SPIRE OBCP Trigger Test Procedures for IST

SPIRE-RAL-PRC-003038
Issue 1.6
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Glossary

AOT	Astronomical Observation Template
BSM	Beam Steering Mirror
CCB	Configuration and Control Board
DTCP	Daily Telecommunication Period
ICC	Instrument Control Centre
ILT	Instrument Level Test
IST	Integrated System Test
LEOP	Launch and Early Orbit Phase
LVDT	Linear Voltage Displacement Transducer
MOC	Mission Operations Centre
MOIS	Mission Operation Information System
MTL	Mission Time Line
OE	Optical Encoder
OPD	Optical Path Difference
PID	Proportional, Integral & Differential (control parameters)
PTC	Photometer Thermal Control
PV	Performance Verification
SMEC	Spectrometer Mechanism
SPIRE	Spectral and Photometric Imaging Receiver
SPT	System Performance Test
PTC	Photometer Thermal Control
PV	Performance Verification
SCOM	SpaceCraft Operations Manager
TBC	To Be Confirmed
TBD	To Be Determined
TBS	To Be Specified
VM	Virtual Machine
ZPD	Zero Path Difference

1. INTRODUCTION

The main purpose of these tests is to check the triggering of spacecraft OBCPs as a result of the instrument generating TM(5,2) exception reports for various instrument anomalies. Four such tests are proposed and the On-board software will generate the following exceptions:

- DPU Anomaly
- DRCU Anomaly
- Observation Anomaly
- Observation Anomaly Corrected

For each test the following steps will be executed

- Execute a standalone TCL script from the CCS. This script runs SPIRE commands which generate the required exception report. The script will wait for a time specified in the test and then issue the required event packet.
- On reception of the exception report the appropriate S/C OBCP is triggered.
- The OBCP trigger and execution are monitored.

Procedures are also included for the S/C OBCPs which switch SPIRE OFF in a controlled sequence and for switching SPIRE into Standby mode from an operational mode.

1.1 References

1.1.1 Applicable Documents

AD01	IID Part A (SCI-PT-IIDA-04624), Issue 3.3
AD02	SPIRE Data ICD (SPIRE-RAL-PRJ-001078), Issue 2.1, 12th July 2007
AD03	SPIRE OBS Upload Procedure (SPIRE-RAL-PRC-002866), Issue 1.2, 6th Feb 2008
AD04	Payload Management & OBCP (H-P-1-ASP-TN-1072), Issue 4, 20/01/2007 [sic - should be 20/01/2008]

1.1.2 Reference Documents

RD01	IID Part B (SCI-PT-IIDB-02124), Issue 3.3
RD02	Herschel IST Test Case 'Test of Instrument FDIR OBCP', HP-2-ASED-TP-0197, Issue 1.0, 12th February 2008

1.1.3 Change Record

ISSUE	DATE	
Issue 1	14th Feb 2008	First Version
Issue 1.1	26th Feb 2008	
Issue 1.2	24th April 2008	Procedures SPIRE-DRCU-ANOMALY and SPIRE-OBCP-OFF-CTRL

		updated after SPIRE FDIR OBCP Debug 22-23 April 2008 and review.
Issue 1.3	25th April 2008	Updated procedure SPIRE-OFF-CTRL to reflect that the S/C OBCP DB_OBCP_H_SPIRE_OFF_CTRL cannot be interrupted. Instrument is now in REDY mode at the start of this procedure. TBCs removed from SPIRE-OBCP-STANDBY.
Issue 1.4	10th January 2009	Updated for IST FDIR OBCP tests
Issue 1.5	6th March 2009	Updated the procedure SPIRE-DRCU-ANOMALY in section 2.2.3 (for NCR-4804) Updated the procedure SPIRE-OBCP-STANDBY in section 2.2.6 (for NCR-4827) Only these two procedures are expected to be run at CSG/Kourou during week beginning 9th March 2009.
Issue 1.6	20th April 2009	Updated the procedure SPIRE-OBCP-STANDBY to perform additional checks following update of the OBCP (to fix NCR H-P-112000-ASED-NC-4957)

2. TEST SPECIFICATION

2.1 Prerequisites

- OBS 3.0.B has been uploaded and written to the EEPROM in accordance with AD03.
- The HPSDB on the CCS includes SPIRE MIB 3.0.B2_PR_13Jan2009
- The CCS/I-EGSE communication link is active so that test TM can be received on the I-EGSE

2.2 Test Procedures

The procedures are designed to be executed in the order given below. The sequence is valid for both SPIRE Prime and Redundant instrument.

2.2.1 Procedure: SPIRE-OBSERVATION-ANOMALY

Version: 1.1
Date: 10th Jan 2009

Purpose:
Trigger the S/C OBCP DB_OBCP_H_SPIRE_OPE_STOP to stop SPIRE operations in the case of an anomaly.

Duration:
~ 1-2 seconds to raise the TM(5,2) exception report

Preconditions:

- SPIRE DPU is ON and generating nominal and critical HK. This is assumed to have been done by executing TCL script SPIRE-IST-DBG-OFF2DPUON.tcl, v 1.1 2007/11/30
- SPIRE DRCU is switched on. This is assumed to have been done executing TCL script SPIRE-IST-DBG-DPUON2STBY.tcl,v 1.1 2007/11/30
- SPIRE FDIR tables have been loaded by running the TCL script `SPIRE-IST-FDIR-TABLES.tcl,v 1.1 2009/01/10`
- SPIRE is in PHOTOPS operational mode. This is assumed to have been done executing TCL script SPIRE-IST-DBG-STBY2OPS.tcl,v 1.1 2007/11/30

Initial Configuration:

- SPIRE is in PHOTOPS mode
- Nominal and critical HK data are being generated
- Photometer science data are being generated

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-OBCPTest-ObservationAnomaly.tcl • **Wait for ~ 1-2 seconds for the reception of TM(5,2) event report with Event ID 0xC100 and SID 0x5200** *The reception of this event should trigger the S/C OBCP to abort the current*	Event ID SID	0xC100 0x5200		

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
	sub-schedule and stop SPIRE operations. *The OBCP should leave the DRCU and DPU switched on.* Note that a TM(5,1) event report with Event ID 0x523 and SID 0x5193 is also expected. This is a feature of the way FDIR tables are used in these tests and should be ignored.				
2	**Check that SPIRE operations have stopped.**				

Final Configuration:

- Same as initial configuration except that MTL execution should have stopped

2.2.2 Procedure: SPIRE-OBSERVATION-ANOMALY-CORRECTED

Version: 1.1
Date: 10th Jan 2009

Purpose:
Trigger the S/C OBCP DB_OBCP_H_SPIRE_OPE_RESUME to resume SPIRE operations after an anomaly has been resolved.

Duration:
~ 1-2 seconds to raise the TM(5,2) exception report

Preconditions:
- Procedure SPIRE-OBSERVATION-ANOMALY has been executed beforehand

Initial Configuration:
- SPIRE is in PHOTOPS mode
- Nominal and critical HK data are being generated
- Photometer science data are being generated
- MTL execution has been stopped

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-OBCPTest-ObservationAnomalyCorrected.tcl • **Wait for ~ 1-2 seconds for the reception of TM(5,2) event report with Event ID 0xC110 and SID 0x5200** *The reception of this event should trigger the S/C OBCP to resume SPIRE operations by starting from the next sub-schedule* Note that a TM(5,1) event report with Event ID 0x523 and SID 0x5193 is also expected. This is a feature of the way FDIR tables are used in these tests and should be ignored.	Event ID SID	0xC110 0x5200		

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
2	**Check that the OBCP to resume SPIRE operations has been executed successfully**				

Final Configuration:

- Same as initial configuration except that MTL execution should have resumed

2.2.3 Procedure: SPIRE-DRCU-ANOMALY

Version: 1.2
Date: 6th March 2009

Purpose:
Trigger the S/C OBCP DB_OBCP_H_SPIRE_DRCU_OFF to switch off the DRCU in the case of an anomaly.

Duration:
~ 10-15 seconds to raise the TM(5,2) exception reports

Preconditions:

- SPIRE DPU is ON and generating nominal and critical HK. This is assumed to have been done by executing TCL script SPIRE-IST-DBG-OFF2DPUON.tcl, v 1.1 2007/11/30
- SPIRE DRCU is switched on. This is assumed to have been done executing TCL script SPIRE-IST-DBG-DPUON2STBY.tcl,v 1.1 2007/11/30
- SPIRE FDIR tables have been loaded by running the TCL script `SPIRE-IST-FDIR-TABLES.tcl,v 1.3 2009/03/06`
- SPIRE is in PHOTOPS operational mode. This is assumed to have been done by executing TCL script SPIRE-IST-DBG-STBY2OPS.tcl,v 1.1 2007/11/30

Initial Configuration:

- SPIRE is in PHOTOPS mode
- Nominal and critical HK data are being generated
- Photometer science data are being generated

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-OBCPTest-DRCUAnomaly.tcl (Issue 1.3, 6th March 2009) *This script initiates the SAFE mode transition for the SPIRE instrument.* **Wait for ~ 1-2 seconds for the reception of TM(5,2) event report with Event ID 0xC100 and SID 0x5200 – OPE_STOP** *The reception of this event should trigger the S/C OBCP to stop the MTL.*	Event ID SID	0xC100 0x5200		

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
	After ~10 seconds a TM(5,2) event report with Event ID 0xC000 and SID 0x5200 should be received – DRCU_OFF *The OBCP should then switch off the DRCU but leave the DPU on and generating critical HK only.*				
2	• **Check that the DRCU has been powered off** • **Check that the nominal HK report generation has stopped** • **Check that critical HK report generation is still in progress, i.e. APID 1280, TM(3,25) packets being received at 2 second intervals** • **Check that the MODE_C parameter is set to 0x900 (SAFE) on the CRITICAL HK PARAMETERS display SA_0_559**	THSK MODE_C	Not incrementing 0x900		

Final Configuration:

- SPIRE DRCU is powered OFF
- SPIRE DPU is on and generating critical HK
- SPIRE is in SAFE mode

2.2.4 Procedure: SPIRE-DPU-ANOMALY

Version: 1.1
Date: 10th Jan 2009

Purpose:
Trigger the S/C OBCP DB_OBCP_H_SPIRE_OFF to switch off the DPU in the case of an anomaly.

Duration:
~ 1-2 seconds to raise the exception report

Preconditions:

- SPIRE DPU is ON and generating nominal and critical HK. This is assumed to have been done by executing TCL script SPIRE-IST-DBG-OFF2DPUON.tcl, v 1.1 2007/11/30
- SPIRE DRCU is switched on. This is assumed to have been done by executing TCL script SPIRE-IST-DBG-DPUON2STBY.tcl,v 1.1 2007/11/30
- SPIRE FDIR tables have been loaded by running the TCL script `SPIRE-IST-FDIR-TABLES.tcl,v 1.1 2009/01/10`

Initial Configuration:

- SPIRE is in REDY mode
- Nominal and critical HK data are being generated

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-OBCPTest-DPUAnomaly.tcl • **Wait for ~ 1-2 seconds for the reception of TM(5,2) event report with Event ID 0xC010 and SID 0x5200** *The reception of this event should trigger the S/C OBCP to switch off the DRCU & DPU* *The OBCP should stop*	Event ID SID	0xC010 0x5200		

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
	the nominal and critical HK report generation and switch off the DPU Note that a TM(5,1) event report with Event ID 0x523 and SID 0x5193 is also expected. This is a feature of the way FDIR tables are used in these test and should be ignored.				
2	• **Check that the nominal and critical HK report generation has stopped** • **Check that the DRCU has been powered off** • **Check that the DPU has been powered off**				

Final Configuration:
SPIRE DPU and DRCU are powered OFF

2.2.5 Procedure: SPIRE-OBCP-OFF-CTRL

Version: 1.3
Date: 10th Jan 2009

Purpose:
Controlled switch off of SPIRE using the S/C OBCP DB_OBCP_H_SPIRE_OFF_CTRL.

Duration:
~ 1-2 minutes

Preconditions:

- SPIRE DPU is ON and generating nominal and critical HK. This is assumed to have been done by executing TCL script SPIRE-IST-DBG-OFF2DPUON.tcl, v 1.1 2007/11/30
- SPIRE DRCU is switched on. This is assumed to have been done executing TCL script SPIRE-IST-DBG-DPUON2STBY.tcl,v 1.1 2007/11/30
- SPIRE FDIR tables have been loaded by running the TCL script `SPIRE-IST-FDIR-TABLES.tcl,v 1.1 2009/01/10`
- SPIRE is in PHOTOPS operational mode. This is assumed to have been done executing TCL script SPIRE-IST-DBG-STBY2OPS.tcl,v 1.1 2007/11/30

Initial Configuration:

- SPIRE is in PHOTOPS mode
- Nominal and critical HK data are being generated
- Photometer science data are being generated

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	**Execute the S/C OBCP DB_OBCP_H_SPIRE_OFF_ CTRL**				
2	**There are 4 SPIRE TCs in the OBCP which are designed to stop currently running VMs. These are expected to fail with failure code 0x080A – VM not running.** **The reception of these TM(1,8) packets does not indicate a problem.**				
3	**DB_OBCP_H_SPIRE_OFF_CTRL executes the SPIRE TC RUN_VM(60,0,0,0) to safe the instrument.** **Ensure that this TC is successfully executed, i.e. TM(1,1), TM(1,3) and TM(1,7) reports are received.** **Wait ~ 2-3 seconds for this TC to put SPIRE into a safe configuration.** **Nominal HK generation will stop but Critical HK generation will continue.** **The C_MODE parameter on the CRITICAL HK PARAMETERS display should read 0x900 (SAFE)**	**C_MODE**	**0x900**		
4	**Check that both the SPIRE DRCU and DPU have been switched off as specified in the OBCP.**				
5	**Note that three TM(5,4) event reports could be received during the delay between the switch off of the DRCU and DPU:** • **Event ID 0x550C, SID 0x5420: SPIRE_ALARM_LSDCU_DEAD** • **Event ID 0x550D, SID 0x5420:**				

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
	SPIRE_ALARM_LSMCU_DEAD • **Event ID 0x550E, SID 0x5420: SPIRE_ALARM_LSSCU_DEAD** **Three TM(5,1) event reports can also be expected during the period between switch off of the DRCU and DPU:** • **Event ID 0x0520, SID 0x510E: No_DCU_Response_Error** • **Event ID 0x0521, SID 0x510F: No_MCU_Response_Error** • **Event ID 0x0522, SID 0x5110: No_MCU_Response_Error**				

Final Configuration:
SPIRE DRCU and DPU are both powered OFF

2.2.6 Procedure: SPIRE-OBCP-STANDBY

Version: 1.4
Date: 20th April 2009

Purpose:
Put SPIRE in Standby mode using the S/C OBCP DB_OBCP_H_SPIRE_STBY.

Duration:
~ 1-2 minutes

Preconditions:

- SPIRE DPU is ON and generating nominal and critical HK. This is assumed to have been done by executing TCL script SPIRE-IST-DBG-OFF2DPUON.tcl, v 1.1 2007/11/30
- SPIRE DRCU is switched on. This is assumed to have been done executing TCL script SPIRE-IST-DBG-DPUON2STBY.tcl,v 1.1 2007/11/30
- SPIRE FDIR tables have been loaded by running the TCL script `SPIRE-IST-FDIR-TABLES.tcl,v 1.3 2009/03/06`
- SPIRE is in PHOTOPS operational mode. This is assumed to have been done by executing TCL script SPIRE-IST-DBG-STBY2OPS.tcl,v 1.1 2007/11/30

Initial Configuration:

- SPIRE is in PHOTOPS mode
- Nominal and critical HK data are being generated at 1Hz and 0.5Hz respectively
- Photometer science data are being generated

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	**Execute TCL script SPIRE-IST-DBG-RUN-VM.tcl,** `v1.1 2009/04/20` **It should run a single VM from Table 253.** **Check the value of the VMSTAT parameter**	VMSTAT	0xFD		
2	**Execute the S/C OBCP DB_OBCP_H_SPIRE_ STANDBY**				
3	**Wait ~2-3 seconds for the following TC to be executed by the OBCP** **RUN_VM(**				

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
	TABLEID=61, INDEX=0, N=0, DATA=0)				
4	**After the OBCP has finished, check that the sampling of the Nominal HK Report is 0.25Hz (OBCP was modified in response to NCR-4827).**	THSK	Refreshes every 4 seconds		
5	**Check that the MODE parameter on the DPU & OBS PARAMETERS display is set to REDY**	MODE	REDY		
6	**Check that VM parameter VMSTAT has been reset to 0xFFFF.** **This should indicate that the VM run in Step 1 was successfully halted by the OBCP**	VMSTAT	0xFFFF		
7	**Check also that the HALT_VM TC executed successfully.** **But the HALT_VM1, HALT_VM2 and HALT_VM3 should all fail with failure code 0x080A – No_Command_List running. This is the expected behaviour when these VMs are not running.**				

Final Configuration:

- SPIRE is in REDY mode
- Nominal and critical HK data are being generated at 0.25Hz and 0.5Hz respectively
- Photometer science data generation has stopped

- End of Document