SPIRE RE Most Emissive Mode EMC Test Procedures for IST
## Issue 1.0

Approved by

1. Introduction

This document describes the SPIRE procedures to be used for IST Radiative Emissions EMC testing in the most emissive mode. The transition to and from the mode for the measurements is as follows:

- **OFF to STBY. Note that the STBY mode is known as REDY mode in SPIRE terminology.** In this mode only SPIRE HK is being generated.
- **STBY to "PHOTOPS"**, where "PHOTOPS" refers to a dummy mode where SPIRE is Prime Instrument and generating both Photometer and MCU science as well as HK data at the nominal data rate. **SPIRE should be in this mode for the duration of the EMC RE tests.**
- **"PHOTOPS" to STBY**
- **STBY to OFF**
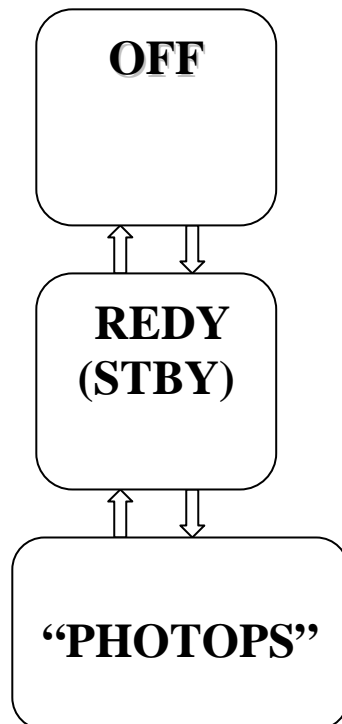
Since these procedures use standalone TCL scripts they do not require initiation from the I-EGSE, although the I-EGSE will be used to monitor the progress of the tests and to archive test data.

1.1 Scope

1.2 Applicable Documents

AD#	Title	Reference	Issue#	Date
AD01	SPIRE Functional Test Specification	SPIRE-RAL-DOC-001652	1.4	22nd July 2005

1.3 Reference Documents

RD#	Title	Reference	Issue#	Date
RD01	SPIRE Instrument User Manual	SPIRE-RAL-PRJ-002395	1.3	9th Nov 2007

1.4 Change Record

Doc	Issue#	Changes	Date of Change
Issue	1.0	First version	25th March 2008

1.5 Open Issues

1.6 Constraints

1.7 List of Acronyms

AND	Alpha Numeric Display
AVM	Avionics Model
BSM	Beam Steering Mirror
CCS	Central Checkout System
CDMU	Command and Data Management Unit
CE	Conductive Emissions
DCU	Detector Control Unit
DPU	Digital Processing Unit
DRCU	Detector Readout and Control Unit
EGSE	Electrical Ground Support Equipment

EMC	Electromagnetic Compatibility
FM	Flight Model
FPU	Focal Plane Unit
I-EGSE	Instrument EGSE
IST	Integrated Systems Test
MCU	Mechanism Control Unit
RE	Radiative Emissions
SMEC	Spectrometer Mechanism
WU	Warm Units

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2. Test Configuration

The main differences between the AVM and the FM configurations are with respect to the hardware. On the SPIRE AVM hardware the Warm Units and the FPU are substituted by a DRCU simulator.

2.1 FM Test Configuration

This is the required configuration prior to the start of the test:

SPIRE WU:

- The SPIRE FM DRCU should be interconnected with the SPIRE FM DPU, both PRIME and REDUNDANT interfaces.
- The SPIRE FM DRCU NOMINAL and REDUNDANT power interfaces to the Herschel satellite should be connected.
- The SPIRE FM DPU NOMINAL and REDUNDANT 1553 interfaces to the Herschel satellite should be connected.
- The SPIRE FM DPU NOMINAL and REDUNDANT power interfaces to the Herschel satellite should be connected.

HCDMU:

- The Bus list selected on the HCDMU should be as appropriate for the planned activity. If SPIRE is to put into an "Operations" mode then bus list should be for SPIRE Prime Instrument, (i.e., 27 TM slots allocated for SPIRE telemetry). For the NOMINAL side tests the BUS Configuration should be SPIRE Nominal (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:

- The SPIRE MIB should be imported on the CCS.

3. IST EMC Procedures Overview

3.1 General instructions for executing the test procedures

- Section 3.2 of this document specifies the sequence to be executed. Each of the steps in the sequence has a detailed specification in section 4.
- The detailed procedures in section 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.
- In general any text in boldface in the procedural steps indicates an action which may have to be performed manually by the CCS staff.

3.2 Test Sequences

3.2.1 EMC Test Sequence

This section specifies the sequence to be executed for switching between OFF and PHOTOPS modes. Maximum estimated times for executing a test sequence are also given.

Procedure Name	Purpose	Duration
SPIRE-IST-EMC-RE-OFF-TO-STBY	To switch SPIRE from OFF to STBY mode	~5 min
SPIRE-IST-EMC-RE-STBY-TO-PHOTOPS	To switch SPIRE from STBY to "PHOTOPS" mode	~5 min
SPIRE-IST-EMC-RE-PHOTOPS-TO-STBY	To switch SPIRE from "PHOTOPS" to STBY mode	~5 min
SPIRE-IST-EMC-RE-STBY-TO-2OFF	To switch SPIRE from STBY to OFF	~5 min

Total: ~ 20 min

4. Detailed IST EMC RE Procedures

4.1 Procedures

4.1.1 Procedure SPIRE-IST-EMC-RE-OFF-TO-STBY

Version	1.0
Date	31st July 2007
Purpose	To switch the SPIRE instrument from OFF to STBY mode
Initial configuration	SPIRE DPU and DRCU are switched off
Final configuration	SPIRE is in STBY mode: • SPIRE DPU and DRCU are on • Generating Nominal HK reports at 4 second intervals • Generating Critical HK reports at 2 second intervals
Preconditions	• SPIRE FM DPU and DRCU are electrically integrated with the Herschel Satellite • SPIRE MIB is imported in the CCS database. • CCS is up and running • DPU AND OBS PARAMETERS AND is selected on the CCS • SFT PARAMETERS AND is selected on the CCS
Duration	5 minutes
Pass/Fail criteria	Nominal and Critical HK reports start being generated at their nominal rates of 0.25Hz and 0.5Hz respectively.

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
1	**Power ON the SPIRE DPU NOMINAL unit using the dedicated spacecraft LCL line and configure 1553 Spacecraft bus for SPIRE DPU (RT = 21)**	—	—	—	
2	Wait for the boot software to produce at least 2 event packets (5,1)	—	—	—	
3	Execute TCL script SPIRE-IST-DBG-OFF2DPUON.tcl – Issue 1.2	—	—	—	

4	Nominal and Critical HK packets should arrive at the CCS for 30 seconds: **SPIRE Nominal HK:** • (type ,subtype) : (3,25) • APID : 0x502 **SPIRE Critical HK:** • (type ,subtype) : (3,25) • APID: 0x500	—	—	—	
5	For this 30 second period check that TM1N and TM2N parameters incremented as indicated	TM1N TM2N	@ 0.5Hz @ 1Hz	—	
6	After this 30 second interval check that all HK TM reception has stopped	TM1N TM2N	Not incrementing Not incrementing	— —	
7	**Power ON the SPIRE DRCU NOMINAL unit using the dedicated spacecraft LCL line.**	—	—	—	
8	Execute TCL script SPIRE-IST-DBG-DPUON2STBY.tcl – Issue 1.3	—	—	—	
9	Check that the THSK parameter is refreshing every 4 seconds	THSK	Refreshing @ 0.25Hz	—	

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
10	Check that TM1N and TM2N parameters are incrementing as indicated	TM1N	Incrementing by 2 every 4 seconds	—	
		TM2N	Incrementing by one every 4 seconds	—	
11	Check that the DRCU parameters show nominal values.	SCUP5V	~ $5.2 \pm 0.5V$		
		SCUP9V	~ $9.0 \pm 0.2V$		
		SCUM9V	~ $-9.0 \pm 0.2V$		
		BIASP5V	~ $5.1 \pm 0.5V$		
		BIASP9V	~ $9.0 \pm 0.2V$		
		BIASM9V	~ $-9.0 \pm 0.2V$		
		MCUBITSTAT	0/1		
		MCUP5V	~ $5.0 \pm 0.3V$		
		MCUP14V	~ $14.0 \pm 0.6V$		
		MCUM14V	~ $-14..0 \pm 0.6V$		
		MCUP15V	~ $15.0 \pm 0.6V$		
		MCUM15V	~ $-15.0 \pm 0.7V$		
12	Check that SPIRE is in REDY mode	MODE	DRCU_ON/REDY		
Test Result (Pass/Fail):					

4.1.2 Procedure SPIRE-IST-EMC-RE-STBY-TO-PHOTOPS

Version	1.0
Date	25th March 2008
Purpose	To switch SPIRE from STBY to "PHOTOPS" mode
Initial configuration	• SPIRE DPU and DRCU are ON • SPIRE is in REDY mode
Final configuration	SPIRE is Prime Instrument and in "PHOTOPS" mode: • Generating critical and nominal HK at 0.5Hz and 1Hz respectively • Photometer LIAs are switched on • BSM and SMEC sensors are switched on • Generating photometer data at ~ 18 packets/s • Generating MCU Eng data at 2 packets/s
Preconditions	• SPIRE MIB is imported in the CCS database. • CCS is up and running • DPU AND OBS PARAMETERS and FUNCTIONAL TEST PARAMETERS ANDs are selected on the CCS
Duration	10 minutes
Pass/Fail criteria	SPIRE is Prime Instrument and in "PHOTOPS" mode: • Generating critical and nominal HK at 0.5Hz and 1Hz respectively • Generating Photometer and MCU engineering data at ~ 18 packets/s and 2 packets/s respectively

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/ After	Success/ Failure
1.	Execute TCL script SPIRE-IST-EMC-RE-STBY2PHOTOPS.tcl – Issue 1.1	—	—	—	
2.	Check that THSK parameter is refreshing every second	THSK	Refreshing @ 1Hz	—	
3.	Check that TM1N and TM2N parameters are incrementing as indicated	TM1N TM2N	@ 0.5Hz @ 1Hz	—	

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/ After	Success/ Failure
4.	Check that the Photometer LIAs have switched on	PLIABITSTAT	0/1		
5.	Check that the BSM sensors have switched on	CHOPSENSPWR JIGGSENSPWR	0/1 0/1		
6.	Check that the SMEC sensors are switched on	SMECENCPWR SMECLVDTPWR	0/1 0/1		
7.	Check that TM3N is incrementing as indicated	TM3N	~18-20 Hz	—	
8.	Check that TM5N is incrementing as indicated	TM5N	Incrementing by ~4-5 every 2 seconds	—	
9.	Check that DCUFRAMECNT and MCUFRAMECNT on the FUNCTIONAL TEST PARAMETERS AND are incrementing as indicated	DCUFRAMECNT MCUFRAMECNT	~18-20 Hz Incrementing by ~96-100 every 2 seconds	— —	
10.	Check that the MODE parameter is set to RAW value 0xFFCD for the "PHOTOPS" mode *Note that "PHOTOPS" is a dummy value for the EMC RE activities – no converted value is defined.*	MODE	REDY (0x200) / 0xFFCD		

Test Result (Pass/Fail):

4.1.3 Procedure SPIRE-IST-EMC-RE-PHOTOPS-TO-STBY

Version	1.0
Date	25th March 2008
Purpose	To switch SPIRE from "PHOTOPS" to STBY mode
Initial configuration	- SPIRE DPU and DRCU are ON - SPIRE is Prime Instrument - SPIRE is in "PHOTOPS" mode and generating photometer and MCU test pattern data, as well as HK - Photometer LIAs are switched on - BSM and SMEC sensors are on
Final configuration	SPIRE is in STBY mode: - Generating only critical and nominal HK at 0.5Hz and 0.25Hz respectively - Photometer LIAs are switched off - BSM and SMEC sensors are switched off
Preconditions	- SPIRE MIB is imported in the CCS database. - CCS is up and running - DPU AND OBS PARAMETERS and FUNCTIONAL TEST PARAMETERS ANDs are selected on the CCS
Duration	10 minutes
Pass/Fail criteria	SPIRE is in STBY mode

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Success/ Failure
1.	Execute TCL script SPIRE-IST-EMC-RE-PHOTOPS2STBY.tcl – Issue 1.0	—	—	—	
2.	Check that the THSK parameter is refreshing every 4 seconds	THSK	Refreshing @ 0.25Hz	—	
3.	Check that TM1N and TM2N parameters are incrementing as indicated	TM1N	Incrementing by 2 every 4 seconds	—	
		TM2N	Incrementing by one every 4 seconds		
4.	Check that TM3N and TM5N have stopped incrementing	TM3N	—	—	
		TM5N	—	—	
5.	Check that DCUFRAMECNT and MCUFRAMECNT on the FUNCTIONAL TEST PARAMETERS AND have stopped incrementing	DCUFRAMECNT	—	—	
		MCUFRAMECNT	—	—	
6.	Check that SPIRE is in REDY mode (RAW 0x200)	MODE	0xFFCD/0x200 (REDY)		

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Success/ Failure
7.	Check that the Photometer LIAs are switched off	PLIABITSTAT	1/0		
8.	Check that the BSM sensors have switched off	CHOPSENSPWR JIGGSENSPWR	1/0 1/0		
9.	Check that the SMEC sensors are switched off	SMECENCPWR SMECLVDTPWR	1/0 1/0		
Test Result (Pass/Fail):					

4.1.4 Procedure SPIRE-IST-EMC-RE-STBY-TO-OFF

Version	1.1
Date	25th March 2008
Purpose	To switch SPIRE from STBY mode to OFF
Initial configuration	• SPIRE DPU and DRCU are ON • SPIRE is in STBY mode: Generating only critical and nominal HK at 0.5Hz and 0.25Hz respectively
Final configuration	SPIRE is OFF: • DPU and DRCU are both OFF
Preconditions	• SPIRE MIB is imported in the CCS database. • CCS is up and running • DPU AND OBS PARAMETERS is selected on the CCS • SFT PARAMETERS AND is selected on the CCS
Duration	5 minutes
Pass/Fail criteria	SPIRE instrument is OFF

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Success/ Failure
1	Execute TCL script SPIRE-IST-DBG-STBY2OFF.tcl – Issue 1.2	—	—	—	
2	Check that TM1N and TM2N parameters have both stopped incrementing	TM1N TM2N	— —	— —	
3	Check that the MCU has been switched off Expected events: • A TM(5,1) event report with Event ID 0x0521 and SID 0x510F will be received to indicate that the DPU is not receiving a response from the MCU. • A TM(5,4) event report with Event ID 0x550D and SID 0x5420 will be received to indicate the MCU disconnection from the DPU.	MCUBITSTAT	1/0		
4	Check that SPIRE is in DRCU_ON mode	MODE	DRCU_ON		
5	**Power OFF the SPIRE DRCU NOMINAL unit.**	—	—	—	
6	**Power OFF the SPIRE DPU NOMINAL unit.**	—	—	—	
Test Result (Pass/Fail):					

NOTE: IF THE DPU IS TO BE POWERED ON AGAIN, PLEASE WAIT ~2 MINUTES AFTER EXECUTION OF SPIRE-IST-EMC-RE-STBY2OFF.