SPIRE Onboard Software Upload Procedure for IST

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SPIRE-RAL-PRC-002866
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Approved by:

1. Introduction

This document describes the procedure to upload On Board Software (OBS) version 3.0.B for the SPIRE instrument using the Alenia OBSM tool as implemented on the Herschel CCS. This procedure requires communication with SPIRE personnel. The SPIRE I-EGSE will be used to verify that the upload procedure is successful.

1.1 Scope

The Alenia OBSM tool is intended to be used for all such uploads and patching of the OBS for the FM IST. It addresses the following issues:

- Upload of an entire OBS image from the Boot Software (BSW)
- Upload of an entire OBS image into Program Memory (PM) from the OBS Application Software (ASW)
- Manual patch of the OBS image in PM
- Verification of the upload and patch in all cases

For SPIRE OBS 2.2.H, only the first option of upload from the BSW will be used. This is because previous attempts to patch and upload from the ASW using the OBSM tool have led to verification problems.

1.2 Applicable Documents

AD#	Title	Reference	Issue#	Date
AD01	SPIRE On-Board Software User Manual	SPIRE-IFS-PRJ-001391	3.0.0	29th Oct 2008
AD02	SPIRE Data ICD	SPIRE-RAL-PRJ-001078	2.1	12/07/2007
AD03	SCOS-2000 OBSM External Interfaces Control Document	S2K-MCS-ICD-0014-TOS-GCI	1.3	11/07/2001

1.3 Reference Documents

RD#	Title	Reference	Issue#	Date
RD01	SPIRE Warm Units Integration Test Procedures	SPIRE-RAL-PRC-002680	1.3	15/02/2007
RD02	SPIRE OBS 3.0.B Acceptance Test Report	SPIRE-RAL-REP-003167	Issue 1	4th Nov 2008

1.4 Change Record

Doc	Issue#	Changes	Date of Change
Draft	1	First Draft Version – untested	18/02/2007
Issue	1	Issue 1 ▪ writing latest OBS into both partitions of EEPROM. ▪ checking the PM contents in SPIRE-OBS-	20/03/2007

			UL-04	
Issue	1.1	• Updated after the following tests: ▪ OBS upload tests at Astrium/FN on the FM DPU from the Boot Software. ▪ Manual patching tests at RAL on the AVM-1 DPU. • All the test procedures have been renamed and redefined.	27/07/2007	
Issue	1.2	Removed the procedures for patching and full image upload because of verification limitations in the Alenia OBSM tool. Only the full OBS image upload from the Boot Software (BSW) will be performed for version 2.2.H.	06/02/2008	
Issue	1.3	Version for upload of OBS 3.0.B • Included procedure for uploading the complete PM image from the ASW • The DM BSW upload procedures are not applicable for this release as CCS prefer to upload using the PM image.	4th Nov 2008	

1.5 Duration

The estimated duration for uploading a SPIRE OBS image from the BSW is approximately **40 minutes. Total duration will be ~ 2 hours for upload to both prime and redundant DPU.**

1.6 Open Issues – <mark>Not applicable for this release</mark>

SPIRE-OBS-22H-BSW-UL-IMAGE-FORCCS.tcl is a standalone TCL script which can be executed from the CCS to upload the SPIRE OBS 2.2.H image from the BSW. This script has been tested on the SPIRE AVM and is provided by SPIRE as an alternative to using the Alenia OBSM tool. It has the advantage that the upload can be completed in ~20 minutes, while still respecting the DM page boundaries.

This script assumes that the Load Memory TC ZCZ04999 is defined in the CCS database and that it accepts four parameters, viz. ZH013999, ZH014999, ZH015999 and ZH010999.

1.7 NCR Status

PRISMA NCRs fixed in this release: 3324, 3327, 4128, 4197, 4198, 4200, 4457, 4495, 4507, 4516

1.8 List of Acronyms

ASW	Application Software
AVM	Avionics Model
BSW	Boot Software
CCS	Central Checkout System
DM	Data Memory (DSP)

DPU	Digital Processing Unit
DSP	Digital Signal Processor
EEPROM	Electronically Erasable Programmable Read Only Memory
EGSE	Electrical Ground Support Equipment
I-EGSE	Instrument EGSE
FM	Flight Model
FN	Friedrichshafen
FPU	Focal Plane Unit
IST	Integrated System Test
NCR	Non Conformance Report
OBS	On Board Software
OBSM	OBS Management Tool
PM	Program Memory (DSP)
PROM	Programmable Read Only Memory
SAU	Single Addressable Unit

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2. Test Configuration

HCDMU:

- The Bus list selected on the HCDMU should be for SPIRE PRIME Instrument, (i.e., 27 TM slots allocated for SPIRE telemetry). For the PRIME side tests the BUS Configuration should be SPIRE Prime (i.e, RT=21) and for the REDUNDANT side test the BUS Configuration should be SPIRE Redundant (i.e, RT=22)
- The HCDMU and CCS should be interconnected.

CCS & I-EGSE:

- The CCS and the I-EGSE should be interconnected via the Pipe GW.
- The SPIRE MIB should be imported on the CCS.
- The CCSHandler application software should be running on the I-EGSE.
- I-EGSE system is up and running.(Database, SCOS , QLA, EGSE Router and Gateway, TM ingestion)

3. OBS Upload Procedure Overview

3.1 General instructions for executing the test procedures

- Before carrying out the next procedure within the test sequence always ask for the go ahead by the SPIRE staff.
- Section 3.4 of this document specifies the sequence and detailed steps to be executed.
- The procedure tables in section 3.4 include blank boxes where the actual values of parameters can be noted. Based on the comparison with the expected values the success or failure of a step should be recorded in the final column of the table.
- The last row in a procedure table should be used to record the overall Pass/Fail result of each test.
- Any text in boldface in the procedural steps generally indicates an action which may have to be performed manually by the CCS staff.

3.2 General Pass/Fail Criteria

Consecutive failure of 2 executions of the same procedure is enough to declare the overall test result as failed. If the repetition of a failed test execution is successful this one should be repeated once again as a 'health' check.

3.3 Constraints

A general constraint (inferred from the test configuration described above) is that the SPIRE DPU power interface to the Herschel satellite must be connected before carrying out this procedure.

3.4 Procedures for Upload of OBS

3.4.1 Procedure SPIRE-OBS-UL-BSW-01: Not applicable for OBS 3.0.B

Version	1.1
Date	6th February 2008
Purpose	To upload complete SPIRE OBS DM image from the BSW for DPU PRIME
Initial configuration	SPIRE DPU PRIME and DRCU are switched off
Final configuration	SPIRE DPU PRIME is ON and SPIRE HK is being produced , SPIRE DRCU is OFF
Preconditions	• SPIRE FM DPU is electrically integrated with the Herschel Satellite • SPIRE MIB PRIME is imported in the CCS database. • CCS is up and running • I-EGSE is up and running • DPU AND OBS PARAMETERS display is selected on the CCS
Duration	~40 minutes
Pass/Fail criteria	Verification of successful upload is that nominal and critical HK reports start being generated at their nominal rates of 1Hz and 0.5Hz respectively.

Procedure Steps:

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
1	**Select DPU AND OBS PARAMETERS display is on the CCS**	—	—	—	
2	**Power ON the SPIRE DPU PRIME unit using the dedicated spacecraft LCL line and configure 1553 Spacecraft bus for SPIRE DPU PRIME (RT = 21)**	—	—	—	
3	**Wait for the boot software to produce at least 2 event packets (5,1) with Event ID 0x8008 and SID 0x0003.** **The last three parameters in the report (before the packet checksum) should be 0xABAB, 0xCDCD and 0xAAAA. Chec**	—	—	—	
4	**Prepare to load the SPIRE OBS from file SPDPRMDA_000022H_ REF_2008_023T200600.IMG** **The OBS image is in ICD 14 format (AD03).** **NOTE: This image specifies the addresses in DM.**	—	—	—	
5	**Verify with the I-EGSE staff the actual sequence of the actual sequence of Load Memory commands which will be uplinked to the DPU. This is to verify that the upload is to the correct Memory Area:** **In the Load Memory TCs generated by the OBSM tool, is the Memory ID set to 0x11?**	Memory ID	0x11		
		Number of	TBD		

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
	Record the number of Load Memory TCs that have been generated by the OBSM tool. **Ensure that the TCs generated by the OBSM tool respect DM page boundaries. A DM page is 1024 SAUs, where a DM SAU is 32-bits.** **Note: NSAU parameter should be 32, based on previous DM image uploads using the Alenia OBSM tool.**	(6,2) Load Memory TCs			
6	**Once instructed by the I-EGSE staff, proceed with the upload of OBS.** *For N Load Memory (6,2) TCs the upload will take N/2 seconds* **For each Load Memory TC, the BSW generates a TM(5,1) event report with Event ID 0x8111 and SID 0x0003. The four subsequent 16-bit words in the packet should be zero. These signify a successful acceptance of the TC by the BSW.**	Time taken for upload	—		
7	Execute the SPIRE TC (8,4) SCD11505: LOAD_TC_AND_BOOT It copies the OBS from DM to PM and starts running it.	—	—	—	
8	**Check that Nominal and Critical HK packets are arriving at the CCS:** **SPIRE Nominal HK:** (type ,subtype) : (3,25) - APID : 0x502				

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
	SPIRE Critical HK: • (type ,subtype) : (3,25) • APID: 0x500				
9	**Check that THSK parameter is refreshing every second**	THSK	Refreshing @ 1 Hz		
10	**Check that TM2N parameter is incrementing by 1 every second**	TM2N	Incrementing @ 1Hz		
11	**Check that TM1N parameter is incrementing by 1 every 2 second**	TM1N	Incrementing @ 0.5Hz		
12	**Check the version of the OBS which has been uploaded**	OBSVER1 OBSVER2 OBSVER2	2 2 H		

3.4.2 Procedure SPIRE-OBS-UL-ASW-01:

Version	1.2
Date	4th Nov 2008
Purpose	To upload the complete SPIRE OBS PM image from the ASW and reboot
Initial configuration	SPIRE DPU PRIME or REDUNDANT is ON and generating nominal and critical HK, SPIRE DRCU is OFF
Final configuration	SPIRE DPU PRIME or REDUNDANT is ON and SPIRE HK is being produced , SPIRE DRCU is OFF
Preconditions	• SPIRE FM DPU is electrically integrated with the Herschel Satellite • SPIRE MIB PRIME is imported in the CCS database. • CCS is up and running • I-EGSE is up and running • DPU AND OBS PARAMETERS display is selected on the CCS
Duration	~40 minutes for PRIME and ~40 minutes for REDUNDANT
Pass/Fail criteria	• The new OBS starts up after upload and produces nominal and critical HK reports at 1Hz and 0.5Hz respectively • Memory dumps and checks produce expected results

Procedure Steps:

Step	Description	Parameter	Expected Values Before/ After	Actual Values Before/ After	Pass/ Fail
1	**Select DPU AND OBS PARAMETERS display on the CCS**	—	—	—	
2	Execute SPIRE TC(8,4) SCR01500 to stop Nominal HK Report: CLEAR_HK_REPORT (PCKTID=0x301) The Nominal HK report generation should stop.	TM2N	Not incrementing anymore	—	
3	Execute SPIRE TC(8,4) SCM06500 to clone the OBS into high PM: **Check with I-EGSE staff for the value of TC parameters**	—	—	—	

Step	Description	Parameter	Expected Values Before/ After	Actual Values Before/ After	Pass/ Fail
	CLONE_OBS (DEST_ADDR, N_PM_WORDS)	DEST_ADDR N_PM_WORDS	0x40000 0x16E13		
4	**Prepare to load the SPIRE OBS PM image from file:** **SPDPRMPG_000030B_REF_ 2008_309T113100.IMG** **Check with the I-EGSE staff the actual PM offset address where the image is to be loaded. Apply this offset when using the OBSM tool to generate the (Type=6, Subtype2) TCs**	—	—	—	
5	**Verify with the I-EGSE staff the actual sequence of the actual sequence of Load Memory commands which will be uploaded to the DPU. This is to verify that the upload is to the correct Memory Area and Address:** **In the Load Memory TCs generated by the OBSM tool, is the Memory ID set to 0x0?** **Record the PM offset and the number of Load Memory TCs that have been generated by the OBSM tool.**	Memory ID PM Offset Number of (6,2) Load Memory TCs	0x0 0x40000 TBD		
6	**Once instructed by the I-EGSE staff, proceed with the upload of OBS.** *For N Load Memory (6,2) TCs the upload will take N/2 seconds*	Time taken for upload	—	—	
7	**Once all the Load Memory TCs have been executed successfully, send the**				

Step	Description	Parameter	Expected Values Before/ After	Actual Values Before/ After	Pass/ Fail
	following commands to check the contents of uploaded image in high PM using SPIRE TC(6,9) SCM02500: CHECK_MEMORY(MEMORYID=0x0, STARTADDR, NSAU)	STARTADDR NSAU	0x44000 0x1795		
	Checksum in TM(6,10) packet	Checksum	0x4C5F		
	CHECK_MEMORY(MEMORYID=0x0, STARTADDR, NSAU)	STARTADDR NSAU	0x46000 0xFFFF		
	Checksum in TM(6,10) packet	Checksum	0x078F		
	CHECK_MEMORY(MEMORYID=0x0, STARTADDR, NSAU)	STARTADDR NSAU	0x55FFF 0xE14		
	Checksum in TM(6,10) packet	Checksum	0xD362		
8	**If previous step is successful then send the command to commit the new OBS and reboot:** **SPIRE TC(8,4) SCM07500:** COMMIT_OBS_AND_ REBOOT (FROM_ADDR=, N_PM_WORDS) **Confirm the parameter values with the I-EGSE staff**	FROM_ADDR N_PM_WORDS	0x40000 0x16E13		

Step	Description	Parameter	Expected Values Before/ After	Actual Values Before/ After	Pass/ Fail
9	**Check that Nominal HK packets have started arriving again at the CCS:** SPIRE Nominal HK: • (type ,subtype) : (3,25) • APID : 0x502 **Check that THSK parameter is refreshing every second** **Check that TM2N parameter is incrementing by 1 every second**	 THSK TM2N	 Refreshing @ 1 Hz Incrementing @ 1Hz		
10	**Check that TM1N parameter is still incrementing by 1 every 2 seconds**	TM1N	Incrementing @ 0.5Hz		
11	**Check the version of the OBS which has been uploaded**	OBSVER1 OBSVER2 OBSVER2	3 0 B		

12	**Now send commands to verify the checksum of the new OBS in low PM using SPIRE TC(6,9) SCM02500:**
	
	 CHECK_MEMORY(
	     MEMORYID=0
	     x0,
	     STARTADDR,
	     NSAU)
	
	 Checksum in TM(6,10) packet
	
	 CHECK_MEMORY(
	     MEMORYID=0
	     x0,
	     STARTADDR,
	     NSAU)
	
	 Checksum in TM(6,10) packet
	
	 CHECK_MEMORY(
	     MEMORYID=0
	     x0,
	     STARTADDR,
	     NSAU)
		
		 STARTADDR
		 NSAU
		
		 Checksum
		
		 STARTADDR
		 NSAU
		
		 Checksum
			
			 0x4000
			 0x1795
			
			 0x4C5F
			
			 0x6000
			 0xFFFF
			
			 0x078F		

Step	Description	Parameter	Expected Values Before/ After	Actual Values Before/ After	Pass/ Fail
	Checksum in TM(6,10) packet	STARTADDR NSAU	0x15FFF 0xE14		
		Checksum	0xD362		

3.4.3 Procedure SPIRE-OBS-UL-EEPROM-01:

Version	1.2
Date	4th Nov 2008
Purpose	To write the uploaded SPIRE OBS into the DPU
Initial configuration	SPIRE DPU PRIME is on and the OBS is running
Final configuration	SPIRE DPU PRIME is on and the OBS is running. The OBS is written into the EEPROM
Preconditions	• CCS is up and running • I-EGSE is up and running • DPU AND OBS PARAMETERS display is selected on the CCS • Procedure SPIRE-OBS-UL-ASW-01 has been successfully run.
Duration	~2 minutes
Pass/Fail criteria	TC to write the OBS into the EEPROM is successful

Procedure Steps:

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/Fail
1	**Select DPU AND OBS PARAMETERS display is on the CCS**	—	—	—	
2	Send TC(8,4) SCD08505 to write the OBS into secondary partition of the EEPROM: WRITE2EEPROM(STARTADDR, ENDADDR, PARTITION_FLAG, JUMP_NPAGES – Group Repeater,) **Note: OBS 3.0.B will be written to just the secondary partition. Primary partition is not to be used until further notice.**	— 0x4000 0x16E13 1 0	—	—	
5	Wait for ~30 seconds to receive TM(1,7) report. Reception of this report indicates a successful completion of procedure.	—	—	—	

3.4.4 Procedure SPIRE-OBS-UL-BSW-02: <mark>Not applicable for OBS 3.0.B</mark>

Version	1.1
Date	6th February 2008
Purpose	To upload complete SPIRE OBS DM image from the BSW for DPU REDUNDANT
Initial configuration	SPIRE DPU and DRCU REDUNDANT are switched off
Final configuration	SPIRE DPU REDUNDANT is ON and SPIRE HK is being produced , SPIRE DRCU is OFF
Preconditions	• SPIRE FM DPU is electrically integrated with the Herschel Satellite • SPIRE MIB REDUNDANT is imported in the CCS database. • CCS is up and running • I-EGSE is up and running • DPU AND OBS PARAMETERS display is selected on the CCS
Duration	~40 minutes
Pass/Fail criteria	Verification of successful upload is that nominal and critical HK reports start being generated at their nominal rates of 1Hz and 0.5Hz respectively.

Procedure Steps:

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
1	**Select DPU AND OBS PARAMETERS display is on the CCS**	—	—	—	
2	**Power ON the SPIRE DPU REDUNDANT unit using the dedicated spacecraft LCL line and configure 1553 Spacecraft bus for SPIRE DPU PRIME (RT = 22)**	—	—	—	
3	**Wait for the boot software to produce at least 2 event packets (5,1) with Event ID 0x8008 and SID 0x0003. These events get generated at 10 second intervals.** **The last three parameters in the report (before the packet checksum) should be 0xABAB, 0xCDCD and 0xAAAA.**	—	—	—	
4	**Prepare to load the SPIRE**	—	—	—	

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
	OBS from file SPDPRMDA_000022H_ REF_2008_023T200600.IMG **The OBS image is in ICD 14 format (AD03).** **NOTE: This image specifies the addresses in DM.**				
5	**Verify with the I-EGSE staff the actual sequence of the actual sequence of Load Memory commands which will be uplinked to the DPU. This is to verify that the upload is to the correct Memory Area:** **In the Load Memory TCs generated by the OBSM tool, is the Memory ID set to 0x11?** **Record the number of Load Memory TCs that have been generated by the OBSM tool.** **Ensure that the TCs generated by the OBSM tool respect DM page boundaries. A DM page is 1024 SAUs, where a DM SAU is 32-bits.** **Note: NSAU parameter should be 32, based on previous DM image uploads using the Alenia OBSM tool.**	Memory ID Number of (6,2) Load Memory TCs	0x11 TBD		
6	**Once instructed by the I-EGSE staff, proceed with the upload of OBS.** *For N Load Memory (6,2) TCs the upload will take N/2*	Time taken	—		

SPIRE Procedure

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Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
	seconds **For each Load Memory TC, the BSW generates a TM(5,1) event report with Event ID 0x8111 and SID 0x0003. The four subsequent 16-bit words in the packet should be zero. These signify a successful acceptance of the TC by the BSW.**	for upload			
7	Execute the SPIRE TC (8,4) SCD11505: LOAD_TC_AND_BOOT It copies the OBS FROM DM to PM and starts running it.	—	—	—	
8	**Check that Nominal and Critical HK packets are arriving at the CCS:** **SPIRE Nominal HK:** • (type ,subtype) : (3,25) • APID : 0x503 **SPIRE Critical HK:** • (type ,subtype) : (3,25) • APID: 0x501				
9	**Check that THSK parameter is refreshing every second**	THSK	Refreshing @ 1 Hz		
10	**Check that TM2N parameter is incrementing by 1 every second**	TM2N	Incrementing @ 1Hz		
11	**Check that TM1N parameter is incrementing by 1 every 2 second**	TM1N	Incrementing @ 0.5Hz		
12	**Check the version of the OBS which has been uploaded**	OBSVER1 OBSVER2 OBSVER2	2 2 H		

3.4.5 Procedure SPIRE-OBS-UL-EEPROM-02:

Version	1.2
Date	4th Nov 2008
Purpose	To write the uploaded SPIRE OBS into the DPU
Initial configuration	SPIRE DPU REDUNDANT is on and the OBS is running
Final configuration	SPIRE DPU REDUNDANT is on and the OBS is running. The OBS is written into the EEPROM
Preconditions	• CCS is up and running • I-EGSE is up and running • DPU AND OBS PARAMETERS display is selected on the CCS • Procedure SPIRE-OBS-UL-ASW-01 has been successfully run.
Duration	~5 minutes
Pass/Fail criteria	TC to write the OBS into the EEPROM is successful

Procedure Steps:

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
1	**Select DPU AND OBS PARAMETERS display is on the CCS**	—	—	—	
2	**Send TC(8,4) SCD08505 to write the OBS into primary partition of the EEPROM:** WRITE2EEPROM(　　　　　STARTADDR, 　　　　　ENDADDR, 　　　PARTITION_FLAG, 　JUMP_NPAGES – Group Repeater,)	— 0x4000 0x16E13 0 0	—	—	
3	Wait for ~30 seconds to receive TM(1,7) report. Reception of this report indicates a successful completion of procedure.	—	—	—	

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
4	**Send TC(8,4) SCD08505 to write the OBS into secondary partition of the EEPROM:** WRITE2EEPROM(STARTADDR, ENDADDR, PARTITION_FLAG, JUMP_NPAGES – Group Repeater,)	— 0x4000 0x16E13 1 0	—	—	
5	Wait for ~30 seconds to receive TM(1,7) report. Reception of this report indicates a successful completion of procedure.	—	—	—	