

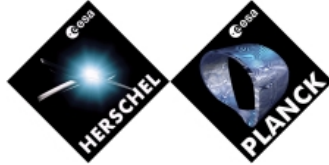
HERSCHEL / PLANCK

HERSCHEL SFT AND AFT SPECIFICATION

Product Code : 100000

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CHANGE RECORDS

ISSUE	DATE	§ CHANGE RECORDS	AUTHOR
1.0	24 JUL 07	First issue	Y. ROCHE
2.0	25 SEP 07	<ul style="list-style-type: none"> • Inclusion of ESA comments • Split SFTs into 2 SFTs (with new definition) and 5 AFTs. 	Y. ROCHE



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1. SCOPE

This document is the leading specification for all the Short Functional Tests and Abbreviated Functional Tests to be performed at satellite level. This specification and derived procedures will be reused for CSG activities.

The propulsion SFTs, which are very specific and can be run independently, are intentionally not part of this specification. They will be subject to a specific specification.

A distinction is brought between two kinds of tests:

- SFT (short functional test).
The purpose of the SFT is to make a check up of the functionalities of the satellite, concentrating on dedicated functions of the subsystems.
- AFT (abbreviated functional test).
The purpose of the AFT is to serve as overall check-up of the satellite functions, without making thorough checks. AFTs are used to give enough confidence in the state of the spacecraft to proceed to the next test.



2. DOCUMENTATION

2.1 APPLICABLE DOCUMENTS

[AD0] H-EPLM AIV and Herschel Satellite AIT Requirement Specification
H-P-1-ASP-SP-0008

[AD1] CDMS SFT Specification
H-P-1-ASP-TS-1384

[AD2] Herschel ACMS SFT at spacecraft level
H-P-2-ASP-TN-1186

[AD3] PCS Health check Test Specification
H-P-1-ASP-TS-1379

[AD4] Test specification for SFT on TT&C S/S
to be issued (will be derived from Planck's equivalent H-P-3-ASP-TS-1328)

[AD5] Test Specification for Herschel Instrument AVM and FM Tests performed at satellite level
H-P-2-ASP-TS-1083 issue 1.0

[AD6] Verification Programme Plan (VPP)
H-P-1-ASPI-PL-0225

2.2 REFERENCE DOCUMENTS

[RD1] Herschel Cryostat SFT Procedure
HP-2-ASED-TP-0099, issue 2.0

[RD2] Herschel Integrated Satellite Test Specification
H-P-2-ASP-SP-0939, issue 4.0



3. REQUIREMENTS VERIFIED BY THE SATELLITE SFT

The purpose of the satellite SFTs and AFTs is to verify that the S/C has not been degraded by transportation and specific tests.

Therefore, the satellite SFTs do not participate directly to the verification of the ESA system requirements traced in TAS-F VCDs. See however the notice in section 2 about the AIV requirement AIAI-110.

4. TEST DEFINITION AND SEQUENCE

4.1 SFT

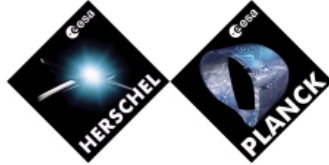
In [AD0], the S/C AIT sequence has the following chronology:

- in Friedrichshafen :
 - Mating,
 - First FM cool down,
 - IST 1,
 - SPT
- Transportation Friedrichshafen – ESTEC
- in ESTEC :
 - EMC Test in He II,
 - TVTB Test in He II,
 - Mechanical Tests in He I,
 - IST 2,
 - SPT.

At the time of the IST1 (debug and formal run) and the SPT, the functions of the satellite will have been checked. Therefore, it is considered useless and time consuming to repeat an SFT before and after transportation to ESTEC. Consequently, the satellite SFTs will be performed at ESTEC, as follows:

- in ESTEC:
 - **SFT#1**: one major reference SFT at arrival,
 - **SFT#2**: one SFT after mechanical tests (to be compared with the results of the SFT#1), that will be completed by the IST 2.

Some sequence optimisation can be performed, in order not to have the SFTs fully in series. For instance, SFT#1 and He activities can overlap, as well as SFT#2 and alignment activities.



4.2 AFT

The AFTs will be run at the following times, in order to give go ahead for the next test phase:

- **AFT#1**: before the Radiated EMC tests,
- **AFT#2**: before the TV/TB test (after installation of Herschel in the LSS),
- **AFT#3**: before the mechanical sine test,
- **AFT#4**: before the mechanical acoustic test,
- **AFT#5**: after the mechanical acoustic test, and before the SFT 2.

5. TEST CONFIGURATION

For all SFTs and AFTs described herein, the S/C will be in vertical position, and does not need to be moved from one test to another.

The EGSE configuration will be:

- SFTs: as defined in [RD2], section 3.1.2.
- AFTs: Herschel shall be connected through the umbilical plugs:
 - power from the Power SCOE,
 - TM and TC through the TM/TC Data Front End.

For specific conditions, refer to relevant Applicable Document, depending on the test.

Helium conditions are given in Table 7-1 for the SFTs and Table 8-1 for the AFTs.

6. SHORT FUNCTIONAL TESTS IN NON NOMINAL CASES

The SFTs to which this general specification refers is the basis for some non nominal runs that would result from NRB dispositions.

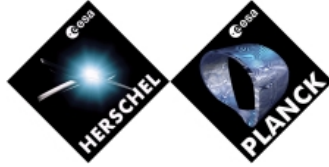
Consequently, it shall be possible to run independently any of the SFT steps (see Table 7-1).

7. SFT APPLICABILITY MATRIX

The Herschel SFTs specifications are the object of specific documents: AD1 to 5 and RD1. Each of these SFTs is split into several steps.

The SFT will be made by:

- switch S/C ON,



- apply Table 7-1 hereunder states which SFTs and which steps are required during the different SFT sessions of the Flight Model AIT. Table 7-1 is not sequential: the optimised sequence will be defined during the preparation of the procedure,
- switch S/C OFF.



			SFT #1 Satellite	SFT #2 Satellite	Expected Duration
		SFT performed after:	IST 1	Mechanical	
		SFT performed before:	EMC	IST2	
		Remark	in He I	in He I	
CDMS SFT	SSMM health check	Made by default in all IST tests. Will be done in // with the ACMS SFT.			
	PM reset	Part of IST spec, e.g. section 5.8.6 (S/C reconfiguration)	Yes	No	1 x 1 shift
	switch over to CDMU PM B	Part of IST spec, e.g. section 5.9.1 and 2 (degraded cases)			
ACMS SFT	AAD	Partially covered by IST spec (launch clean run)			
	SAS	Partially covered by IST spec (launch clean run)			
	CRSA	Partially covered by IST spec (S/C reconfiguration). This test is done in // with other ACMS tests.		No	
	GYR	Covered by IST (all tests with gyro ON). This test is done in // with other ACMS tests.	Yes		1 x 2 shifts + 1 x ½ shift
	RW	Covered by IST in representative cases (full torque/full speed not covered)			
	STR	Not covered by IST spec. To be done before/after envt. Access to STRs is possible with VIS and VSS, not with MPT.		Yes	
	AAU	Covered by IST spec (S/C reconfiguration)		No	
PCS SFT	PCDU Start Up Verification	S/C power ON, on BATSIM, covered by IST.			
	PCDU 2-domain Verification	Transition from BATSIM to SAS. Covered by IST launch sequence. Interesting for isolated SFT.	Yes	No	1 x 1 shift
	Command and Monitor Verification	Check of 1553 bus on PCDU/CDMU. Covered by IST S/C reconfiguration.		Yes	1 x ½ shift
	SAS-Section PCDU Input Shunt operation verification	Not part of IST. Interesting for isolated SFT.			
TT&C SFT	Simultaneous TC + TM + RG (end to end functional check)	Partially covered by TTC SIT	Yes	Yes	2 x 1 shift
PACS SFT	Switch-on PACS Nominal	Refer to [AD5]	Yes	No	1 x 2 x
	Basic chopper moves				



			SFT #1 Satellite	SFT #2 Satellite	Expected Duration
	Optional launch-lock open / close steps				1 h 12 min
	Open loop / closed loop simple grating moves				
	Calibration sources, simple check (no stabilisation)				
	Heater/Flashers: simple check of currents				
	Filter wheel Phot: 3 full turns				
	Filter wheel Spec: 3 full turns				
	T Sensors: plausibility check				
	Ge:Ga detector chain: mainly dummy resistor check				
	Cooler: check if heater currents can be applied (T response)				
	Bolometer detector chain: bias staircase pattern				
	Configure PACS to non Prime				
SPiRE SFT	SPiRE-IST-DPU-ON	Refer to [AD5]	Yes	No	1 x 2 x 1 h
	SPiRE-IST-DRCU-ON				
	SPiRE-IST-FUNC-SCU-01				
	SPiRE-IST-FUNC-SCU-03				
	SPiRE-IST-FUNC-SCU-06				
	SPiRE-IST-FUNC-SCU-07				
	SPiRE-IST-FUNC-SCU-04				
	SPiRE-IST-FUNC-SCU-05				
	SPiRE-IST-FUNC-MCU-01				
	SPiRE-IST-FUNC-MCU-02				
	SPiRE-IST-FUNC-BSM-01				
	SPiRE-IST-BSM-OFF				
	SPiRE-IST-FUNC-SMEC-01				
	SPiRE-IST-SMEC-OFF				
	SPiRE-IST-FUNC-DCU-01				
	SPiRE-IST-FUNC-DCU-04-P				
	SPiRE-IST-PLIA-OFF				
	SPiRE-IST-FUNC-DCU-04-S				
	SPiRE-IST-SLIA-OFF				
	SPiRE-IST-MCU-OFF				
	SPiRE-IST-SCU-OFF				
	SPiRE-IST-DRCU-OFF				
	SPiRE-IST-DPU-OFF				
HIFI SFT	Switch-on HIFI (= OFF -> SAFE transition)	Refer to [AD5]	Yes	No	1 x 2 x 1 h
	ICU SFT				
	HRS SFT				
	WBS SFT				
	FP SFT (all bands)				
	LO SFT (all bands)				
	SFT on redundant FCU, ICU				
	Standby / Shut Down				



			SFT #1 Satellite	SFT #2 Satellite	Expected Duration
CRYO SFT	Verify C100 Thermistors	Refer to [RD1]	Yes	Yes	TBD by ASED, to be done in // with other SFT tests (check of download ed TM).
	Verify Pt1000 Thermistors				
	Verify Pressure Sensors				
	Verify Liquid Level Probes				
	Switch Valves				
	Switch Heaters				
		Duration, total per SFT	6 shifts	2 shifts	

Table 7-1 – SFT applicability matrix



8. AFT SEQUENCE

All AFT sequences are identical. However, the Helium state varies, in accordance with the Table 8-1:

AFT #	Helium State
1	He II
2	
3	He I
4	
5	

Table 8-1 – Helium state during AFTs

The AFT sequence is defined in Table 8-2.

As for the SFTs, the cryo sequence described in Table 7-1 shall be run in parallel during the complete AFT sequence, at the most suitable time to be defined in the procedure.



Step #	Step Title	CDMU PM / bus	CDMS mode	ACC PM / bus	ACMS mode	PCDU	XPND	Instruments	Defined in / comment	Expected duration
1	switch ON S/C	A / A	launch	A / A	SB	A	A	off	Accelerated switch on procedure used in IST, and [RD2], §5.8.2	4 h
2	separation	A / A	SAM	A / A	SAM	A	A	off	[RD2], §5.8.2.4.6	
3	CDMU transition SAM → NOM	A / A	NOM	A / A	SAM	A	A	off	[RD2], §5.8.2.4.9	
4	ACC transition SAM → OCM	A / A	NOM	A / A	OCM	A	A	off	[RD2], §5.8.2.4.9	
5	Switch ON reaction wheels	A / A	NOM	A / A	OCM	A	A	off	[RD2], §5.8.5.7	
6	ACMS transition OCM → SCM	A / A	NOM	A / A	SCM	A	A	off	[RD2], §5.8.5.7	
7	SFT HIFI A	A / A	NOM	A / A	SCM	A	A	HIFI A	[AD5],	3½ h
8	SFT PACS A	A / A	NOM	A / A	SCM	A	A	PACS A	[AD5]	
9	SFT SPIRE A	A / A	NOM	A / A	SCM	A	A	SPIRE A	[AD5]	
10	CDMU reconf. PM A → B (level 3b)	B / A	EAM	A / A	SCM	A	A	off	[RD2], §5.8.6.4	1½ h
11	CDMU Bus A → B	B / B	EAM	A / A	SCM	A	A	off	TC Bus A → Bus B	
12	PCDU A → B	B / B	EAM	A / A	SCM	B	A	off	[RD2], §5.8.7.2.5	



Step #	Step Title	CDMU PM / bus	CDMS mode	ACC PM / bus	ACMS mode	PCDU	XPND	Instruments	Defined in / comment	Expected duration
13	TTC A → B	B / B	EAM	A / A	SCM	B	B	off	manual swap	
14	CDMU NOM	B / B	NOM	A / A	SCM	B	B	off	[RD2], §5.8.5.11	
15	ACMS Bus A → B	B / B	NOM	A / B	SCM	B	B	off	TC Bus A → Bus B	½ h
16	Gyro IF 1 → IF 2 (A, B, C, D ON in both cases)	B / B	NOM	A / B	SCM	B	B	off	[RD2], §5.8.5.8 (partial)	
17	SFT HIFI B	B / B	NOM	A / B	SCM	B	B	HIFI B	[AD5]	3½ h
18	SFT PACS B	B / B	NOM	A / B	SCM	B	B	PACS B	[AD5]	
19	SFT SPIRE B	B / B	NOM	A / B	SCM	B	B	SPIRE B	[AD5]	
20	ACC level 4	B / B	SAM	B / B	SM	B	B	off	[RD2], §5.8.6.5	1 h
21	S/C OFF	off	off	off	off	off	off	off	Switch off procedure used in IST.	2 h
TOTAL										16 h

Table 8-2 – AFT sequence



9. SUCCESS CRITERIA

9.1 SFTs

Refer to [AD1], [AD2], [AD3], [AD4] and [AD5].

9.2 AFTs

The nominal HK Telemetry shall be downloaded throughout the tests.

The contents of the Solid State Mass Memory, CDMU Critical Event Log, CDMU RM Log and ACC Event Buffer shall be downloaded at the end of the AFT.

The success criteria are defined in the sections referred to in Table 8-2.

The contents of the CDMU Critical Event Log, CDMU RM Log and ACC Event Buffer shall contain only the events and configurations expected per the sequence defined in Table 8-2.



10. ORGANISATION AND RESPONSIBILITIES

The Satellite SFTs and AFTs involve the following parties:

- TAS-F
- ASED
- ESA
- Instruments
- ETS

The responsibility is shared as follows:

- TAS-F
 - Test director,
 - PA,
 - Test specification,
 - Management of technical supports from industry,
 - Test evaluation
- ASED
 - Test conductor (procedure, execution),
 - Interface with TAS-F test director and facilities
 - QA,
 - Dedicated GSE installation / validations and use,
 - Interface between the Satellite and the test facility,
 - Test Reports,
 - Engineering support for the evaluation of tests related to the H-EPLM.
- ESA (representative)
 - point of contact of TAS-F test director,
 - management of technical supports from instruments.
- Instruments
 - Engineering support for the evaluation of tests related to the instruments.
- ETS
 - Management of the facilities,
 - Interface with ASED.

END OF DOCUMENT