Science Data
APID5	0xCC00	DCU Transparent Data
APID5	0xCC01	MCU Transparent Data
APID5	0xCC02	SCU Transparent Data

The *parameters* field contains one or more blocks of science data all of the same type.

Normally the DPU fills the TM packet with the maximum number of blocks before the packet is made available for transmission. In the event of a **FLUSH_FIFO** telecommand the packet is transmitted immediately and will not be filled. The **length** field, with the APID and SID, allows the number of blocks in the packet to be calculated.

The possible block types are as follows:



4.2.21.4.1 Photometer Offsets Block

This block of data is inserted in the *Parameter* field once.

Block Length=294
FrameID=0x07
288 Offsets
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The order of the detector offsets in the block is shown by the full array indices in Appendices C to H.

4.2.21.4.2 Spectrometer Offsets Block

Block Length=78
FrameID=0x08
72 Offsets
ADC_Flags
Frame_Time MSW
Frame_Time LSW
Checksum

The order of the detector offsets in the block is shown by the full array indices in Appendices C to H.



4.2.21.4.3 Housekeeping Packet Definition

The reported parameters are those sent in the Housekeeping Packet definition command

HKPCKTID
HKSID
HKINTERVAL
HKREPEAT
TABLEID
MONITOR_TABLEID

4.2.21.4.4 Report Table Report

The parameters field contains the requested table contents.

Note: As the Table contents could be larger than could be accommodated in one TM packet. The data is sent as a group of packets using the segmentation flags (AD01 – para 4.1.1.2.1) to identify the first, intermediate and last packets. NDATA is the number of 16-bit words in the reported table.

TABLEID
INDEX
NDATA
Table Data

4.2.21.4.5 VM Science Block

These packets are normally generated by the VMs for PTC and SCAL..



4.2.21.4.5.1 PTC block

A PTC block or frame contains 41 words each of length 32 bits. For a loop period of 0.2 seconds in the VM, five PTC blocks are packed into a single science TM packet. One such VM packet is generated per second.

TABLEID = 0x52	
INDEX=0	
NDATA=0x19A (410 16-bit words)	
_packet_len ; index of PTC block in packet. It is set 0xCD (205 decimal) in the first block, which is the size of 5 blocks. In subsequent blocks it is set to the start address of the block inside packet.	
Frame ID=0x0000FACE	
_timC	; time to perform PID calculations
_set_point	; required temperature
_sdex	; memory for SDEX response
_ptc_cmd	; PTC temperature get command
_ptc_sig_tm0	; current PTC output (mean over previous control cycle)
_ptc_sig_tm1	; PTC output at time t-1
_ptc_sig_tm2	; PTC output at time t-2
_ptc_sig_lp_tm0	; current filtered PTC output (time t)
_ptc_sig_lp_tm1	; filtered PTC output at time t-1
_ptc_sig_lp_tm2	; filtered PTC output at time t-2
_Kp	; Proportional PID control parameter
_Ki	; Integral PID control parameter
_Kd	; Differential PID control parameter
_Ki_Plim	; Ki Positive limit
_Ki_Nlim	; Ki Negative Limit
_det_freq	; update rate of the controller
_loop_period	; Loop period
_half_loop_period	; half the loop period
_lp_gain	; low pass filter gain
_lp_b1	; low pass filter coefficient
_lp_b2	; low pass filter coefficient
_DAC_setting	; exact setting for DAC



_DAC_fract	; fractional portion of the DAC setting
_DAC_high	; high-level DAC setting
_DAC_low	; low-level DAC setting
_t_high	; time at high DAC level
_t_low	; time at low DAC level
_err_t0	;
_err_t1	;
_err_int	;
_prop_term	;
_int_term	;
_deriv_term	;
_DAC_limit	; maximum DAC output
_DAC_const	; DAC constant offset
_PWM	;
_frame_count	;
_error_comp	; Error compensation parameter
Frame End Marker= 0xCAFE	
<i>The above PTC block is repeated 4 times in the packet</i>	

4.2.21.4.5.2 SCAL block

An SCAL block or frame contains 40 words each of length 32 bits. For a loop period of 0.2 seconds in the VM, five PTC blocks are packed into a single science TM packet. One such VM packet is generated per second.

TABLEID = 0x52	
INDEX=0	
NDATA=0x190 (400 16-bit words)	
_packet_len ; index of SCAL block in packet. It is set 0xC8 (200 decimal) in the first block, which is the size of 5 blocks. In subsequent blocks it is set to the start address of the block inside packet.	
Frame ID=0x0000FACE	
_timC	; time to perform PID calculations
_set_point	; required SCAL temperature



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078

Issue: Issue 3.0

Date: 2nd August 2010

Page: 134 of 163

_temp_cmd	; SCAL temperature get command
_htr_cmd	; heater set command
_sig_tm0	; current PTC output (mean over previous control cycle)
_sig_tm1	; PTC output at time t-1
_sig_tm2	; PTC output at time t-2
_sig_lp_tm0	; current filtered PTC output (time t)
_sig_lp_tm1	; filtered PTC output at time t-1
_sig_lp_tm2	; filtered PTC output at time t-2
_Kp	; Proportional PID control parameter
_Ki	; Integral PID control parameter
_Kd	; Differential PID control parameter
_Ki_Plim	; Ki Positive limit
_Ki_Nlim	; Ki Negative Limit
_det_freq	; update rate of the controller
_loop_period	; Loop period
_half_loop_period	; half the loop period
_lp_gain	; low pass filter gain
_lp_b1	; low pass filter coefficient
_lp_b2	; low pass filter coefficient
_DAC_setting	; exact setting for DAC
_DAC_fract	; fractional portion of the DAC setting
_DAC_high	; high-level DAC setting
_DAC_low	; low-level DAC setting
_t_high	; time at high DAC level
_t_low	; time at low DAC level
_err_t0	;
_err_t1	;
_err_int	;



<code>_prop_term</code>	<code>;</code>
<code>_int_term</code>	<code>;</code>
<code>_deriv_term</code>	<code>;</code>
<code>_DAC_limit</code>	<code>; maximum DAC output</code>
<code>_DAC_const</code>	<code>; DAC constant offset</code>
<code>_PWM</code>	<code>;</code>
<code>_frame_count</code>	<code>;</code>
Frame End Marker= 0xCAFE	
<i>The above SCAL block is repeated 4 times in the packet</i>	

4.2.22 Context Saving Service

Not Used



5. PARAMETERS

The information presented in this section is not exhaustive. Please refer to the SPIRE MIB and parameter tables for the complete list.

5.1 TC Parameters

5.1.1 Parameter Definition

Parameter Name	Service Reference	Type	Size (bits)	Conversion Curve	Constraint Table	Comments
Activity_ID	(8,4)	Integer	8	None	None	
APID	(20,1) (20,2)	Integer	11	None	None	Application ID
BBID BBINTR BBTYPE BBCOUNT	(8,4)	Constant Integer Integer	32 2 14 16	None None None	None None None	Field is split into 3 parts: Location: Bits 0-1 Value: 2 Location: Bits 2-15 Location: Bits 16-31
COUNT	(8,4)	Integer	16	None	None	Number of words to be reported
CRC	(6,2)	Unsigned Integer	16	None	None	Cyclic Redundancy Check - algorithm is defined in AD01 – Appendix 4
Data	(6,2) (8,4)					Variable length field of any data type. Must be an integer number of 16 bits in length
FIFOFLAGS FIFODPU FIFODCU FIFOSCU FIFOMCU	(8,4)	Integer Integer Integer Integer	16 1 1 1 1	Flush Flush Flush Flush	None None None None	Flags indicating the FIFO(s) to flush Location: bit 15: DPU science buffer Location: bit 14: DCU FIFO Location: bit 13: SCU FIFO Location: bit 12: MCU FIFO
FRAMEID	(8,4)	Integer	16	None	Frame	
FUNCTIONID	(8,1) (8,2) (8,4) (8,5)	Integer	8	Func_ID	None	
HKPCKTID	(3,1) (3,3) (3,9)	Integer	16	None	HK_ID	Identifies housekeeping packet definitions
HKSID	(3,1)	Unsigned	16	None	None	Unique identifier for housekeeping parameter list



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078
Issue: Issue 3.0
Date: 2nd August 2010
Page: 137 of 163

Parameter Name	Service Reference	Type	Size (bits)	Conversion Curve	Constraint Table	Comments
		Integer				Value = 0x03nn where nn = a unique number (starting from 0) defining the report structure
HKINTERVAL	(3,1)	Unsigned Integer	16	None	Period	Time between each packet generated, in milliseconds
INDEX	(8,4)	Unsigned Integer	16	None	None	Offset into a table(in octets)
Length	(6,2) (6,5) (6,9)	Unsigned Integer	16	None	None	
MEMORYID	(6,2) (6,5) (6,9)	Integer	16	Mem_ID	None	ID of Memory Area to be addressed
MODE	(8,4)	Unsigned Integer	16	None	None	Observing Mode
N	(8,4)	Unsigned Integer	16	None	N32	
NCHOP	(8,4)	Integer	16	None	None	Number of Chop science data frames to combine into one Chop Science TM Packet
NDATA	(8,4)	Unsigned Integer	16	None	N32	
NDCU	(8,4)	Integer	16	None	None	Number of DCU science data frames to combine into one Chop Science TM Packet
NDPU	(8,4)	Integer	16	None	None	Number of DPU science data frames to combine into one Chop Science TM Packet
NJIGGLE	(8,4)	Integer	16	None	None	Number of Jiggle science data frames to combine into one Chop Science TM Packet
NPCKTS	(14,1) (14,2)	Integer	16	None	None	Number of packet types to follow
NSAU	(6,2) (6,5) (6,9)	Integer	16	None	None	Number of SAUs to transfer
NSCU	(8,4)	Integer	16	None	None	Number of SCU science data frames to combine into one Chop Science TM Packet
NSMEC	(8,4)	Integer	16	None	None	Number of SMEC science data frames to combine into one



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078
Issue: Issue 3.0
Date: 2nd August 2010
Page: 138 of 163

Parameter Name	Service Reference	Type	Size (bits)	Conversion Curve	Constraint Table	Comments
						Chop Science TM Packet
OBSID	(8,4)	Unsigned Integer	32	None	None	Observation ID
Parameters	(8,4)					Variable length field of 32 data words.
SID	(8,1) (8,4) (14,1) (14,2) (20,1) (20,2)	Unsigned Integer	16	None	None	Unique identifier for parameter list
STARTADDR	(6,2) (6,5) (6,9)	Unsigned Integer	16	None	None	Start address of memory area to be addressed
STEP	(8,4)	Unsigned Integer	16	None	None	Observation Step
SUBTYPE	(14,1) (14,2)	Integer	8	None	None	Packet Subtype
TABLEID	(8,4)	Integer	16	None	Tab_ID	Number of an OBS table
TABLESIZE	(8,4)	Integer	16	None	None	Table size in 32 bit words
TYPE	(14,1) (14,2)	Integer	8	None	None	Packet Type



5.1.2 Conversion Curves

Name	Type	Raw Value	Converted Value	Comments
Data_Type	Enumerated	0 1 2 3	8Bits 16Bits 24Bits 32Bits	
Func_ID	Enumerated	0x01 0x02 0x03 0x04 0xC0 0xC1 0xCA	Table Cooler SCAL 300mK Ops Obs DPU	TableManagement CoolerControl SCALControl 300mKControl Operations Observations DPU
Info_Type	Enumerated	0 1 2 3	Off Target On Target Start Scan End Scan	
Mem_ID	Enumerated	0 1 2 3 4	Program Memory (RAM) Data Memory (RAM) EEPROM 1553 I/F DPRAM Boot S/W PROM	
Flush	Enumerated	0 1	Do not flush FIFO Flush FIFO	

5.1.3 Constraints

Name	Type	Minimum	Maximum	Comments
------	------	---------	---------	----------



		Value	Value	
Bit2	Range	0	3	Value held in lowest 2 bits of field
Frame	Set			Set of possible frame IDs, TBD
HK_ID	Range	0	3	Allows up to 4 housekeeping packets to be defined
HK_Value	Range	0x00000000	0x000FFFFFFF	The value is held in lowest 20 bits of the field
N16	Range	1	112	Number of 16 bit data words held in a command
N32	Range	1	56	Number of 32 bit data words held in a command
Nsamples	Range	1	32	
Period	Range	10	60000	Time period expressed as milliseconds - range is 0.01 to 60 seconds
Tab_ID	Range	0	127	

5.1.4 Conversion Curves

Name	Type	Raw Value	Converted Value	Units	Comments
BIAS	Analogue	0 255	0.0 Vbmax	Volts	$Eng = \frac{Vb \max * Raw}{255}$
BIASFREQ	Derived Calculated	Raw	Eng	Hz	$Eng = \frac{10^7 Hz}{512 * (Raw + 1)}$ Raw parameters are PHOTMCLKDIV and SPECCLKDIV
BIASMODE	Enumerated	0c00 0x01 0x02 0xFD 0xFE 0xFF	OFF DC001 DC002 DC253 DC252 SINE		Values 0x01 to 0xFE are test levels
CHOPMODE	Enumerated	0 1 2	STOP STEP TOGGLE		Chopping Stopped Chopping in step mode Chopping in toggle mode



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078
Issue: Issue 3.0
Date: 2nd August 2010
Page: 141 of 163

Name	Type	Raw Value	Converted Value	Units	Comments
CHOPSENSPWR	Enumerated	0 1	ON OFF		
CLOOPMODE	Enumerated	0 1 2	OPEN BEMF SENS		Loop Open Loop closed using Back EMF Loop Closed using Magnetoresistive Sensor
DCUFRMS	Enumerated	0 1 2 254 255	CONT. 1 2 254 255		
DCUMODE	Enumerated	0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x08 0x0C 0x10 0x14 0x18 0x1C	PHOT PSW PMW PLW SPEC SSW SLW PTEST STEST POFFSET SOFFSET POFFGET SOFFGET		
DCUSTAT	Enumerated	0 1	OFF RUN		
HTR	Analogue	0 255	0.0 Vhmax	Volts	$Eng = \frac{Vh \max * Raw}{255}$
JFETSTAT	Enumerated	0 1	OFF ON		



Project Document

SPIRE Data ICD

Ref: SPIRE-RAL-PRJ-001078

Issue: Issue 3.0

Date: 2nd August 2010

Page: 142 of 163

Name	Type	Raw Value	Converted Value	Units	Comments
JFETV	Analogue	0 255	0.0 VSSmax	Volts	$Eng = \frac{VSS \max * Raw}{255}$
JIGGLESENSPWR	Enumerated	0 1	ON OFF		
JLOOPMODE	Enumerated	0 1 2	OPEN BEMF SENS		Loop Open Loop closed using Back EMF Loop Closed using Magneto-resistive Sensor
LOOPMODE	Enumerated	0 1 2 3	OPEN BEMF LVDT OENC		Loop Open Loop closed using Back EMF Loop Closed using LVDT Loop Closed using Optical Encoder
MONSTAT	Enumerated	0 1	OFF ON		Subsystem off Subsystem on
PERIOD				mS	
PHASE	Analogue	0 255	0 360	Degrees	$Eng = \frac{360 * Raw}{255}$
PHOTSAMPFREQ	Derived Calculated	Raw	Eng	Hz	$Eng = \frac{PHOTBIASFR EQ Eng}{2 * Raw}$ Raw parameter is PHOTBIASDIV
SCANMODE	Enumerated	0 1 2 3	STOP STEP SAWTOOTH TRIANGLE		
SCANSTAT	Enumerated	0 1	STOP RUN		
SPECSAMPFREQ	Derived Calculated	Raw	Eng	Hz	$Eng = \frac{SPECBIASFR EQ Eng}{2 * Raw}$ Raw parameter is SPECBIASDIV



6. APPENDIX A – OBS TABLES

Much of the data used by the OBS for operations will be held in tables. These will be used to hold, for example:

- Housekeeping packet parameter lists
- Chop/Jiggle position tables
- Command Lists
- Monitoring Tables
- Autonomy Functions

Table ID [DEC]	TID [HEX]	Length (32-bit words)	Source	Contents/
0	0x00	23	RAL	Essential HouseKeeping TM packet definition
1	0x01	374	RAL	Nominal HouseKeeping TM packet definition
2	0x02	23	IFSI	Diagnostic HouseKeeping TM packet definition - predefined to report the status of the OBS Tasks
3	0x03	6	IFSI	Diagnostic HouseKeeping TM packet definition - predefined to report the status of the OBS Memory Pools
5	0x05	89	IFSI RAL	Monitoring Table definition – Not suitable for flight operations (Dummy)
6	0x06	36		OBS Configuration Table
7	0x07	32	RAL	[RAL] – VM HK storage area, v1.0
10	0x0A	12	RAL	[RAL] – Base SMEC Selection, v1.0
50	0x32	17	RAL	[RAL] – Jiggle Map 7, v1.4 (includes END word) – Not suitable for flight operations
51	0x33	129	RAL	[RAL] – Jiggle Map 64, v 1.1 (includes END word) – Not suitable for flight operations
52	0x34	2	RAL	[RAL] – S-Map 01, v1.0 (includes END word) – Not suitable for flight operations
53	0x35	17	RAL	[RAL] – S-Map 016, v1.0 (includes END word) – Not suitable for flight operations
54	0x36	2	RAL	[RAL] – S-Map 04, v1.0 – Not suitable for flight operations (Dummy)
64	0x40		IFSI	Auto Suspend VM 0 (size = 1)
65	0x41		IFSI	Auto Suspend VM 1 (size = 1)
66	0x42		IFSI	Auto Suspend VM 2 (size = 1)
67	0x43		IFSI	Auto Suspend VM 3 (size = 1)
68	0x44		IFSI	Auto Suspend VM AFX (size = 1)
70	0x46		RAL	[RAL] – Flash , v1.3 – Not suitable for flight operations
71	0x47		RAL	[RAL] – Chop, v1.4 – Not suitable for flight operations
72	0x48		RAL	[RAL] – JiggleMap, v1.4 – Not suitable for flight operations
73	0x49		RAL	[RAL] – BSM Move, v1.0 – Not suitable for flight operations
74	0x4A		RAL	[RAL] – Step and Chop, v1.2 – Not suitable for flight operations
80	0x50		RAL	[RAL] – SCAL, v2.1 – Not suitable for flight operations (contains an error)
81	0x51		RAL	[RAL] – PTC, 1.10 – Not suitable for flight operations
82	0x52	64	RAL	[RAL] – VMTM, v1.0
83	0x53		RAL	[RAL] – CREC, v1.7 – Not suitable for flight operations
100	0x64			[RAL] – Functions, v1.4 – Not suitable for flight operations
212	0xD4	9	IFSI	VM Procedure to go into SAFE MODE – Not suitable for flight operations (Dummy)
213	0xD5	14	IFSI	VM Procedure to Inhibit commanding to MCU – Not suitable for flight operations (Dummy)
248	0xF8	64	IFSI	DCU Command Inhibition Table (size = 64)
249	0xF9	64	IFSI	MCU Command Inhibition Table (size = 64)
250	0xFA	64	IFSI	SCU Command Inhibition Table (size = 64)
253	0xFD		-	Table to temporarily hold VM code uplinked via the <i>Execute_Command_List</i> TC
254	0xFE		IFSI	MOAT SCHEMA REFLECTION Mirror [WARNING DON'T MODIFY]



Table ID [DEC]	TID [HEX]	Length (32-bit words)	Source	Contents/
255	0xFF		IFSI	MOAT SCHEMA REFLECTION Primary [WARNING DON'T MODIFY]
256	0x100		IFSI	<i>Embedded On Board Function</i> <i>Unexistent Virtual Table. See §Error! Reference source not found.</i>

The OBS will provide for the definition of up to 256 tables, within a fixed-size memory area and will automatically move data within this memory area in order to allow update of tables, including a change in size.

By default the following table numbers are assigned and populated in the OBS, though they may be changed by command. The full list of tables can be found in RD08.

All tables are accessed using a Table_ID and individual locations in the table are accessed by an index, specified as a number of words, offset from the beginning of the table. The word size is 32bits.



7. APPENDIX B – TELEMETRY DATA RATES

- Maximum TM packet length = 1024 bytes
- TM Packet Header + CRC = 14 x 16-bit words = 28 bytes
- Maximum bytes available for science data = 1024 - 28 = 996 bytes (498 16-bit words)

Frame Type	# Data Words (16-bits) in Frame	Number of frames in science TM Packet	Nominal Packet Length (16-bit words)	Nominal Frame Sampling Rate / Hz	TM Packet Rate / Hz	Data rate / kbps
PF	294	1	308	18	18	88.70
SF	78	6	482	80	14	107.97
BSM	13	38	508	64	2	16.26
SCU	30	16	494	80	5	39.20
SMEC	12	41	506	250	7	56.67
MCU ENG	21	23	497	250	11	87.47
SMEC Select	6	83	512	250	3	24.57

Table 1 Science TM data rates

Packet Type	Modes	Sampling Rate / Hz	Nominal Packet Length (16-bit words)	TM Packet Rate / Hz	Data rate / kbps
Critical HK	All	2	37	0.5	0.3
Nominal HK	REDY	0.25	397	0.25	1.6
Nominal HK	All other SPIRE modes	1	397	1	6.4
Memory Dump TM(6,6)	REDY	NA	511	~14	114.5



Packet Type	Modes	Sampling Rate / Hz	Nominal Packet Length (16-bit words)	TM Packet Rate / Hz	Data rate / kbps
Memory Check TM (6,10)	REDY	NA	13	1	0.2

Table 2 HK TM data rates

8. APPENDIX C – PSW ARRAY

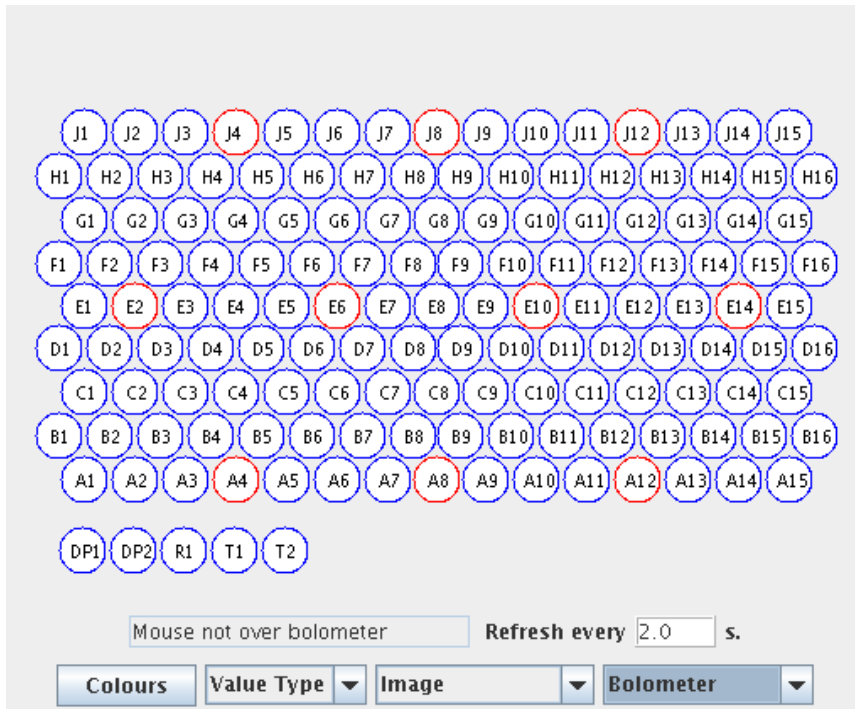


Figure 1 PSW Array: Bolometer Labels (see RD12 for details)

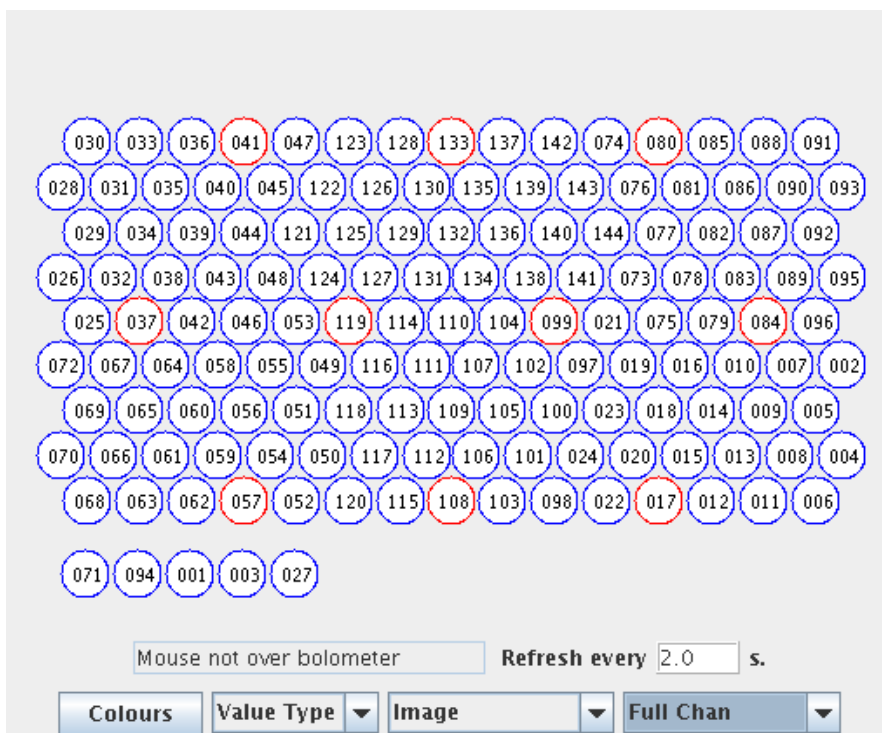


Figure 2 PSW Array: Full Array Indices

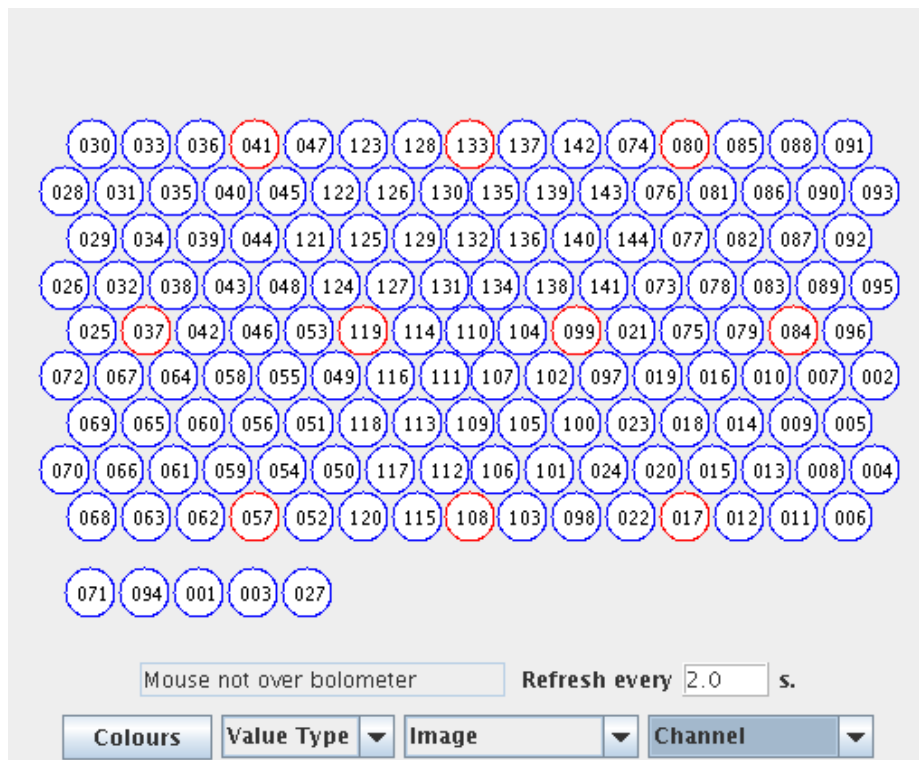


Figure 3 PSW Array Indices

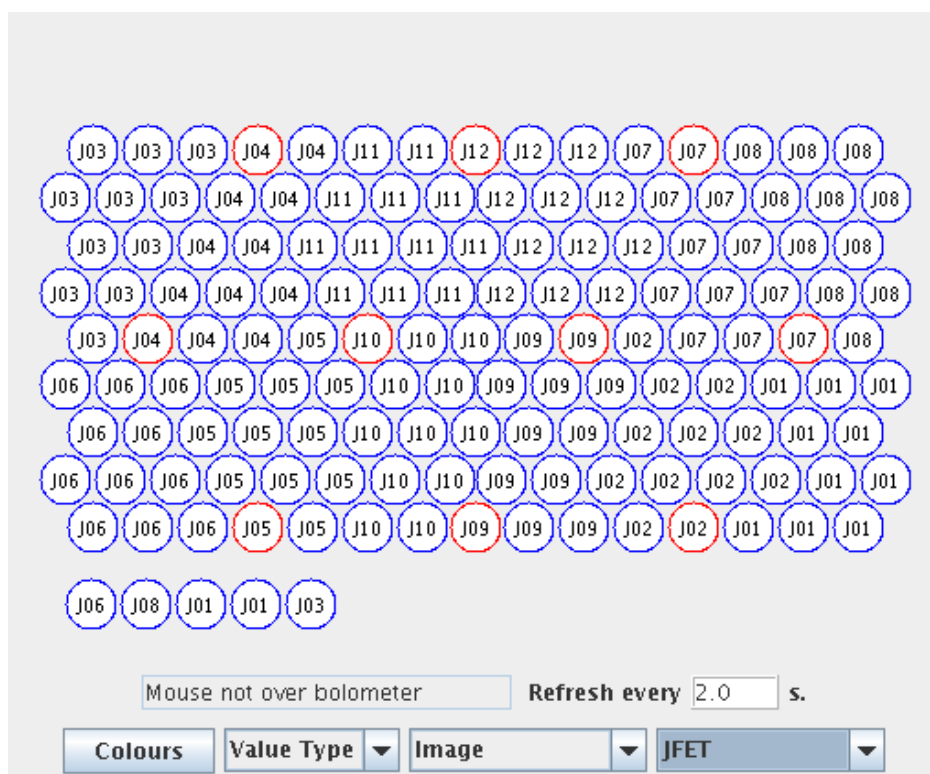


Figure 4 PSW Array: JFET Labels (Output Connector)

9. APPENDIX D – PMW ARRAY

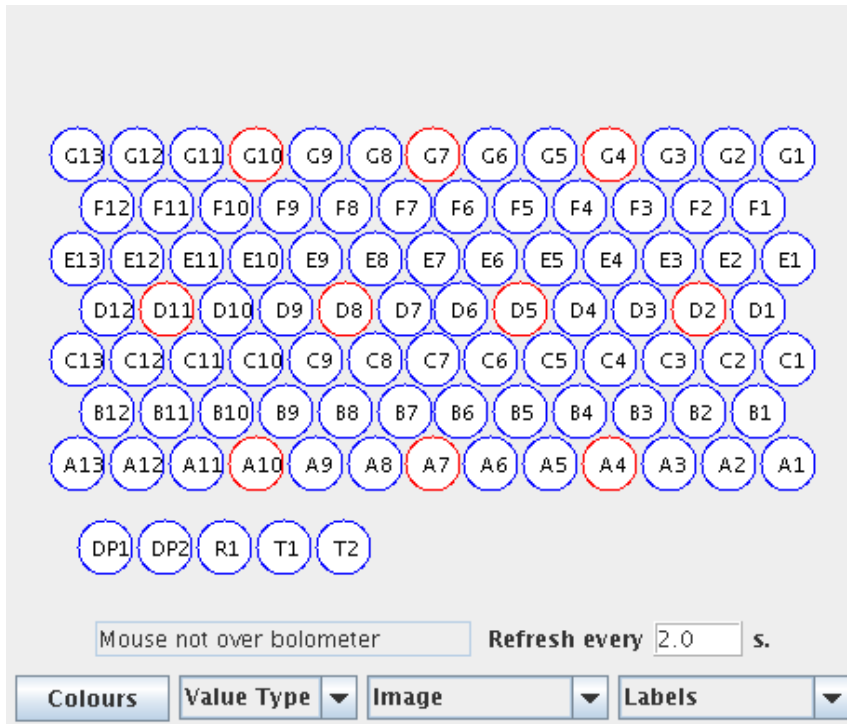


Figure 6 PMW Array: Bolometer Labels (see RD12 for details)

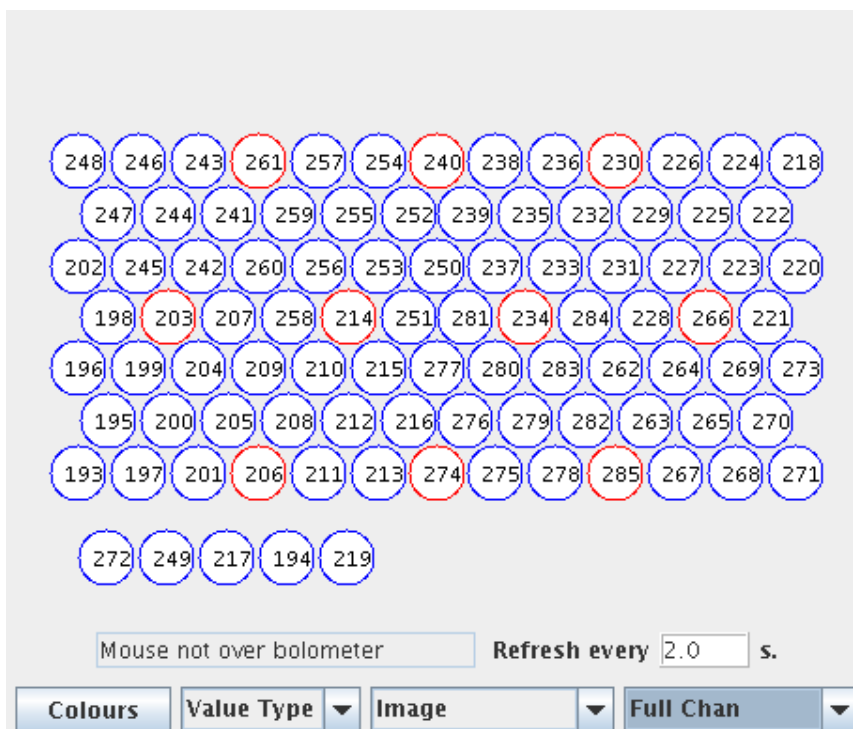


Figure 7 PMW Array: Full Array Indices

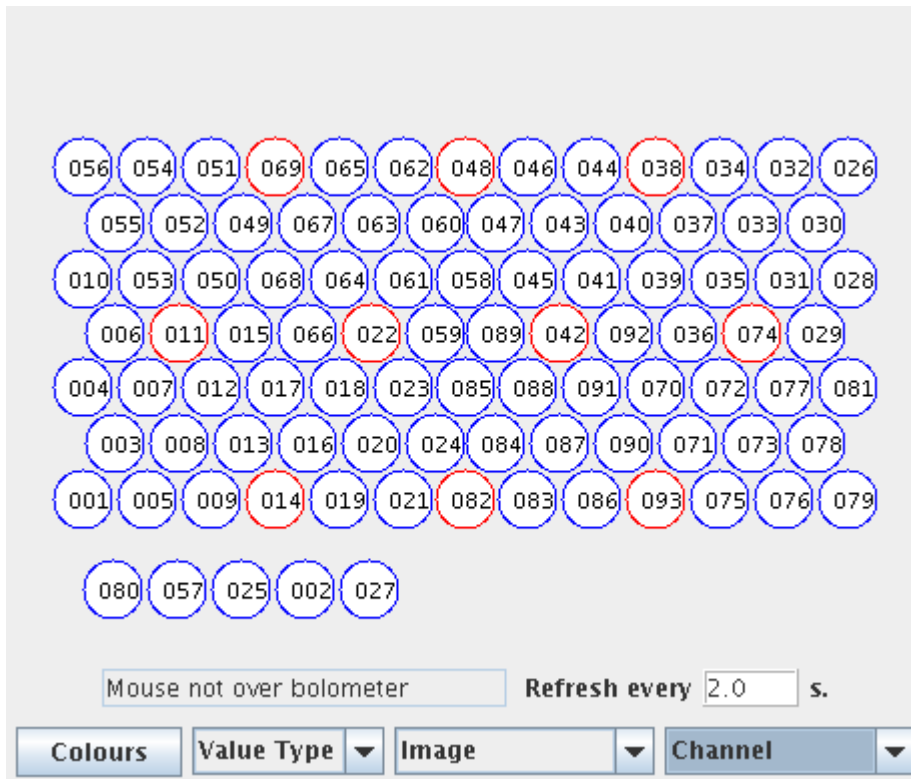


Figure 8 PMW Array Indices

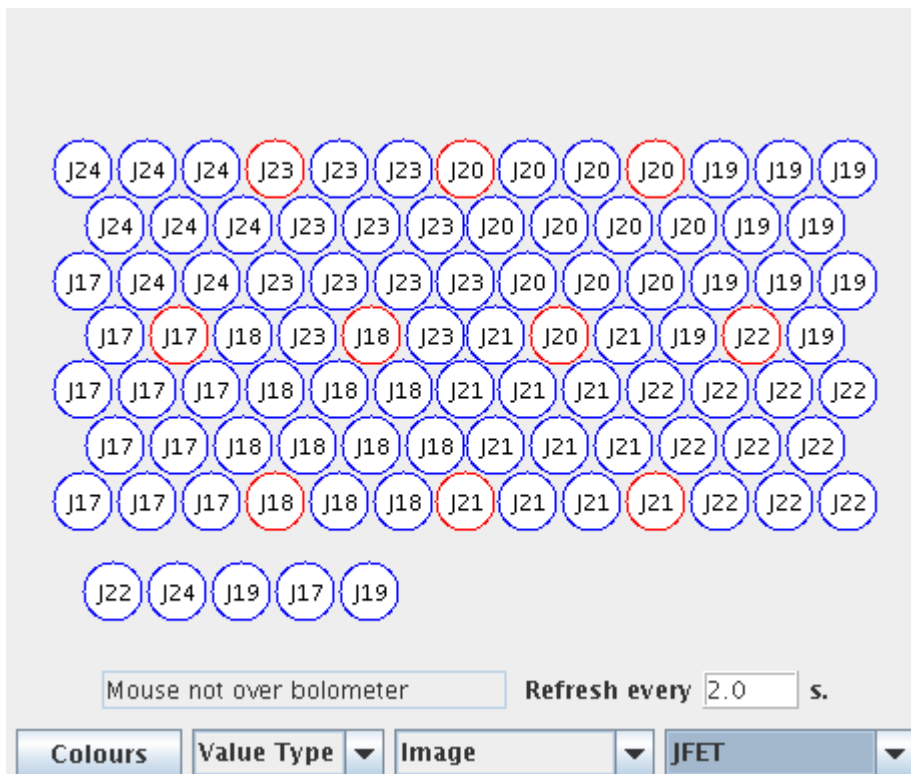


Figure 9 PMW Array: JFET Labels (Output Connector)

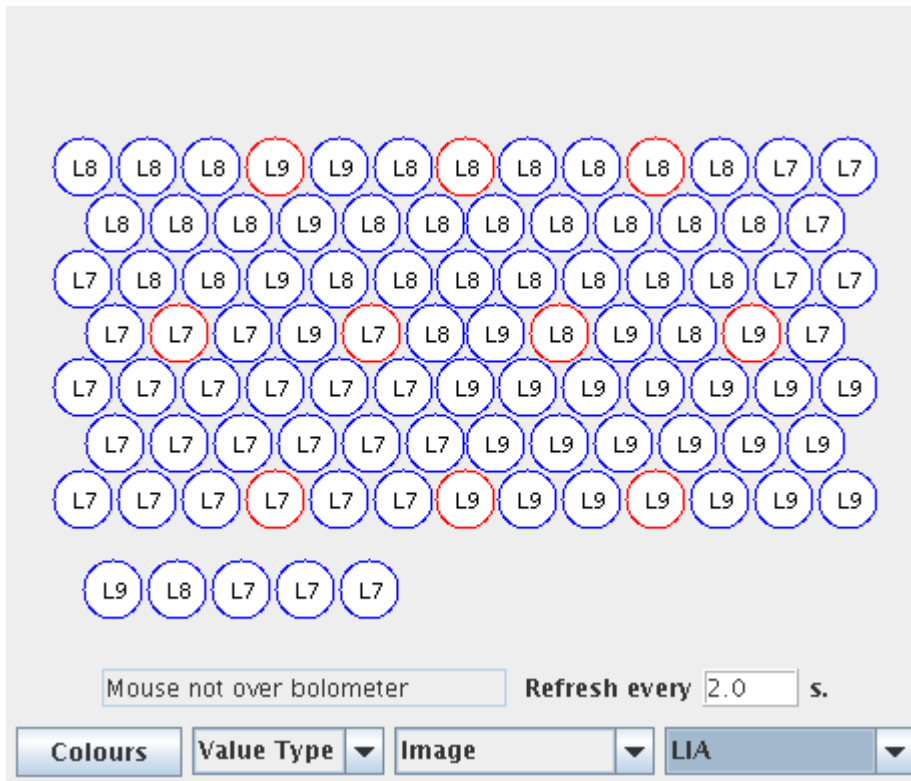


Figure 10 PMW Array: LIA Labels

10. APPENDIX E – PLW ARRAY

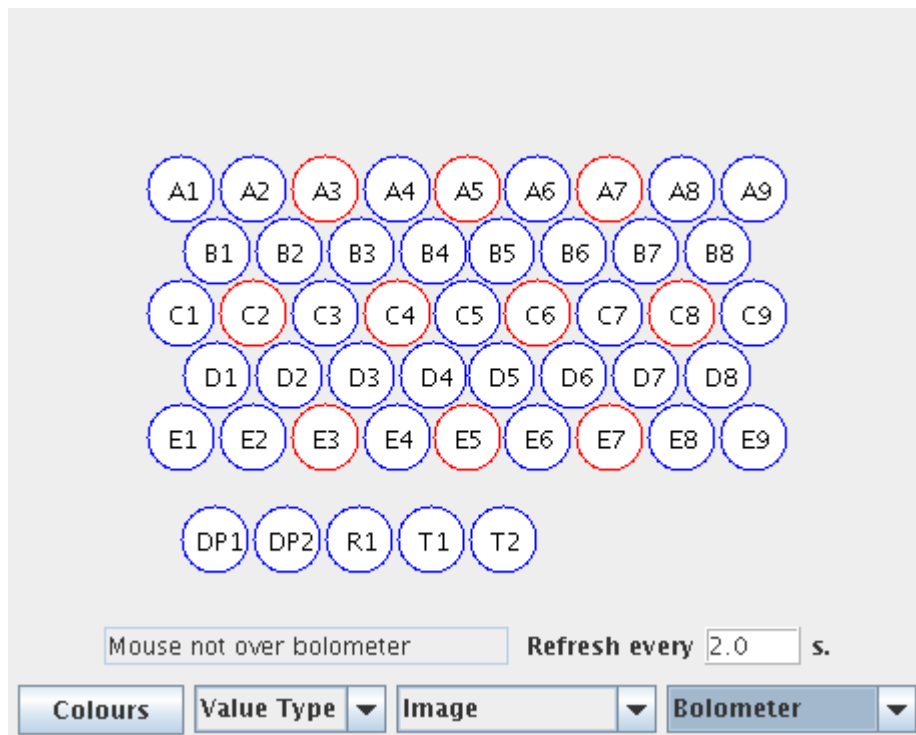


Figure 11 PLW Array: Bolometer Labels (see RD12 for details)

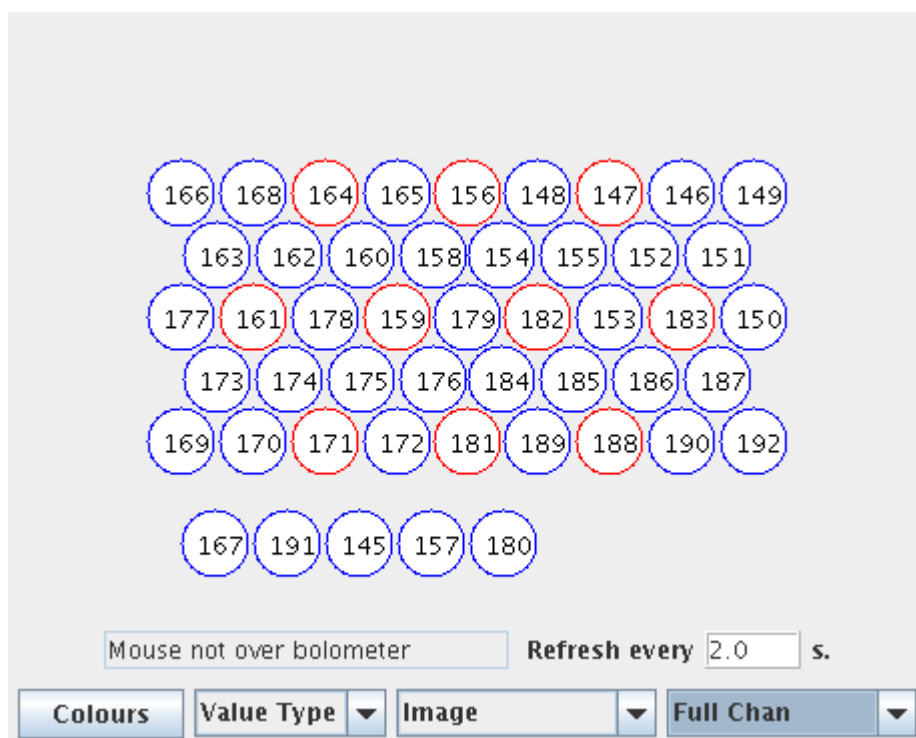


Figure 12 PLW Array: Full Array Indices

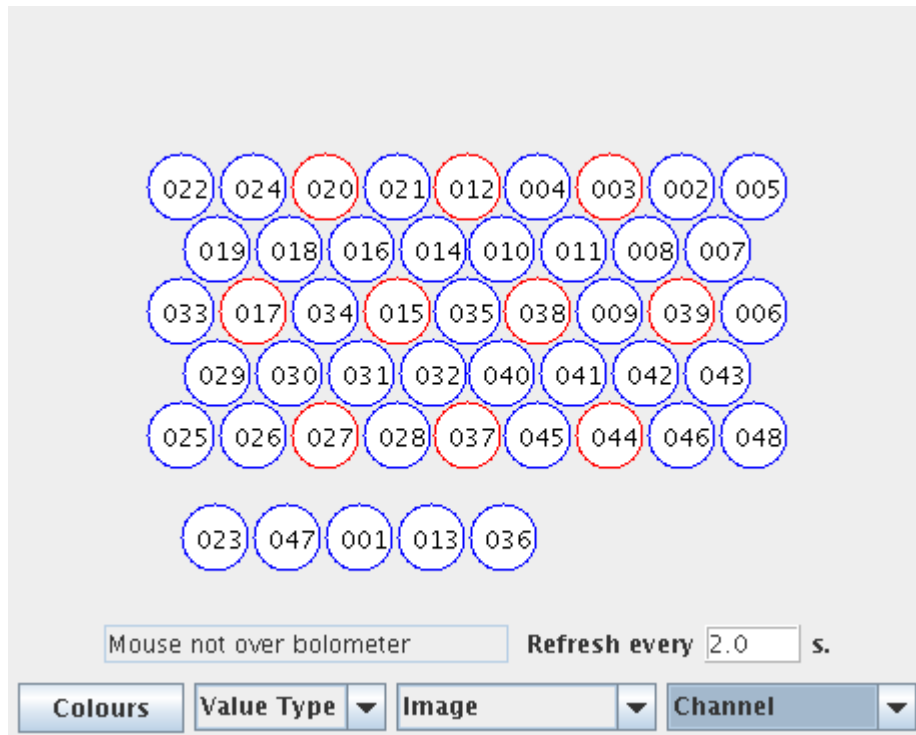


Figure 13 PLW Array Indices

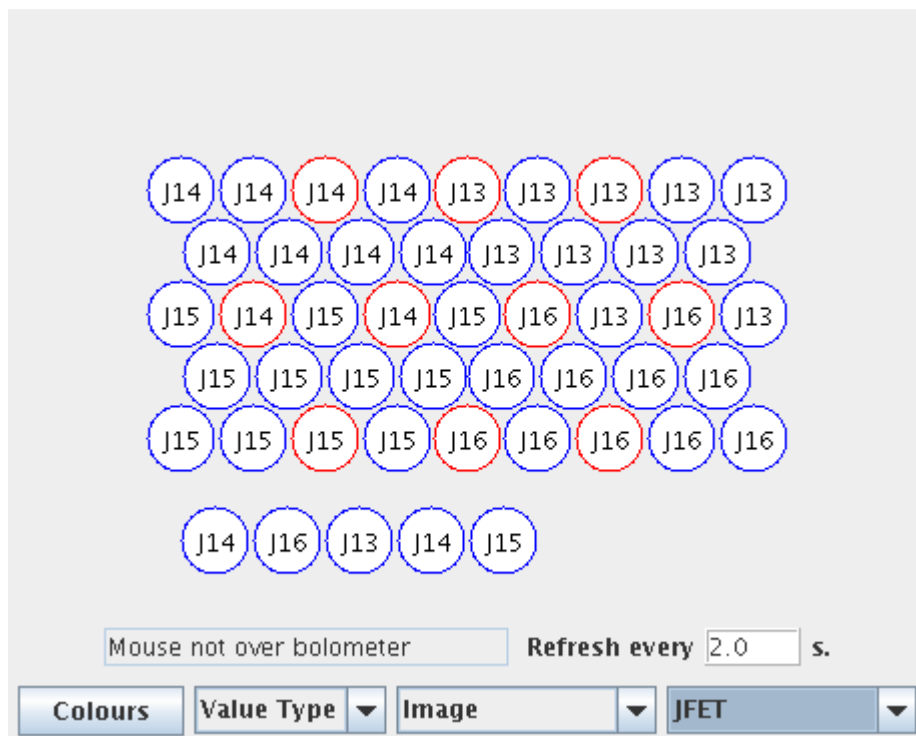


Figure 14 PLW Array: JFET Labels (Output Connector)

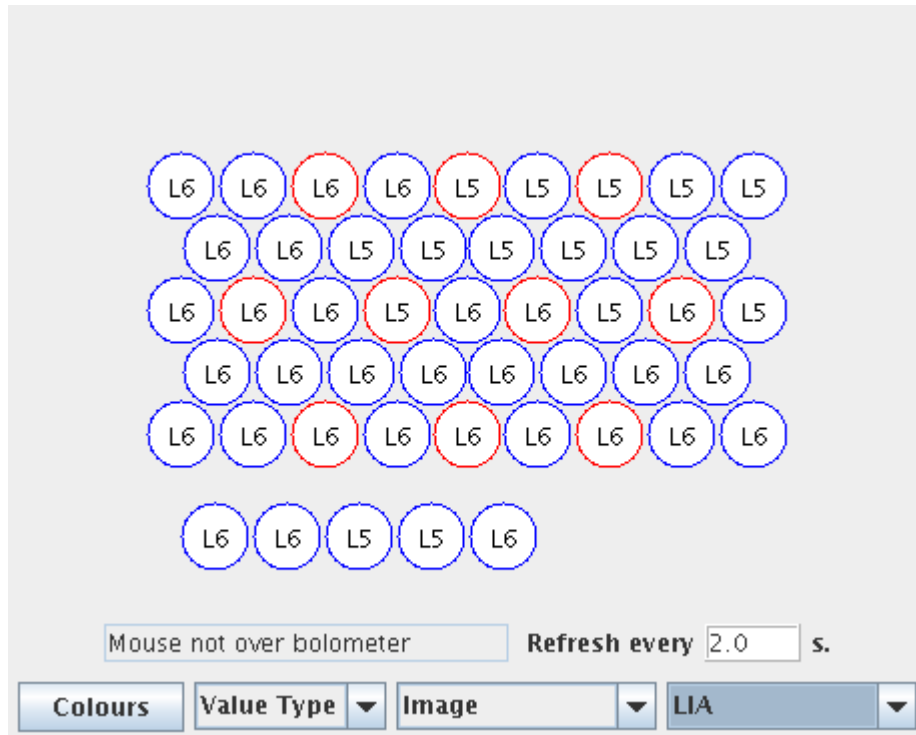


Figure 15 PLW Array: LIA Labels

11. APPENDIX F – PTC CHANNELS (ON PMW ARRAY)

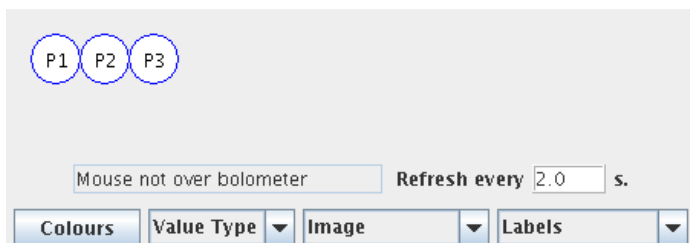


Figure 16 PTC Channels: Bolometer labels (see RD12 for details)

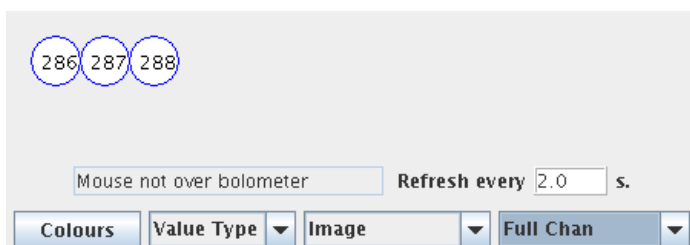


Figure 17 PTC Channels: Full Array Indices



Figure 18 PTC Channel Indices (located in PMW Array)

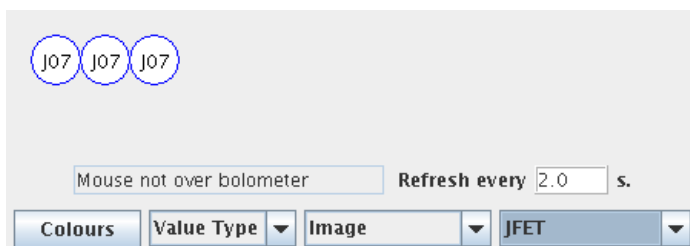


Figure 19 PTC Channels: JFET Labels (Output Connector)

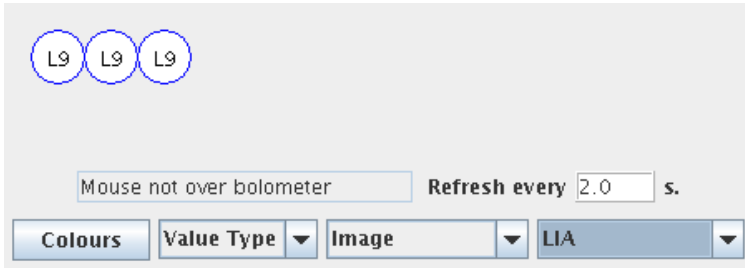


Figure 20 PTC Channels: LIA Labels

12. APPENDIX G – SSW ARRAY

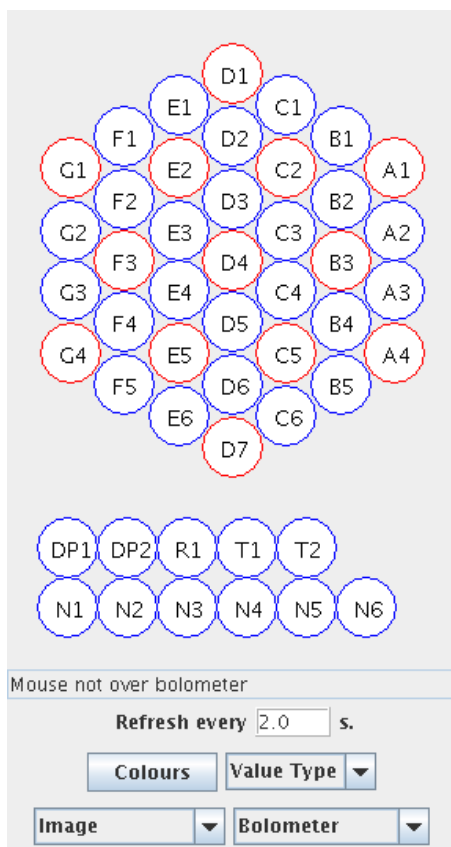


Figure 21 SSW Array: Bolometer Labels (see RD12 for details)

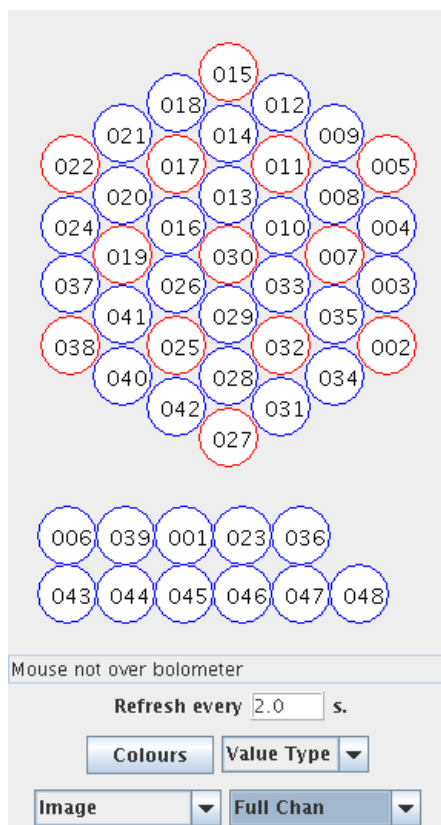


Figure 22 SSW Array: Full Array Indices

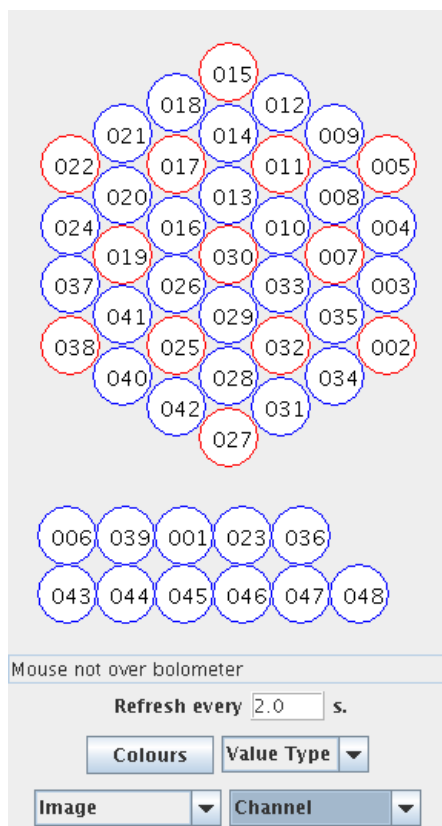


Figure 23 SSW Array Indices

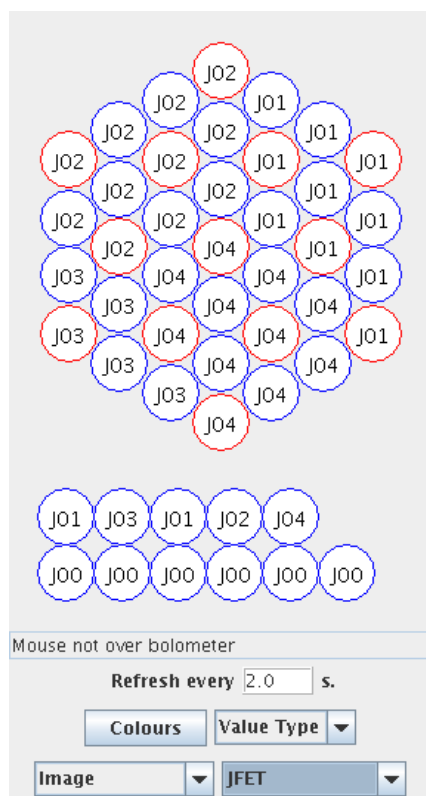


Figure 24 SSW Array: JFET Labels (Output Connector)

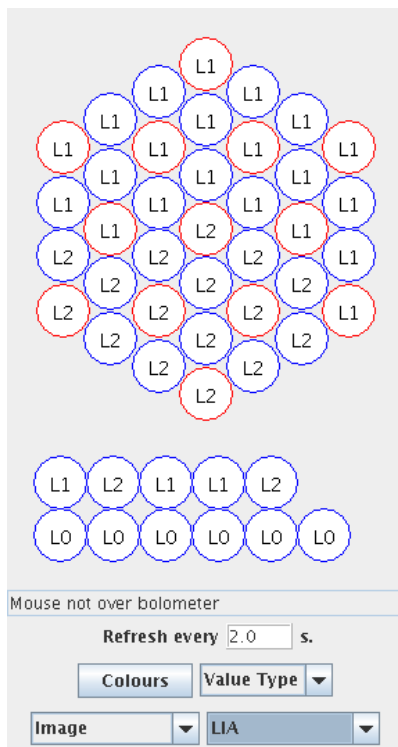


Figure 25 SSW Array: LIA Labels

13. APPENDIX H – SLW ARRAY

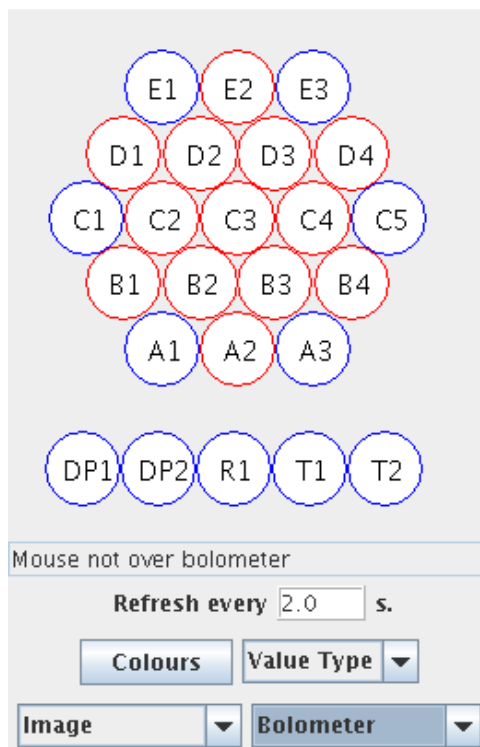


Figure 26 SLW Array: Bolometer Labels (see RD12 for details)

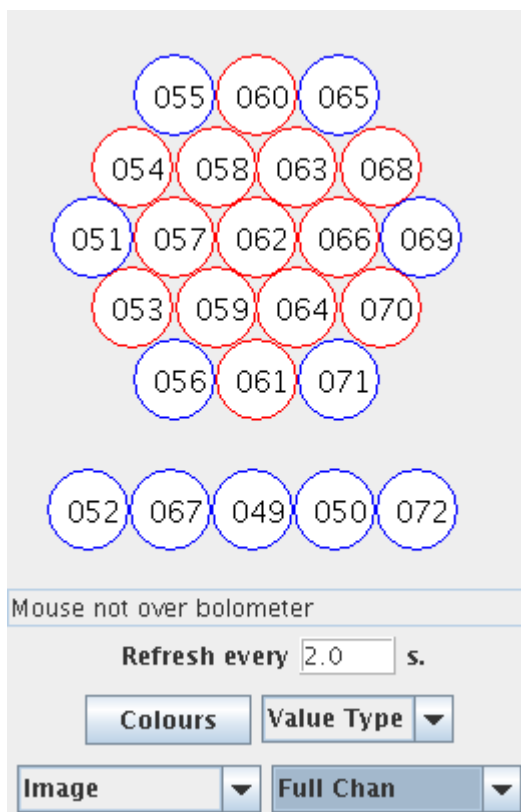


Figure 27 SLW Array: Full Array Indices

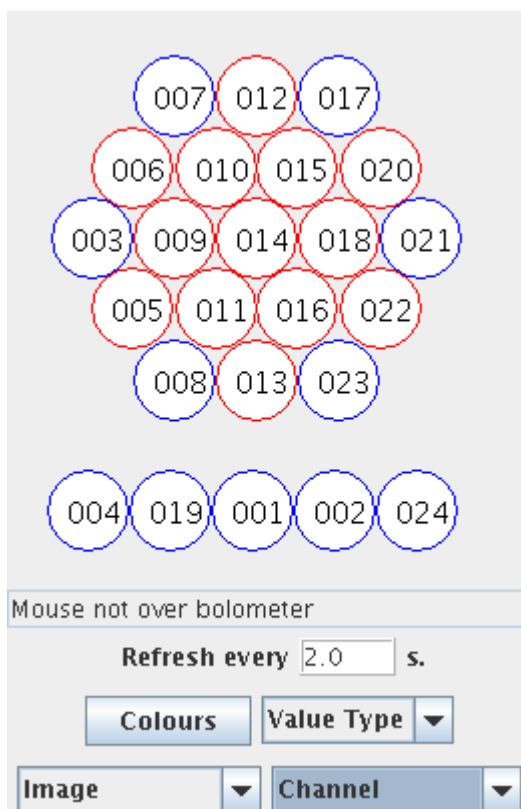


Figure 28 SLW Array Indices

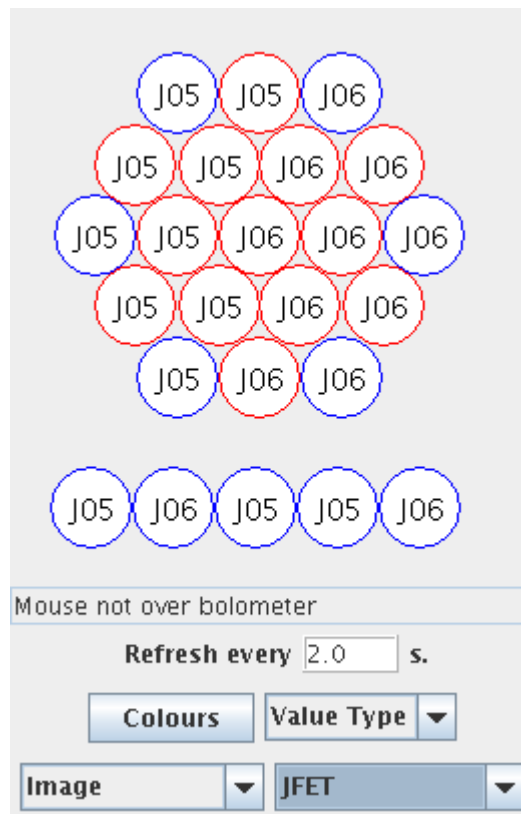


Figure 29 SLW Array: JFET Labels (Output Connector)

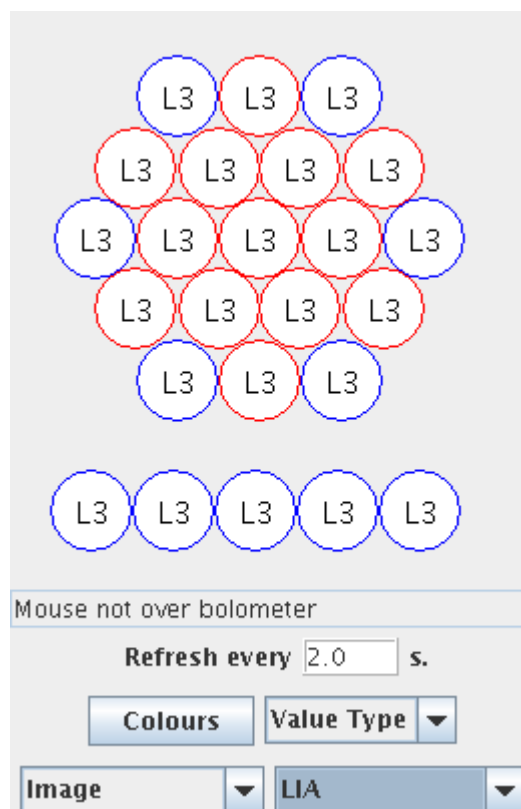


Figure 30 SLW Array: LIA Labels