

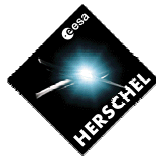


**HERSCHEL / PLANCK**

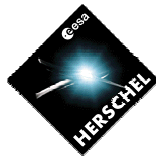
**Test specification for AVM and FM  
Planck Instruments System tests  
performed at satellite level.  
H-P-2-ASP-TS-1084**

Rédigé par/ <i>Written by</i>	Responsabilité-Service-Société <i>Responsibility-Office -Company</i>	Date	Signature
B.Collaudin J.P.Chambelland	Instruments Interfaces	26/4/07	
<b>Vérifié par/<i>Verified by</i></b>			
P.Couzin	Electrical Engineering	21/5/07	
P.Rideau	System Engineer	21/05/07	
J.Y. Charnier	AIT manager	14/06/07	
T.Banos	Planck Manager	21/06/07	
<b>Approbation/<i>Approved</i></b>			
J.M.Reix		26/06/07	
Th. Grassin		29/06/07	

**Entité Emettrice :** Thales Alenia Space - France  
(détentrice de l'original) :



PLANCK/PLANCK		DISTRIBUTION RECORD	
DOCUMENT NUMBER :		Issue :	
		Date:	
EXTERNAL DISTRIBUTION		INTERNAL DISTRIBUTION	
<b>ESA</b>	<u>X</u>	<b>HP team</b>	<u>X</u>
<b>ESOC</b>	<u>X</u>	P.Couzin	<u>X</u>
<b><u>Thales Alenia</u> SPACE -Italia</b>	<u>X</u>	G.Beaufils	<u>X</u>
<b>Planck Instruments</b>		J.P.Chambelland	<u>X</u>
<b>HFI, LFI, SCS</b>		F.Sauvage	<u>X</u>
		F.Chatte	<u>X</u>
		S.Pitaval	<u>X</u>
		P.Armand	<u>X</u>
		G.P.Dragan	<u>X</u>
		B.Demolder	<u>X</u>
		L.Ouchet	<u>X</u>
		B.Marchand	<u>X</u>
		P.Rideau	<u>X</u>
		K.R.Hibbert	<u>X</u>
		R.Dupre	<u>X</u>
		S.Dos Santos	<u>X</u>
		B.Carvalho	<u>X</u>
		T.Banos	<u>X</u>
		J.M.Reix	<u>X</u>
		J.J.Juillet	<u>X</u>
		J.Y.Charnier	<u>X</u>
		N.Sivelle	<u>X</u>
		P.Rihet	<u>X</u>
		<b>Clf Documentation</b>	<b>Orig.</b>



**ENREGISTREMENT DES EVOLUTIONS / CHANGE RECORDS**

ISSUE	DATE	§ : DESCRIPTION DES EVOLUTIONS § : CHANGE RECORD	REDACTEUR AUTHOR
<p>1_draft <a href="#">1.0</a> draft <a href="#">1.0</a></p>	<p>20/9 <a href="#">06/04/07</a>  <a href="#">25/5/07</a></p>	<p>Initial Issue – Distributed as draft on 6/12 <a href="#">Issue 1/ Comments from HFI/LFI/ESA</a> <a href="#">See change log</a> <a href="#">Reviewed by project</a></p>	<p>B.Collaudin <a href="#">B.Collaudin</a>  <a href="#">B.Collaudin</a></p>

on issue	ID	Ref	Comment from	Origin	Section Nb	Page	title, fig, table, or req	Remarks	Action	Industry Reply, or ref	reply	Modify spec (Y/N)	Done
1-draft	1	Mail from LS 15/12/06	LFI	LS		8	Par 1.1	“satellite AIT plan (AD5)...” wrong reference document shouldn’t be AD11?		Yes, This is a typo --> Corrected AD5-->AD11 & AD6-->AD12		y	y
1-draft	2	Mail from LS 15/12/06	LFI	LS		19	Par 5.1	“before and after each environmental test SFT will be performed” What are these environmental tests? It is clear in the document the SFT will be performed before and after Vibration tests, what about EMC and RF? Should I expect a short functional test before and after each test?		Yes. SFT should be performed before and after each environment test (vibration, thermal & EMC), to verify that the test did not alter the instruments. RF test will be performed with test horn, and do not need the instruments to be switched on (not part of this spec)		n	y
1-draft	3	Mail from LS 15/12/06	LFI	LS		21	Fig. 5.2	The REBA UFT test is placed before the PLM SVM mating. I did understand that the UFT will be performed once the REBA is fully integrated and from the table 5.1 at pag 23 this time will be around 40 days after the mating.		In the initial plan, the REBA UFT was placed before SVM mating (in fact pre-integration tests, as connection would be open for SVM mating), but currently, REBA's integration & UFT's will be performed after SVM mating. Affects fig 5.2 & table 5.1. Can be updated, but does not affect the specification		n	y
1-draft	4	Mail from LS 15/12/06	LFI	LS		23	tab 5.1	Not all the SFT are indicated in the table		OK. The table 5.1 is extracted from the planck schedule. It will not be modified before the schedule		n	y
1-draft	5	Mail from LS 15/12/06	LFI	LS		27	par 5.4.2	After the patching in an unused RAM in step 3 the patch is removed. Why do we need to do that? Do we need to repeat this test more than once?		The original content of the memory is restored after the patch test to keep the original content (& allow checksums)		n	

on issue	ID	Ref	Comment from	Origin	Section Nb	Page	title, fig, table, or req	Remarks	Action	Industry Reply, or ref	reply	Modify spec (Y/N)	Done
1-draft	6	Mail from LS 15/12/06	LFI	LS		28	par 5.4.3	It is not clear to me if during the UFT warm unit will be connected directly to SVM. I understood that during the integration test (par 5.4.1) the interface between the warm unit and SVM is checked and tested, if this is the true why do we need to run UFT in a different configuration?		UFT are performed with the instrument DPU connected to the SVM (and commanded through the SVM). This will be precised in the text. : " The DPU is still connected to the SVM from the previous electrical integration test."		y	y
1-draft	7	Mail from LS 15/12/06	LFI	LS		32	First line	It is said that the SIT is similar to IST/commissioning. In the excel file where the sequences are described "Planck instruments FM IST_from LFI_14-11-06" the IST/ commissioning is sometime different from the one described in table at pag 33. This table should be more similar to the SFT (even if some timing are wrong). If we are going to perform the IST/commissioning at this time why do we need to perform it again later? What are the differences?		the SIT is similar to the part of the IST/Commissioning test where all instruments are run together (ie HFI + LFI parallele operation only) The table in section 5.4.3.4 - PLM SIT has been introduced to make a proposition for the test, based on the simple sequence between the 2 instruments and the SCE. but you are free to propose a better content for the instrument test phase, if it fits with the duration (10h allocated). SFT is OK for us. We can consider this section as still open, and iterate again on a content. LFI will modify the table to be included		y	y
1-draft	8	Mail from LS 15/12/06	LFI	LS			Tables	The references put on the tables are not updated for the new Issue of the User Manual I'll send you the new version as soon as possible.		Agreed. To be updated. When data is available		y	y
1-draft	9	Mail from LS 15/12/06	LFI	LS		31	par 5.6	LFI position is to have IOT present each time a SFT is needed just because the EGSE is needed to check scientific telemetry that is not visible without TQL.		OK This can be included in the text "LFI indicate that they want the Instrument Operation team to be present each time the SFT is to be run."		y	y

on issue	ID	Ref	Comment from	Origin	Section Nb	Page	title, fig, table, or req	Remarks	Action	Industry Reply, or ref	reply	Modify spec (Y/N)	Done
1-draft	10	Mail from LS 15/12/06	LFI	LS	5.7.1	35	During DTCP, after reception of dedicated TM....REBA	I would add a comment just to be more clear. During a nominal operation day in principle there is no need to do any change in LFI configuration and so no need to update the scientific parameters of the REBA (GMF1, GMF2...). But it could be necessary to update some of these parameters during the mission if something has changed (4K target temperature, DAE Gain, DAE offset, BEU temperature...). This is no a contingency operation because LFI is not giving any alarm, and the procedure needed to change these parameters is in the nominal procedure set described in UM. The uploading of these parameters could be done using a few TC (even just one, depending from how many parameters we need to change) in a very simple procedure.		It has been included here to verify this procedure		n	
1-draft	11	Mail from LS 15/12/06	LFI	LS	5.7.2.4	38	HFI+LFI+SC Commissioning	The sequence of the test in details is in a TBW state. I'm working with the instrument team to have more details before next AIT meeting.		OK To be updated when available. Should be Similar to PPLM SIT (comment n°7)		y	y
1-draft	12	Mail from LS 15/12/06	LFI	LS	6.1.1	46	Success Criteria/basic principle	I do not understand the first paragraph. Do we need to compare the TM acquired from the umbilical line in real time with the one stored in the SSMM after a downlink session? Do the two data-sets are in the same format? Why do we need to do that more than once?		We propose here a generic method for success criteria (reproduced here from the IST spec)		n	y
1-draft	13	Mail from LS 15/12/06	LFI	LS	7.3	49	responsibilities	I think that we need to put in this table as soon as possible some names, at least the one who are in a position to be an interface point between ESA-ALCATEL-Instrument.		yes		y	y

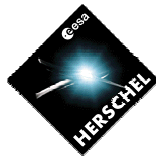
on issue	ID	Ref	Com ment from	Origi n	Seccio n Nb	Page	title, fig, table, or req	Remarks	Action	Industry Reply, or ref	reply	Modify spec (Y/N)	Done
1-draft	14	Mail from TM 18/12/06	HFI	TM	§ 1.2.2			Instrument Specific Test Definitions and Objectives What do you mean by "Instrument Alignment Check In warm and cold conditions" for HFI ? Why does the Verification of instrument performance is restricted to cold conditions during TV ? We will propose you a CSL test sequence for HFI at the latest in February, but I think that we will propose HFI verification of performances also during the hot SVM TV phase.		Alignment: this section could be removed from this test specification, as it is not used later on (except may be during RF test). TV: WSFT (and/or WFFT) will be performed before & after TV test.		y	y
1-draft	15	Mail from TM 18/12/06	HFI	TM	§2.1.3		HFI Documents	The list can be updated following the update of the documentation list sent last week.		OK. Change: - DPU-6 PR-PHB-600334-IAS_1.2 - HFI-19 PR-PHZY-600416-LAL_1.0 - HFI-21 PR-PH430-600805-IAS_1.0		y	y
1-draft	16	Mail from TM 18/12/06	HFI	TM	§3.1.1		HFI	For AVM: The DPU is CQM3, JFET Box is CQM, PAU/JFET Harness is CQM. Replace all simulator harness by CQM.		Corrected. Except PHECCA (that is not present) DCCU harness to sensors)		y	y
1-draft	17	Mail from TM 18/12/06	HFI	TM	§3.2.2		Instruments EGSE	HFI will use an autonomous EGSE (CESR EGSE) during the stand alone verification of the detection chain.		OK. Added		y	y
1-draft	18	Mail from TM 18/12/06	HFI	TM	Figure 5 2:		Planck FM Integration flow chart	The integration flow of the detection chain is not quite in line with the one proposed in the HFI leading procedure (PR-PH450-600735-IAS). To be discussed.		Adaptation will have to be made for hardware availability & schedule optimisation. For the moment, we keep this approach		n	y
1-draft	19	Mail from TM 18/12/06	HFI	TM	§5.4.1		Instruments full software image patch with OBSM (AVM test only)	We need to patch the complete DPU software image for the 2 DPU FM's.		The OBSM test is foreseen only for AVM, to verify that the OBSM tool is operational. Later-on, if the FM software needs to be upgraded, this will be done on case by case basis, using the Non-conformance tool.		n	y

on issue	ID	Ref	Comment from	Origin	Section Nb	Page	title, fig, table, or req	Remarks	Action	Industry Reply, or ref	reply	Modify spec (Y/N)	Done
1-draft	20	Mail from TM 18/12/06	HFI	TM	§5.7.1		IST overall description	There is a reference to SPIRE spectrometer in the table.		Yes. corrected.		y	y
1-draft	21	Mail from TM 18/12/06	HFI	TM	§5.8		TV test	An HFI TV test sequence proposal will be provided at the latest in February in which you will find answers to all open points.		Input provided, but not included yet in this test sequence, as the impact on the TV test duration is significant. Needs to be negotiated at ESA/project level. However, the test sequence has been updated to be consistent with the Planck TV test specification		y	n
1-draft	22		AAS-F	BC	2.1.1		Test Specifications:	Change AD23 (EMC test spec) from issue 1 to issue 2		AD-23 – H-P-3-ASP-TS-0820_2.0 - Planck EMC test specification		y	y
1-draft	23		AAS-F	BC	2.1.2		LFI Document	add AD-93 - PL-LFI-PST-PR-018 1.0AVM - LFI Short Functional Test procedure ) redlined for AVM tests		AD-93 - PL-LFI-PST-PR-018 1.0AVM - LFI Short Functional Test procedure ) redlined for AVM tests		y	y
1-draft	24		AAS-F	BC	5.4.3.3		LFI UFT	For AVM, a reduced version of LFI SFT will be used for AVM UFT. Ref to new AD93		For LFI AVM, a reduced version of the LFI SFT will be used instead of the above procedures. The applicable document is : AD-93 - PL-LFI-PST-PR-018 1.0AVM - LFI Short Functional Test procedure ) redlined for AVM tests		y	y
1-draft	25	Mail from J.Patterson on 6/2/07	ESA	Braghin	3.5	17		TV tests: (& SFT) ref RD-03: H-P-3-ASP-AN-0996_2.0 – Planck CQM TV test correlation I do not think this is a good reference, neither for AVM, nor for PFM.		I'll refer to the IST, TV & EMC test spec AD-21 – H-P-3-ASP-TS-0881_3 - Planck IST test specification AD-22 – H-P-3-ASP-TS-0893_1- Planck TV test specification AD-23 – H-P-3-ASP-TS-0820_2.0 - Planck EMC test specification		y	y



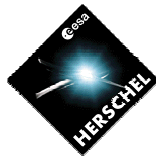
on issue	ID	Ref	Com ment from	Origi n	Section Nb	Page	title, fig, table, or req	Remarks	Action	Industry Reply, or ref	reply	Modify spec (Y/N)	Done
1-draft	26	Mail from J.Patters on 6/2/08	ESA	Brag hin	4	18		Integration SFT warm, IST: None Power connections, power rate, protections, safety precautions, environmental conditions, cleanliness included: all this information is missing		This is to be included in the relevant procedures. This is a top level specification.		n	y
1-draft	27	Mail from J.Patters on 6/2/09	ESA	Brag hin	5.1	19		Figure 5.1: Planck FM test sequence flow chart Flow is changing. There is e.g. no mention of the ESTEC test done on the telescope. Do we anticipate electrical testing due to telescope delay? To be updated.		Telescope tests are not included in this specification: only operation & functional tests.		n	y
1-draft	28	Mail from J.Patters on 6/2/10	ESA	Brag hin	5.1	22		Table 5.1: Planck FM test sequence table I think there is something wrong with a combined IST lasting 190 days!		This appeared like that on the schedule file I got dur to the activities included under IST. This is anyhow updated in the new issue		y	y
1-draft	29	Mail from J.Patters on 6/2/11	ESA	Brag hin	5.1	23		Figure 5.2: Herschel & Planck AVM integration & test sequence flow chart (test order may be modified). Do we have any practical link we can place / show on this spec.? I believe it would be useful (unless not necessary because superseded by events)		refere to table 5.1 updated		y	y
1-draft	30	Mail from J.Patters on 6/2/12	ESA	Brag hin	General	General		The list of the requirements that are verified by the activities required by this specification is not there. This is to be added. It is a reporting application outcome from Doors system.		refere to VCD for that. This specification has been buit from both the Satellite level tests specifications (IST, TV, EMC), and the Instruments input corresponding to the allocated slots. Objective of this specification is to identify the instruments tests in the FM test sequence, and allow to prepare the corresponding procedures.		n	y
1-draft	31	Mail from J.Patters on 6/2/13	ESA	Brag hin	General	General		Many test requirements from the Instruments look just missing. Are they now available for their insertion into this document? They would also need the tracing from source (IID?) requirements.		same as above. Refere to VCD		n	y

on issue	ID	Ref	Comment from	Origin	Section Nb	Page	title, fig, table, or req	Remarks	Action	Industry Reply, or ref	reply	Modify spec (Y/N)	Done
1-draft	32	Mail from J.Patters on 6/2/14	ESA	Oliver				I do not see in which order or in which configuration UFT tests are performed		There is a proposed order here. However the actual order for UFT is dictated by the delivery Schedule. Refer to table 5-1		n	y
1-draft	33	Mail from J.Patters on 6/2/15	ESA	Oliver	8.1			I suppose there will be a second level of test spec. this document organising them (as suggested by para 8.1). Success criteria can then be specified (see para 6).		No. The next step are the Instruments test procedures/scripts, that will be ingested in the satellite test procedures, or as necessary test sheets. There is also a test sheet covering the satellite preparation before switching on/off the instrument (mainly the bus profile configuration & FDIR management during the switch-on)		n	y
1-draft	34	Mail from J.Patters on 6/2/16	ESA	Oliver	7.1			ESA PA/QA (customer quality) is totally ignored in the organisation. And there is no link between AAS-F PA and AAS-F QA. Any meaning in the direction of the arrows (para 7.1).		OK Flow chart updated		y	y
1-draft	35		RAS	BC	all			Clerical: Change Alcatel to Thales, AAS to TAS, remove all references to Herschel or ASED (replace by Planck & TAS-F AIT) remove issues of the reference documents in the test table (to simplify further edition)		Done		y	y



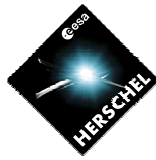
## TABLE OF CONTENTS

<b>TABLE OF CONTENTS .....</b>	<b>4</b>
<b>To do List.....</b>	<b>7</b>
<b>1. TEST OBJECTIVE.....</b>	<b>8</b>
1.1 Introduction.....	8
1.2 Test objectives.....	8
1.2.1 Planck FM Satellite/AVM Test Programme General Objectives .....	8
1.2.2 Instrument Specific Test Definitions and Objectives .....	8
<b>2. DOCUMENTS .....</b>	<b>10</b>
2.1 Applicable documents.....	10
2.1.1 Thales Documents: .....	10
2.1.2 LFI Documents: .....	11
2.1.3 HFI Documents:.....	11
2.2 Reference documents .....	12
2.3 Acronyms .....	13
<b>3. TEST SPECIMEN DEFINITION.....</b>	<b>13</b>
3.1 Instruments Configurations for AVM & FM tests .....	14
3.1.1 HFI:.....	14
3.1.2 LFI and Sorption cooler.....	15
3.2 EGSE Configurations for AVM & FM tests.....	15
3.2.1 Satellite EGSE configuration.....	15
3.2.2 Instruments EGSE .....	16
3.3 Instruments database configuration .....	16
3.4 Instruments software configuration.....	16
3.5 PPLM Configuration for IST and TV test.....	16
<b>4. TEST FACILITY REQUIREMENTS.....</b>	<b>17</b>
<b>5. TEST DEFINITION.....</b>	<b>17</b>
5.1 Overview of Planck AVM & FM tests sequence.....	17
5.2 Time Allocation for instruments tests .....	23
5.3 Incoming Inspection.....	24
5.4 Electrical Integration tests, UFT's (Units functional tests), and SIT (Subsystem Integration Test).....	24
5.4.1 Electrical Integration tests .....	24



5.4.2	Instruments full software image patch with OBSM (AVM test only)	25
5.4.3	UFT's (Unit Functional Test)/ SIT (Subsystem Integration Test)	25
5.5	<i>(warm) Full Functional Tests, FFT</i>	30
5.5.1	HFI FFT	30
5.5.2	LFI FFT	31
5.5.3	SCS FFT	32
5.6	<i>Short Functional test - SFT</i>	33
5.6.1	HFI SFT	33
5.6.2	LFI SFT	33
5.6.3	SCS SFT	34
5.7	<i>Integrated system test: IST</i>	34
5.7.1	IST overall description	34
5.7.2	IST / Commissioning	38
5.7.3	IST RMS	40
5.8	<i>TV test</i>	41
5.8.1	SCS TV test	45
5.8.2	HFI TV Test	45
5.8.3	LFI TV Test	46
5.9	<i>EMC test</i>	48
5.9.1	HFI EMC Test	48
5.9.2	LFI EMC Test	48
5.9.3	SCS EMC test	49
<b>6.</b>	<b>SUCCESS CRITERIA</b>	<b>49</b>
6.1	<i>"out of limit" and TC checking</i>	50
6.1.1	BASIC Principle	50
6.1.2	"soft" and "hard" limits	50
<b>7.</b>	<b>ORGANISATION &amp; RESPONSABILITIES</b>	<b>51</b>
7.1	<i>Organisation</i>	51
7.2	<i>Test organisation</i>	52
7.3	<i>Responsibilities</i>	52
7.4	<i>Tasks distribution</i>	53
7.4.1	General Tasks breakdown	53
<b>8.</b>	<b>DOCUMENTATION</b>	<b>54</b>
8.1	<i>Documents required before the test</i>	54
8.2	<i>Data acquired during the test</i>	54
8.2.1	S/C housekeeping	54
8.2.2	Instrument housekeeping	55
8.3	<i>Documents issued after the test</i>	55
8.3.1	Test Reports	55
8.3.2	Evaluation reports	56
<b>9.</b>	<b>ANNEXes</b>	<b>56</b>





## TO DO LIST

### Documents to be prepared:

#### Sorption cooler:

AD-56: [TBD \(see PFM1\) SCS test procedure for TV test](#)

#### LFI

[AD101 - PL-LFI-PST-PR-019 1.0 - ST1 and IST2 \(Combined HFI/LFI functional Tests\) procedure](#)

[AD-111 - PL-LFI-PST-PR-020-1 - EMC/RF tests \(Combined EMC Tests & Ambient RF FM Tests\) procedure \(draft to issue 1\)](#)

[AD-120- PL-LFI-PST-PL-010 – LFI TV Test Plan \(TBW\)](#)

[AD-121 - PL-LFI-PST-PR-021 - TV Tests \(LFI Functional Test Under Vacuum\) procedure \(TBW\)](#)

#### HFI

[4K-16 PR-PHD-600165-IAS 1.0 4K C&C verification procedure \(UFT\) \(Draft available. Signed version to be provided\)](#)

[HFI-7 PR-PH740-600718-IAS 1.0 HFI Warm Short and Full Functional tests \(WSFT & WFFT\) Specification and HPCCS tcl procedures \(Draft available. Signed version to be provided\)](#)

[HFI-10 \(SP-PH740-500596-IAS\) 1.3 HFI FM CSL CRYOTEST PHASES \(excel sheet available, to be discussed/agreed\)](#)

[HFI-11 TBD HFI CSL CRYOTEST HPCCS tcl procedures](#)

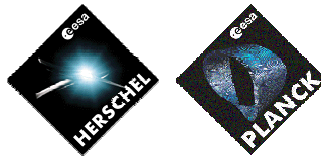
[HFI-12 \(PR-PH740-500609-IAS\) 1.0 HFI FM CSL Cryo-Test DC Failure Modes Macro-sequence](#)

[HFI-13 \(PR-PH740-500610-IAS\) 1.0 HFI FM CSL CRYOTEST 4K COOLER FAILURE MODES MACROSEQUENCES](#)

[HFI-14 \(PR-PH740-500611-IAS\) 1.1 HFI FM CSL Cryo-Test RU Failure Modes Macro-sequence](#)

[HFI-15 \(PR-PH740-500612-IAS\) 1.1 HFI FM CSL Cryo-Test DPU Failure Modes Macro-sequence](#)

[TBD - HFI ILT Warm Short and Full Functional tests \(WSFT & WFFT\) test report](#)



## 1. TEST OBJECTIVE

### 1.1 Introduction

This test specification defines the instrument tests sequences to be performed at satellite level during the Planck AVM and PFM programme.

It is complementary to the Planck IST specification AD-21.

This includes the instrument incoming inspections after delivery to Industry, the activities and interface tests planned for the instrument integration on the satellite (FPU in [PPLM](#) and warm units in SVM) and the instrument related tests to be performed during the various [Planck](#) satellite test phases (SFT, IST, TV test & EMC). All these activities and tests are described per instrument and per test activity.

These tests sequences have been defined together with instruments teams, and in close collaboration with [TAS-F](#) engineering team responsible of the IST preparation, during dedicated IST preparation meeting where the objectives and constraints from both satellite and instrument sides have been explained.

This document is based on the Instrument Interface Documents (AD 1, AD 2, AD 3 and AD 4) and the Satellite AIT Plan ([AD11](#)), instruments test plan ([AD12](#)) and takes into account the current status of the satellite AIT schedule and the information on desired test sequences provided by the instrument teams.

It has been elaborated with input from instruments, elaborated during dedicated technical meetings, after clarification of the aims of the IST.

### 1.2 Test objectives

#### 1.2.1 Planck FM Satellite/AVM Test Programme General Objectives

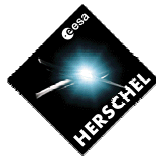
The objective of Planck IST is twofold :

- to verify the correct performance of the satellite and the compatibility between all the integrated electrical subsystems and instruments,
- to validate the operation procedures which will be exercised during the different phases of the satellite mission.

More details in section 2.1 of IST specification AD 21

#### 1.2.2 Instrument Specific Test Definitions and Objectives

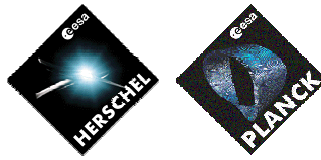
The following table gives an overview of the instrument tests to be carried out on PLM PFM and satellite level with their instrument related objectives.



Test	Test Objectives	Conditions	Remarks
Instrument EGSE Validation	Check of Instrument EGSE function (self-test). Check of Instrument EGSE interfaces to CCS.	Ambient	
Instrument integration tests	Check instruments during integration of warm units, WIH & cryoharnesses, & connection to FPU's	<a href="#">Ambient</a>	
Instrument Short Functional Test (SFT)	Instrument switch on and functional verification of instrument interfaces. Evaluation should preferably be based on housekeeping data. Two different types of instrument SFTs: warm and cold.	SFT warm: Ambient SFT Cold : During TV test	SFT
Integrated System Test (IST)	Verification of the functional performance of the integrated instrument in all possible modes. Check of the instrument performance as far as possible with satellite configuration. 2 sequences are proposed : <ul style="list-style-type: none"> <li>• Simulation of instrument commissioning.</li> <li>• Reference Mission Scenario.</li> </ul>	Warm conditions	Before and/or after environmental tests.
EMC Test	Check of functional performance of the integrated instrument under electromagnetic worst case conditions (radiated susceptibility) and measurement of instrument electromagnetic emissions (conducted and radiated emission).	Warm conditions (CE, E-RE), + dedicated H-RS during TV test	Instruments to be in the most sensitive mode(s) for susceptibility tests and most noisiest mode(s) for emission tests.
Sine Vibration and Acoustic Noise Test	Verification of workmanship. Verification of alignment stability.	Warm conditions	SFT will be performed before and after.
TB/TV Test	TMM validation. Verification of instrument performance in nearly flight conditions.	Cold conditions <a href="#">+ Warm SFT before &amp; after</a>	In TV chamber. During TV test, sorption cooler FM2 will be used (as FM1 was used during PFM1 test).
System Validation Test (SVT)	Verification of instrument commanding, telemetry and science data from/to the Mission Operation Centre.		Satellite level test. This test is under the responsibility of ESA/ESOC.

**Table 1-1: Instrument related Tests on PLM PFM and Satellite Level**





## 2. DOCUMENTS

Rem: Documents **outlined** are still to be issued

Most documents are uploaded on ftp

ftp://ftp.hp-instruments.as-b2b.com/industry\_to\_instruments/Planck%20FM%20tests/

### 2.1 Applicable documents

#### 2.1.1 **Thales Documents:**

##### Specifications

AD-01 – IID-A

AD-02 – HFI IID-B

AD-03 – LFI IID-B (includes SCS ICD)

(IID-B's include also specific ICD's of AVM units when they differ from the FM)

AD-05 - H-P-1-ASPI-SP-0018\_3.3 - PA Requirements for Subcontractors

AD-06 - H-P-1-ASPI-PL-0055\_2.2 – PA Plan

AD-07 – S2K-MCS-ICD-0144-TOS-GCI\_1.3 - SCOS 2000 OBSM External Interfaces Control Document

##### Test Plans (AD of IID-A):

AD-11 – H-P-3-ASP-PL-0208\_3\_1 - Planck FM AIT Plan

AD-12 – HP-3-ASP-TN-0676\_1.0 - Planck Instrument Testing at PFM S/C Level

AD-13 – H-P-1-ASP-TN-0852\_1.0 - Instrument Testing on AVM level

AD 14 – Reference Mission Scenario – SCI-PT-12759\_3.0

##### Test Specifications:

AD-21 – H-P-3-ASP-TS-0881\_3 - Planck IST test specification

AD-22 – [H-P-3-ASP-TS-0893\\_1](#) - Planck TV test specification

AD-23 – H-P-3-ASP-TS-0820\_2.0 - Planck EMC test specification

[AD-24 - ASP-6-AIT-AVIO-PL-3130 - Bus Configuration for Instruments](#)

##### Mechanical Integration specifications

NA

##### FM Instruments Electrical integration specifications:

AD-41 - H-P-3-ASP-TS-1112\_01 - REBA - SVM Electrical Integration Specification

AD-42 - H-P-3-ASP-TS-1113\_01 - HFI-DPU - SVM Electrical Integration Specification

AD-43 - H-P-3-ASP-TS-1131\_01 - FM SVM - SCE Electrical Integration Specification

AD-44 - H-P-3-ASP-TS-1149\_01 - 4K CDE & Precharge regulator - SVM Electrical Integration Specification

AD-45 - H-P-3-ASP-TS-1201\_01 - REU - SVM Electrical Integration Specification

AD-46 - H-P-3-ASP-TS-1204\_01 - DCE - SVM Electrical Integration Specification

AD-47 - H-P-2-ASP-TS-1220\_01 - LFI-DAE-Power Box -SVM Electrical Integration specification

##### AVM Instruments Electrical integration specification.

AD-50 - H-P-SP-AI-0083 - HP Warm Units AVM Test Spec

##### Instruments User manuals

AD-51 – UM-PH921-300334-IAS [1.1](#) – HFI User Manual

AD-52 - PL-LFI-PST-MA-001\_2.1 – LFI User Manual



AD-53 – PL-LFI-PST-MA-002\_1.0 – Sorption Cooler User Manual

## Instruments test Procedures

Sorption cooler:

AD-55 - H-P-3-ASP-TS-1126\_2 - SCS health-check at ambient

AD-56: TBD (see PFM1) SCS test procedure for TV test

### 2.1.2 LFI Documents:

#### Incoming Inspections

AD60 [\(not performed, replaced by SFT later on\)](#)

#### Mechanical Integration Procedures

AD-71 - PL-LFI-LAB-PR-030\_2.0 - RAA (HFI+LFI) handling procedure.

#### Electrical Integration and UFT's

AD81 - PL-LFI-PST-PR-015\_2.1 - LFI Electrical Integration REBA on SVM and Functional Tests (UFT) procedure

AD82 - PL-LFI-PST-PR-016\_1.1 - LFI Electrical Integration REBA-DAE Power Box-DAE and Functional Test Procedure (UFT)

#### SFT's FFT

AD-91 - PL-LFI-PST-PR-017\_1.2 - LFI Full Warm Functional Test procedure

AD-92 - PL-LFI-PST-PR-018\_1.1 - LFI Short Functional Test procedure )

[AD-93 - PL-LFI-PST-PR-018\\_1.0\\_AVM - LFI Short Functional Test procedure redlined for AVM tests](#)

#### IST

AD101 - PL-LFI-PST-PR-019\_1.0- ST1 and IST2 (Combined HFI/LFI functional Tests) procedure

#### EMC

AD-111 - PL-LFI-PST-PR-020\_draft - EMC/RF tests (Combined EMC Tests & Ambient RF FM Tests) procedure

#### TV test

[AD-120- PL-LFI-PST-PL-010 – LFI TV Test Plan \(TBW\)](#)

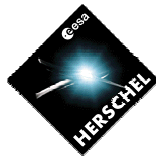
AD-121 - PL-LFI-PST-PR-021 – [LFI TV Tests \(LFI Functional Test Under Vacuum\) procedure \(TBW\)](#)

### 2.1.3 HFI Documents:

Only relevant HFI test procedures are included here.

The complete set of HFI AIV documentation is included in the HFI leading procedure HFI-1

Type	model	Ref	reference	title
UFT	FM (AVM)	DC-12	<a href="#">PR-PH740-700907-IAS1/0_1.1</a>	<a href="#">DCCU C&amp;C procedure (UFT N°1 and N°2 ; 0.1K Pipes/DCCU connection operation)</a>
UFT	FM (AVM)	DPU-6	<a href="#">PR-PHB-600334-IAS_1.2</a>	DPU C&C verification procedure (UFT)



Type	model	Ref	reference	title
UFT	FM (AVM)	RU-5	<a href="#">PR-PH740-600733-IAS_1.1</a>	FM FPU-JFET-PAU Functional Electrical Verification Procedure (belt by belt)
UFT	FM (AVM)	RU-7	<a href="#">PR-PH470-600817-IAS_2</a>	FM PAU-REU-Harness Functional Electrical Verification Procedure
UFT	FM (AVM)	RU-8	PR-PH740-600734-IAS_1.0	FM FPU-JFET-PAU-REU chain functional electrical verification procedure
UFT	FM (AVM)	RU-9	<a href="#">PR-PHCB-600280-IAS_1.1</a>	REU C&C verification procedure (UFT)
<b>UFT</b>	<b>FM (AVM)</b>	<b>4K-16</b>	<a href="#">PR-PHD-600165-IAS_1.0</a>	<b>4K C&amp;C verification procedure (UFT)</b>
All	FM	HFI-1	PR-PH450-600735-IAS_1.0	Leading procedure for the integration and the verification of HFI FM on the spacecraft
SFT/FFT IST	FM	HFI-7	PR-PH740-600718-IAS_1.0	HFI Warm Short and Full Functional tests (WSFT & WFFT) Specification and HPCCS tcl procedures
<b>TV</b>	<b>FM</b>	<b>HFI-10</b>	<a href="#">(SP-PH740-500596-IAS)_1.3</a>	<b>HFI FM CSL CRYOTEST PHASES</b>
<b>TV</b>	<b>FM</b>	<b>HFI-11</b>	<a href="#">TBD</a>	<b>HFI CSL CRYOTEST HPCCS tcl procedures</b>
<b>TV</b>	<b>FM</b>	<b>HFI-12</b>	<a href="#">(PR-PH740-500609-IAS)_1.0</a>	<b>HFI FM CSL Cryo-Test DC Failure Modes Macro-sequence</b>
<b>TV</b>	<b>FM</b>	<b>HFI-13</b>	<a href="#">(PR-PH740-500610-IAS)_1.0</a>	<b>HFI FM CSL CRYOTEST 4K COOLER FAILURE MODES MACROSEQUENCES</b>
<b>TV</b>	<b>FM</b>	<b>HFI-14</b>	<a href="#">(PR-PH740-500611-IAS)_1.1</a>	<b>HFI FM CSL Cryo-Test RU Failure Modes Macro-sequence</b>
<b>TV</b>	<b>FM</b>	<b>HFI-15</b>	<a href="#">(PR-PH740-500612-IAS)_1.1</a>	<b>HFI FM CSL Cryo-Test DPU Failure Modes Macro-sequence</b>
TV	FM	HFI-18	<a href="#">(PR-PH740-500617-IAS)_1.0</a>	HFI FM & AVM Monitoring parameters
All	FM	HFI-19	<a href="#">PR-PHZY-600416-LAL_1.0</a>	DPU/REU/4K OBSW handling procedure for patch and dump
EMC	FM	HFI-20		HFI EMC at ambient test sequence specification = HFI WSFT
UFT	AVM	HFI-20	PR-PH450-600736-IAS_1.0	Leading procedure for the integration and the verification of HFI AVM
IST	AVM	HFI-21	<a href="#">PR-PH430-600805-IAS_1.0</a>	HFI Warm Short and Full Functional tests (WSFT & WFFT) Specification and HPCCS tcl procedures for AVM

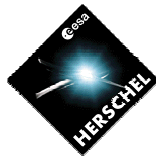
## 2.2 Reference documents

### Planck AVM & FM design descriptions

- RD-01: H-P-TN-AI-0052\_2 - Herschel/Planck SVM AVM Technical Description
- RD-02: H-P-3-ASPI-AN-0330\_2\_0 - Planck PLM thermal analyses – (RD 78 of IID-A)
- RD-03: H-P-3-ASP-AN-0996\_2.0 – Planck CQM TV test correlation
- RD-04: H-P-3-ASP-RP-0313\_2\_0 - PPLM design report (RD47 of IID-A)
- RD-05: H-P-RP-AI-0005\_3\_0 - SVM Design Report (RD46 of IID-A)
- RD-06: H-P-3-ASP-TN-0645\_3.0 - Planck cryogenic & Thermal test programme

### QM & PFM1 test procedures and test reports

- RD-21: H-P-3-ASP-RP-1257\_01 - PLANCK CQM Test Evaluation Report.
- RD-22: Planck PFM1 summary report
- RD-23: H-P-3-ASP-RP-1146\_01 - PFM1 test functional evaluation report



RD-24: [H-P-RP-AI-0214 - Planck Instruments AVM WU & abbreviated functional test-report](#)  
RD-25: HFI: TR-PH430-600816-IAS\_1.0 - HFI AVM WSFT test report @ALENIA (oct-06)  
RD-25 – H-P-3-ASP-TS-0883\_04 - PFM1 test spec  
RD-26 - H-P-3-ASP-TS-993 - SCS Test requirement for PFM1 issue 3

### Instruments FM ILT test procedure or test reports

PL-LFI-LAB-PL-009\_4.0 - TL20750-4 - LFI FM ILT Test Plan  
PL-LFI-LAB-PR-034\_3.0 - TL22610-3 - LFI FM ILT Test Procedure Issue  
PL-LFI-LAB-RP-073\_1 - Planck LFI ILT FM Test Report  
TBD - HFI ILT Warm Short and Full Functional tests (WSFT & WFFT) test report

## 2.3 Acronyms

AD: Applicable document  
AVM: AVionic Model  
CFT: Cold Functional Test  
DTCP: Daily Tele-Communication Period  
EGSE: Electrical Ground Support Equipment.  
FM: Flight Model  
I-EGSE Instrument EGSE  
IPR:  
IST: Integrated System test  
RD: Reference Document  
RMS: Reference Mission Scenario  
SIT: Subsystem Integration Test  
SFT: Short Functional Test  
SPT: Special Performance Test  
SVT: System Validation Test (from ESOC)  
TV/TB: Thermal Vacuum/Thermal Balance test  
UFT: Unit Functional Test  
WFT: Warm Functional test  
WFFT: Warm Full Functional test  
WSFT: Warm Short Functional test  
WU: (Instruments) Warm units

Instruments warm units acronyms are defined in the next section.

## 3. TEST SPECIMEN DEFINITION

The Satellite, SVM and [PPLM](#) configurations are described in the following documents.

RD-04: H-P-3-ASP-RP-0313\_2\_0 - PPLM design report (RD47 of IID-A)  
RD-05: H-P-RP-AI-0005\_3\_0 - SVM Design Report (RD46 of IID-A)

For IST, the satellite configuration is described in AD-21 (IST Specification).

Only the instruments configuration for FM and AVM and the [PPLM](#) configuration during the tests is given here.

For AVM tests, the AVM configuration is given in this document:

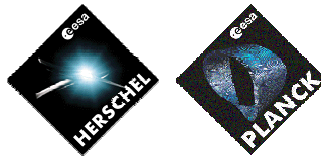
RD-01: H-P-TN-AI-0052\_2 - Herschel/Planck SVM AVM Technical Description



### 3.1 Instruments Configurations for AVM & FM tests

#### 3.1.1 HFI:

Satellite	Instru- ment	Product Tree Id	Subsystem	description	cod e	code	Sat AVM	PFM
Planck	HFI	212111	Detection	Focal Plane Unit (FPU)	PH	A	simulator	PFM
Planck	HFI	212112	Detection	Data Processing Unit (DPU) Nominal	PH	BA-N	CQM 3	PFM
Planck	HFI	212113	Detection	Data Processing Unit (DPU) Redundant	PH	BA-R	N/A	PFM
Planck	HFI	212114	Detection	JFET Box	PH	CA	CQM	PFM
Planck	HFI	212115	Detection	Pre-Amplifier Unit (PAU)	PH	CBA	CQM	PFM
Planck	HFI	212116	Detection	Readout Electronics Unit (REU)	PH	CBC	CQM	PFM
Planck	HFI	212151	Detection	FPU/JFET Box Harness	PH	AD	N/A	PFM
Planck	HFI	212152	Detection	DPU-N/REU Harness (Signal)	PH	BBA-N	CQM	PFM
Planck	HFI	212153	Detection	DPU-R/REU Harness (Signal)	PH	BBA-R	N/A	PFM
Planck	HFI	212154	Detection	DPU-N/REU Harness (Power)	PH	BBB-N	CQM	PFM
Planck	HFI	212155	Detection	DPU-R/REU Harness (Power)	PH	BBB-R	N/A	PFM
Planck	HFI	212156	Detection	DPU-N/4K-CDE Harness	PH	BBE-N	CQM	PFM
Planck	HFI	212157	Detection	DPU-R/4K-CDE Harness	PH	BBE-R	N/A	PFM
Planck	HFI	212158	Detection	DPU-N/0.1K-DCCU Harness	PH	BBC-N	CQM	PFM
Planck	HFI	212159	Detection	DPU-R/0.1K-DCCU Harness	PH	BBC-R	N/A	PFM
Planck	HFI	212160	Detection	DPU-N/DPU-R Harness (x2)	PH	BBG 1 & 2	N/A	PFM's
Planck	HFI	212161	Detection	PAU/JFET Box Harness	PH	CBB	CQM	PFM
Planck	HFI	212162	Detection	PAU/REU Harness	PH	CBD	CQM	PFM
Planck	HFI	212211	4K Cooler	4K Cooler Compressor Unit (CCU)	PH	DA	not present	PFM
Planck	HFI	212212	4K Cooler	4K Cooler Ancillary Unit (CAU)	PH	DB	DM	PFM
Planck	HFI	212213	4K Cooler	4K Cooler Electronics Unit (4K-CDE)	PH	DC	DM	PFM
Planck	HFI	212214	4K Cooler	4K Cooler Cold End (CCE), pipes and cryoharness & brackets from SVM bracket to FPU	PH	DD	N/A	PFM
Planck	HFI	212215	4K Cooler	4K Cooler Current Regulator (CCR)	PH	DJ	Not Present	PFM
Planck	HFI	212201	4K Cooler	4K Compressor magnetic shield				PFM
Planck	HFI	212240	4K Cooler	4K warm pipework and harnesses from CAU to SVM	PH	DE	N/A	PFM
Planck	HFI	212251	4K Cooler	4K-CDE/CCU PPO A Harness	PH	DFA-A	Not Present	PFM
Planck	HFI	212252	4K Cooler	4K-CDE/CCU PPO B Harness	PH	DFA-B	Not Present	PFM
Planck	HFI	212253	4K Cooler	4K-CDE/CCU Force Harness	PH	DFB	Not Present	PFM
Planck	HFI	212254	4K Cooler	4K-CDE/CCU Drive A Harness	PH	DFC-A	Not Present	PFM
Planck	HFI	212255	4K Cooler	4K-CDE/CCU Drive B Harness	PH	DFC-B	Not Present	PFM
Planck	HFI	212256	4K Cooler	4K-CDE/CCU Temperature Harness	PH	DFE	Not Present	PFM
Planck	HFI	212257	4K Cooler	4K-CDE/CAU Harness	PH	DFD	Not Present	PFM
Planck	HFI	212258	4K Cooler	PCDU to 4KCDE including 4KCRR to 4KCDE filtered power	PH	DK	Not Present	PFM
Planck	HFI	212314	0.1K Cooler	0.1K Dilution Cooler GSU 3He Tank (D3T) (+Z)	PH	EAAA	N/A	PFM
Planck	HFI	212311	0.1K Cooler	0.1K Dilution Cooler GSU 4He Tank (D4T) #1 (+Y)	PH	EAAAB	N/A	PFM
Planck	HFI	212312	0.1K Cooler	0.1K Dilution Cooler GSU 4He Tank (D4T) #2 (-Z)	PH	EAAAC	N/A	PFM
Planck	HFI	212313	0.1K Cooler	0.1K Dilution Cooler GSU 4He Tank (D4T) #3 (+Y)	PH	EAAAD	N/A	PFM
Planck	HFI	212324	0.1K Cooler	D3T/0.1K-DCCU piping + Support (+Z)	PH	EABA	N/A	PFM
Planck	HFI	212321	0.1K Cooler	D4T #1/0.1K-DCCU piping + Support (+Y)	PH	EABB	N/A	PFM
Planck	HFI	212322	0.1K Cooler	D4T #2/0.1K-DCCU piping + Support (-Z)	PH	EABCB	N/A	PFM
Planck	HFI	212323	0.1K Cooler	D4T #3/0.1K-DCCU piping + Support (-Y)	PH	EABD	N/A	PFM
Planck	HFI	212354	0.1K Cooler	D3T/0.1K-DCCU harness	PH	EACA	N/A	PFM
Planck	HFI	212351	0.1K Cooler	D4T #1/0.1K-DCCU harness	PH	EACB	N/A	PFM
Planck	HFI	212352	0.1K Cooler	D4T #2/0.1K-DCCU harness	PH	EACC	N/A	PFM
Planck	HFI	212353	0.1K Cooler	D4T #3/0.1K-DCCU harness	PH	EACD	N/A	PFM
Planck	HFI	212331	0.1K Cooler	0.1K Dilution Cooler Control Unit (0.1K-DCCU)	PH	EB	CQM DCE	PFM
Planck	HFI	212341	0.1K Cooler	Helium exhaust	PH	EEF	N/A	PFM
Planck	HFI	212342	0.1K Cooler	0.1K Cooler Pipes + supports + fittings assembly between DCCU & SVM connector	PH	ECAA	N/A	PFM
Planck	HFI	212343	0.1K Cooler	0.1K Cooler Pipes between SVM connector to 50K	PH	ECBA	N/A	PFM
Planck	HFI	212344	0.1K Cooler	0.1K Cooler Pipes between 50K TO 18K	PH	ECBB	N/A	PFM
Planck	HFI	212345	0.1K Cooler	0.1K Cooler subplatform bracket equipped (pneumatic fittings & electrical connectors)	PH	ECBC	N/A	PFM
Planck	HFI	212346	0.1K Cooler	0.1K Cooler fixing bracket on VG1 (140K)	PH	ECBD	N/A	PFM
Planck	HFI	212347	0.1K Cooler	0.1K Cooler fixing bracket on VG2 (100K)	PH	ECBE	N/A	PFM
Planck	HFI	212348	0.1K Cooler	0.1K Cooler 50K plate equipped	PH	ECBF	N/A	PFM
Planck	HFI	212349	0.1K Cooler	0.1K fixing bracket on VG2 (100K)	PH	ECBG	N/A	PFM
Planck	HFI	212355	0.1K Cooler	0.1K Harness + connectors between DCCU & subplatform disconnection bracket	PH	ECCA	NA	PFM
Planck	HFI	212356	0.1K Cooler	0.1K Harness fixing clamps between DCCU & subplatform disconnection bracket	PH	ECCB	N/A	PFM
Planck	HFI	212357	0.1K Cooler	0.1K Harness + connectors between subplatform disconnection bracket & 18K stage	PH	ECDA	N/A	PFM
Planck	HFI	212358	0.1K Cooler	0.1K Harness fixing clamps between subplatform disconnection bracket & 18K stage	PH	ECDB	N/A	PFM



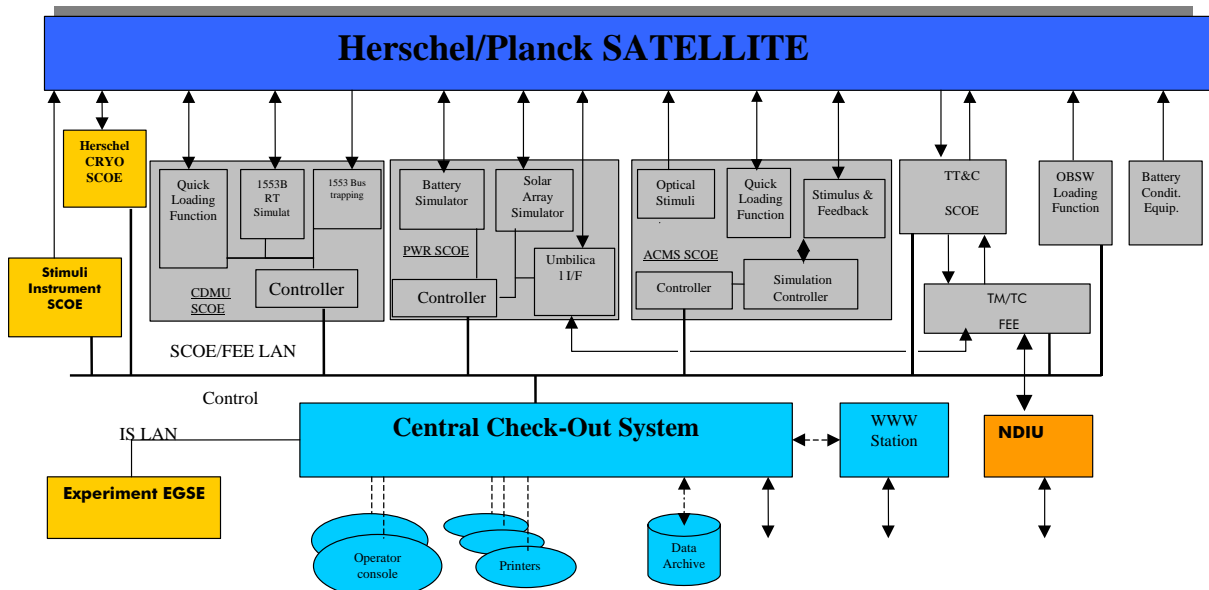
### 3.1.2 LFI and Sorption cooler

Satellite	Instru- ment	Product Tree Id	Subsystem	description	cod e	code	Sat AVM	PFM
Planck	LFI	211111	Radiometer Array Assembly (RAA)	Front End Unit (FEU)	PL	FEU	N/A	PFM
Planck	LFI	211112	Radiometer Array Assembly (RAA)	DAE Back End Unit (BEU)	PL	BEU	CQM	PFM
Planck	LFI	211113	Radiometer Array Assembly (RAA)	DAE Power Box	PL	CB	CQM	PFM
Planck	LFI	211114	Radiometer Array Assembly (RAA)	4K Reference load (Mounted on HFI)	PL	4K	N/A	PFM
Planck	LFI	211115	Radiometer Array Assembly (RAA)	Wave Guides (WG)	PL	WG	N/A	PFM
Planck	LFI	211131	Radiometer Array Assembly (RAA)	FEU/DAE cryo Harness	PL	AHB	N/A	PFM
Planck	LFI	211132	Radiometer Array Assembly (RAA)	DAE Power Box/BEU Harness A	PL	AHA/A	CQM	PFM
Planck	LFI	211133	Radiometer Array Assembly (RAA)	DAE Power Box/BEU Harness B	PL	AHA/B	CQM	PFM
Planck	LFI	211134	Radiometer Array Assembly (RAA)	DAE BEU/lateral trays Harness	PL	AHA/C	CQM	PFM
Planck	LFI	211121	Radiometer Electronics Box Assembly (REBA)	REBA Nominal	PL	REN	CQM	PFM
Planck	LFI	211122	Radiometer Electronics Box Assembly (REBA)	REBA Redundant	PL	RER	N/A	PFM
Planck	LFI	211135	Radiometer Electronics Box Assembly (REBA)	REBA/BEU Harness	PL	EBO	CQM	PFM
Planck	LFI	211510	GSE	LFI MGSE	PL			
Planck	LFI	211511	GSE	LFI Transport Container	PL			
Planck	LFI	211520	GSE	LFI EGSE	PL			
Planck	LFI	211211	Sorption Cooler Subsystem (SCS)	SC Cold End (SCCE) Nominal	PS	M1	N/A	FM2
Planck	LFI	211212	Sorption Cooler Subsystem (SCS)	SC Pipes (PACE) Nominal	PS	M2	N/A	FM2
Planck	LFI	211213	Sorption Cooler Subsystem (SCS)	SC Compressor (SCC) Nominal	PS	M3	Simulator	FM2
Planck	LFI	211221	Sorption Cooler Subsystem (SCS)	SC Electronics (SCE) Nominal	PS	M4	CQM	FM2
Planck	LFI	211231	Sorption Cooler Subsystem (SCS)	SCE/SCC Harness (Power) Nominal	PS	M5A	CQM	FM2
Planck	LFI	211232	Sorption Cooler Subsystem (SCS)	SCE/SCC Harness (Signal) Nominal	PS	M5B	CQM	FM2
Planck	LFI	211233	Sorption Cooler Subsystem (SCS)	SCE/SCCE Harness Nominal	PS	M5C	N/A	FM2
Planck	LFI	211234	Sorption Cooler Subsystem (SCS)	SCC-SCCE Harness Nominal	PS	M5D	N/A	FM2
Planck	LFI	211216	Sorption Cooler Subsystem (SCS)	SC Cold End (SCCE) Redundant	PS	R1	N/A	FM1
Planck	LFI	211217	Sorption Cooler Subsystem (SCS)	SC Pipes (PACE) Redundant	PS	R2	N/A	FM1
Planck	LFI	211218	Sorption Cooler Subsystem (SCS)	SC Compressor (SCC) Redundant	PS	R3	N/A	FM1
Planck	LFI	211222	Sorption Cooler Subsystem (SCS)	SC Electronics (SCE) Redundant	PS	R4	N/A	FM1
Planck	LFI	211235	Sorption Cooler Subsystem (SCS)	SCE/SCC Harness (Power) Redundant	PS	R5A	N/A	FM1
Planck	LFI	211236	Sorption Cooler Subsystem (SCS)	SCE/SCC Harness (Signal) Redundant	PS	R5B	N/A	FM1
Planck	LFI	211237	Sorption Cooler Subsystem (SCS)	SCE/SCCE Harness Redundant	PS	R5C	N/A	FM1
Planck	LFI	211238	Sorption Cooler Subsystem (SCS)	SCC-SCCE Harness Redundant	PS	R5D	N/A	FM1

## 3.2 EGSE Configurations for AVM & FM tests

### 3.2.1 Satellite EGSE configuration

The EGSE configuration during the [Planck](#) Satellite test phase is the following.



**Figure 3-1: Satellite EGSE Configuration**

### 3.2.2 Instruments EGSE

Instrument I-EGSE will be used by instrument teams during most of the tests mainly to analyse the instrument science and housekeeping data, using the QLA (Quick Look Analysis) tool, or dedicated analysis software.

For Planck, each instrument has its own dedicated EGSE.

In addition, HFI will use an autonomous EGSE (CESR EGSE) during the stand alone verification of the detection chain (during the REU/FPU integration process).

### 3.3 Instruments database configuration.

The instrument database shall be Part of the instrument AVM or FM EIDP

It shall be under Configuration

It shall be sent to ASP-F (F.Chatte) for compatibility check with, and to be integrated to HPSDB at least 3 weeks before the test.

As the database version is likely to change after checking, the database issue to be used for the test shall be frozen at the TRR

### 3.4 Instruments software configuration.

The instruments boot and application software version used in the DPU/ICU and other warm units when applicable shall be described in the instrument AVM or FM EIDP, and acknowledged at the DRB, and TRR.

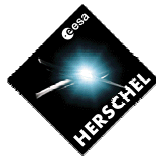
### 3.5 PPLM Configuration for IST and TV test.

refere to related detailed test specification

AD-21 – H-P-3-ASP-TS-0881\_3 - Planck IST test specification

AD-22 – H-P-3-ASP-TS-0893\_1 - Planck TV test specification

AD-23 – H-P-3-ASP-TS-0820\_2.0 - Planck EMC test specification.



## 4. TEST FACILITY REQUIREMENTS

Integration : [refer to AD 41 to 47](#)

SFT warm, IST: [Refer to AD 21](#)

TV test: [refer to AD 22](#)

EMC: [Refer to AD 23](#)

## 5. TEST DEFINITION

### 5.1 Overview of Planck AVM & FM tests sequence

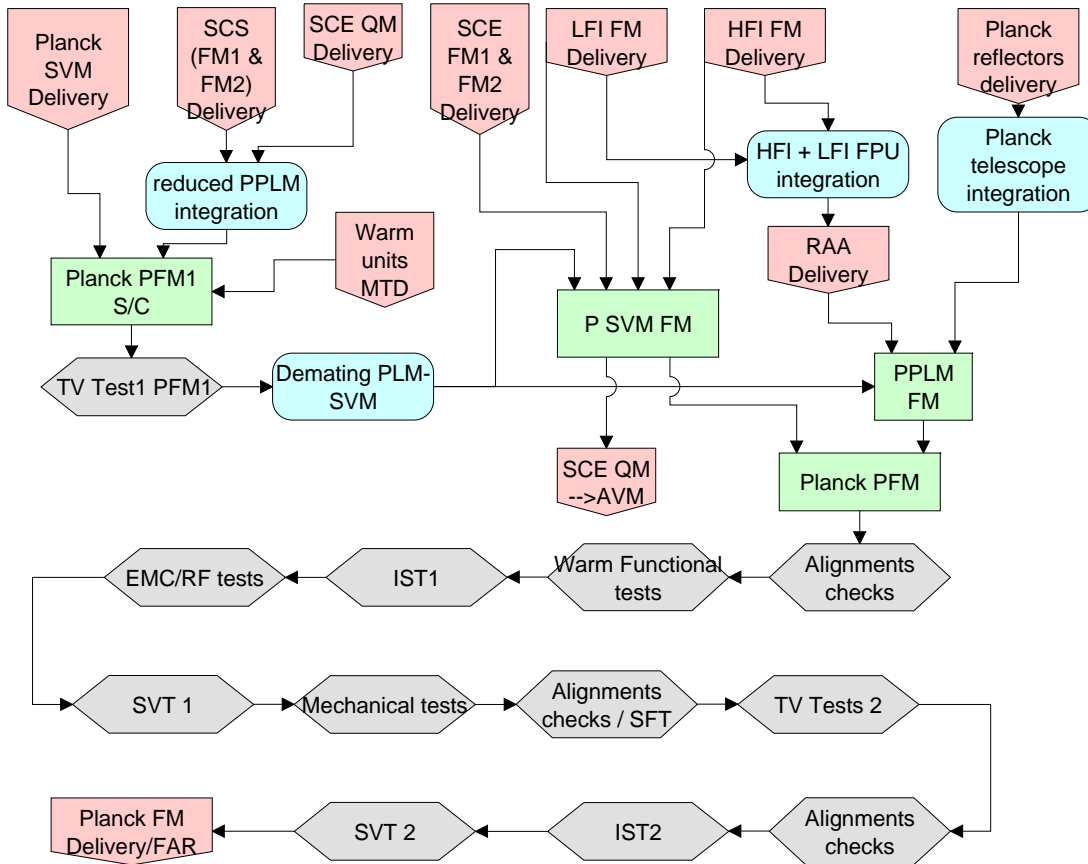
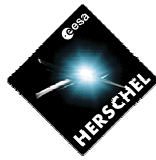
The Planck Spacecraft, after integration (and instruments integration tests and UFT), will be submitted to Acceptance environment tests (TV test, EMC test, and Mechanical tests).

Before and after Environment test, the satellite will be submitted to Integrated System Tests (IST, ref RD21), with the aim to verify all (or at least most of) functionalities and modes of the Spacecraft and Instruments are performing correctly, and that they are not altered by the environmental tests.

Before and after each environment test, SFT will be performed to health check of the instruments.

The overall test logic on the FM is described in the following flow diagram.





**Figure 5-1: Planck FM test sequence flow chart**

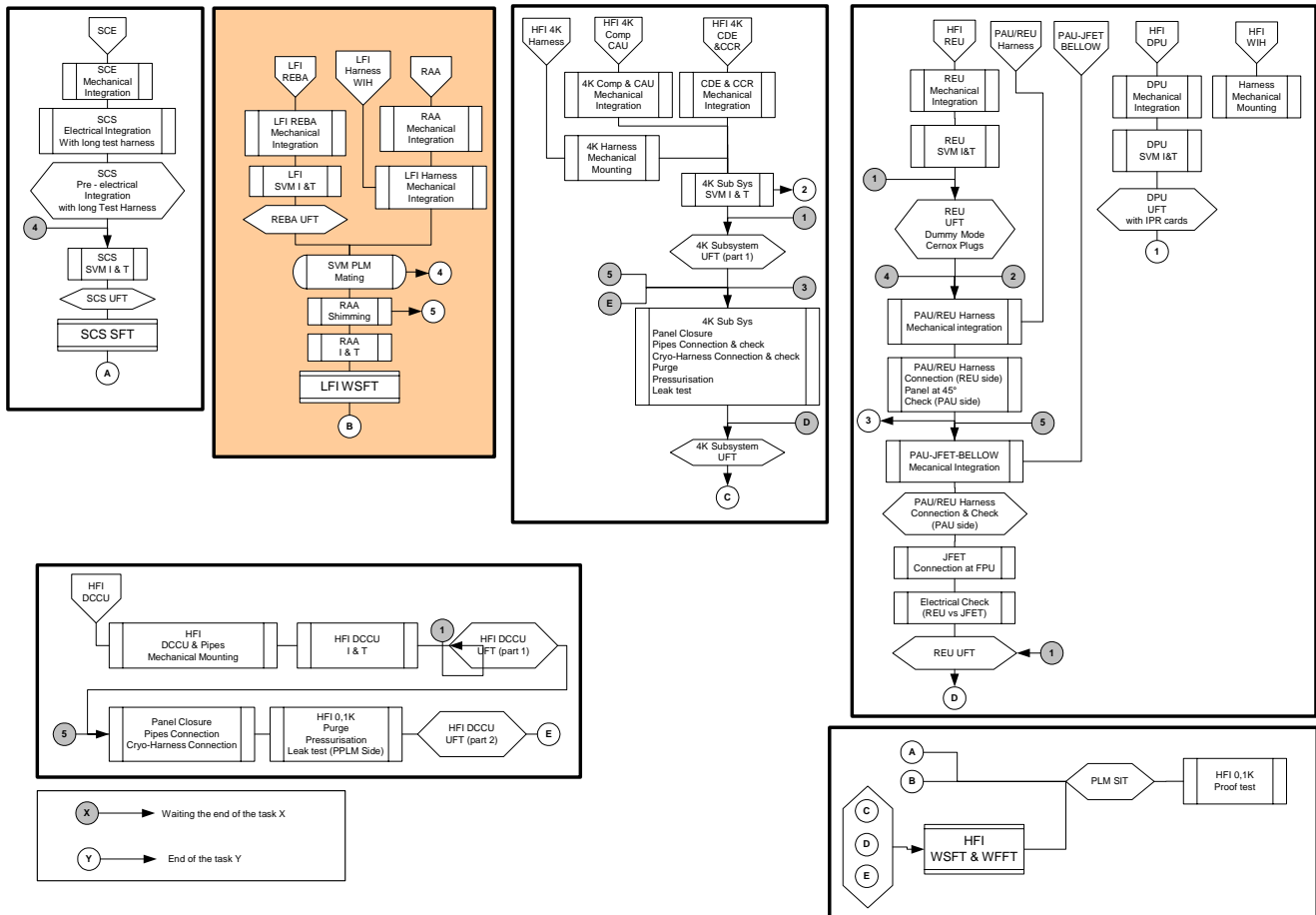
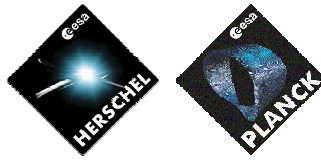


Figure 5-2: Planck FM Integration flow chart

The sequence & duration of each activity is given in the following table



**Table 5-1: Planck FM test sequence table. Typical date for test after delivery is given for information only).**

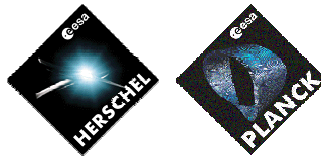
NOM TACHE	Calendar days after RAA delivery	Durati on (d)	Instru ment	Location	task	PPLM temperat ure
<b>LFI/HFI Integration/Alignment</b>	-122	<b>142</b>	<b>1</b>	<b>AAS-F</b>	<b>Intégration</b>	<b>Warm</b>
LFI FM RAA equipment	-19	0	1	AAS-F	Intégration	Warm
HFI FM FPU equipment	-123	0	1	AAS-F	Intégration	Warm
LFI /HFI FPU integration /alignment +3D	-16	12	1	AAS-F	Intégration	Warm
<b>RAA DRB</b>	0	<b>0</b>	<b>1</b>	<b>AAS-F</b>	<b>Intégration</b>	<b>Warm</b>
RAA NRB & adjustments	1	16	1	AAS-F	Intégration	Warm
<b>Cryo-structure re-int. + SVM/PLM mating (2x8 6/7d)</b>	1	<b>70</b>	<b>1</b>	<b>AAS-F</b>	<b>Intégration</b>	<b>Warm</b>
Mating TRR part 3 (RAA)	1	0	1	AAS-F	Intégration	Warm
RAA preparation	2	3	1	AAS-F	Intégration	Warm
RAA on subplatform	20	3	1	AAS-F	Intégration	Warm
Cryo-structure re-assembly	23	6	1	AAS-F	Intégration	Warm
SVM / PLM mating	38	8	1	AAS-F	Intégration	Warm
SCSs cnx & electrical int.(incl. nom cryo hrs) (reduced f	68	3	1	AAS-F	Intégration	Warm
He tanks	51	0	1	AAS-F	Delivery	Warm
Helium tanks remounting (AAS-F& HFI & AAS-I)	56	3	1	AAS-F	Intégration	Warm
<b>Coolers &amp; Warm Unit integration (2x8 6/7d)</b>	-69	<b>192</b>	<b>1</b>	<b>AAS-F</b>	<b>Intégration</b>	<b>Warm</b>
HFI DPU N delivery date	-16	0	1	AAS-F	Delivery	Warm
HFI DPU R delivery date	-16	0	1	AAS-F	Delivery	Warm
HFI DPUs mouting & integration /SVM	-7	4	1	AAS-F	Intégration	Warm
HFI DPUs UFT with IPR cards	7	4	1	AAS-F	UFT	Warm
HFI REU delivery date	-33	0	1	AAS-F	Delivery	Warm
HFI REU mounting	38	1	1	AAS-F	Intégration	Warm
PAU - REU Harness delivery	-69	0	1	AAS-F	Delivery	Warm
PAU - REU harness mechanical pre-integration	62	5	1	AAS-F	Intégration	Warm
HFI DCCU delivery date	40	0	1	AAS-F	Delivery	Warm
HFI DCCU mounting	52	1	1	AAS-F	Intégration	Warm
HFI 4K CAU & CCU delivery date	-20	0	1	AAS-F	Delivery	Warm
HFI 4K CAU & CCU mounting	65	1	1	AAS-F	Intégration	Warm
HFI 4K CCR delivery date	16	0	1	AAS-F	Delivery	Warm
4K CCR mounting	64	1	1	AAS-F	Intégration	Warm
4K Harness	-14	0	1	AAS-F	Delivery	Warm
Harness mounting on 4K panel + harness connexion da	68	1	1	AAS-F	Intégration	Warm
LFI REBA N delivery date	54	0	1	AAS-F	Delivery	Warm
LFI REBA N mouting	58	1	1	AAS-F	Intégration	Warm
LFI REBA R delivery date (tbc)	68	0	<b>1</b>	<b>AAS-F</b>	<b>Delivery</b>	<b>Warm</b>
LFI REBA R mouting (tbc)	70	1	1	AAS-F	Intégration	Warm
LFI DAE power box FM delivery date	-19	0	1	AAS-F	Delivery	Warm
LFI DAE pwr box mounting	54	1	1	AAS-F	Intégration	Warm
LFI Harness	54	0	1	AAS-F	Delivery	Warm
LFI BEU/REBA/DAE harness mounting	71	3	1	AAS-F	Intégration	Warm
LFI REBAs pre-electrical integration	115	4	1	AAS-F	Elect. Intégr.	Warm
DCCU UFT part 1 +REU UFT part 1	120	3	1	AAS-F	UFT	Warm
<b>SVM activities on Planck FM</b>	68	<b>47</b>	<b>1</b>	<b>AAS-F</b>	<b>SIT</b>	<b>Warm</b>
<b>FM Planck Telescope post-LSS test campaign activitie</b>	-85	<b>213</b>	<b>1</b>	<b>AAS-F</b>	<b>Intégration</b>	<b>Warm</b>
<b>PPLM mechanical integration (2x8 6/7 d)</b>	-118	<b>311</b>	<b>1</b>	<b>AAS-F</b>	<b>Intégration</b>	<b>Warm</b>
FM Telescope mounting/shimming	128	4	1	AAS-F	Intégration	Warm
RAA Adjustment / shimming (incl. RAA MGSE dismount)	134	8	1	AAS-F	Intégration	Warm
RAA and harness Mounting on subplatform & pipes cnx	143	5	1	AAS-F	Intégration	Warm
4K CDE QM delivery date	-14	0	1	AAS-F	Delivery	Warm
4K CDE FM delivery date	122	0	1	AAS-F	Delivery	Warm
4K CDE FM mounting	134	1	1	AAS-F	Intégration	Warm
4K CDE FM electrical integration	135	2	1	AAS-F	Elect. Intégr.	Warm
LFI REBAs electrical integration	143	4	1	AAS-F	Intégration	Warm
HFI REU/PAU harness mounting	149	3	1	AAS-F	Elect. Intégr.	Warm
HFI REU (PAU cnx side check) (HFI - CESR)	154	1	1	AAS-F	UFT	Warm
HFI PAU / Bellow / J-FET delivery date	-118	0	1	AAS-F	Delivery	Warm
HFI PAU / bellow / J-FET mounting	155	2	1	AAS-F	Intégration	Warm
HFI REU(> PAU) harness cnx & checks (HFI - CESR)	157	2	1	AAS-F	UFT	Warm
HFI WU end of cnx & electrical integration	162	4	1	AAS-F	Elect. Intégr.	Warm
HFI DCCU & IF PLM pipes mounting & panel closure	167	3	1	AAS-F	Intégration	Warm
HFI detection chain cnx & electrical integration & 4K/REU	173	2	1	AAS-F	Elect. Intégr.	Warm
Grooves Piping fastening & Thermal Control routing	175	9	1	AAS-F	Intégration	Warm
Baffle Mounting	185	2	1	AAS-F	Intégration	Warm
External Groove & SLI mounting	188	5	1	AAS-F	Intégration	Warm



NOM TACHE	Calendar days after RAA delivery	Duration (d)	Instrument	Location	task	PPLM temperature
<b>Instruments coolers integration (2x8 6/7 d)</b>	194	10	1	AAS-F	Intégration	Warm
HFI 4 K cooler purge/pressu & leak (HFI - RAL - IAS)	194	4	1	AAS-F	Leak	Warm
HFI 0.1 K cooler purge/pressu & leak under vac. (HFI - IAS)	198	3	1	AAS-F	Leak	Warm
0,1 & 4 K Electrical check (including FPU I/F)	202	1	1	AAS-F	Elect. Intégr.	Warm
HFI detection chain cnx (J-FET with check before cnx)	203	1	1	AAS-F	Elect. Intégr.	Warm
HFI cnx check REU / FPU & REU/4K synchro.)	204	1	1	AAS-F	Elect. Intégr.	Warm
<b>Instruments funct. test / SIT (2x8 6/7d)</b>	175	36	1	AAS-F	UFT	Warm
SCCs short funct. tests (with LFI & AAS-I support)	175	5	1	AAS-F	SFT	Warm
Thermal Control Check(harness routing) (with AAS-I support)	181	4	1	AAS-F	UFT	Warm
HFI WFT (with HFI & AAS-I support)	205	2	1	AAS-F	UFT	Warm
LFI WFT (with LFI & AAS-I support)	208	2	1	AAS-F	UFT	Warm
PLM SIT (with HFI & LFI & AAS-I support)	210	6	1	AAS-F	SIT	Warm
<b>Conducted EMC (2x8 6/7 d)</b>	217	7	1	AAS-F	EMC	Warm
SVM/PLM MLI central part mounting (AAS-I with AAS-F support)	217	3	1	AAS-F	EMC	Warm
CE/CS test set-up	220	1	1	AAS-F	EMC	Warm
CE/CS tests	222	3	1	AAS-F	EMC	Warm
<b>S/C end of integration (2x8 6/7 d)</b>	225	33	1	AAS-F	Intégration	Warm
Upper panels closure & SREM mounting	226	3	1	AAS-F	Intégration	Warm
SC transfer to T05	239	2	1	AAS-F	Intégration	Warm
HFI 0.1 K cooler leak + proof/ pres.at 400 b (hazardous)	241	2	1	AAS-F	Intégration	Warm
SC transfer to cleanroom	244	2	1	AAS-F	Intégration	Warm
HFI cooler global leaks	246	4	1	AAS-F	Intégration	Warm
PLM cleaning (telescope/grooves)	253	1	1	AAS-F	Intégration	Warm
Alignment ref. (AAS-F with AAS-I support), including SC	254	5	1	AAS-F	Intégration	Warm
MLI mounting/grounding on lateral panels	262	1	1	AAS-F	Intégration	Warm
<b>IST 1 (2x8 6/7 d) &amp; SVT 1 (1x6 5/7 d)</b>	222	142	1	AAS-F	IST	Warm
SVM IST Regression (V2.8) & Formal run (AAS-I)	222	6	1	AAS-F	IST	Warm
ACMS (M3+M2 xIST) SIT Deb/Run v3.3 (AAS-I)	230	15	1	AAS-F	IST	Warm
IST 1 Flight branch (with AAS-I support)	331	15	1	AAS-F	IST	Warm
LIT initial	344	1	1	AAS-F	IST	Warm
LIT additional	348	0	1	AAS-F	IST	Warm
SVT 1 (5d/7) part 1	350	10	1	AAS-F	SVT	Warm
<b>EMC tests (2x8 6/7d) - Radiated EMC tests</b>	364	14	1	AAS-F	EMC	Warm
S/C Transfer to CATR	364	1	1	AAS-F	EMC	Warm
RE/RS test set-up	365	1	1	AAS-F	EMC	Warm
RE/RS tests	366	3	1	AAS-F	EMC	Warm
Launch compatibility set-up & test	370	2	1	AAS-F	EMC	Warm
HFI/LFI RF tests set-up	372	2	1	AAS-F	RF	Warm
HFI/LFI RF tests	374	5	1	AAS-F	RF	Warm
<b>SVT / IST</b>	380	29	1	AAS-F	SVT	Warm
SVT 1 (5d/7) part 2	380	5	1	AAS-F	SVT	Warm
FM SA dismount., Instrum. replace, STM SA mouting (dismount)	387	8	1	AAS-F	Intégration	Warm
Packing	399	5	1	AAS-F	Intégration	Warm
HFI coolers global leak	405	4	1	AAS-F	Leak	Warm
<b>MCI &amp; Balancing tests</b>	268	12	1	AAS-F	Mech. tests	Warm
<b>Vibration tests (2x8 6/7 d)</b>	285	40	1	AAS-F	Mech. tests	Warm
µvib	285	3	1	AAS-F	Mech. tests	Warm
Vibrations SC set up	288	3	1	AAS-F	Mech. tests	Warm
Accelerometer instrumentation finalisation ( around 50)	288	2	1	AAS-F	Mech. tests	Warm
RCS filling & valves leak tests	288	3	1	AAS-F	Mech. tests	Warm
Vibration & Acoustic	292	20	1	AAS-F	Mech. tests	Warm
Sine tests	292	16	1	AAS-F	Mech. tests	Warm
SC transfer to shaker & accelr. cnx	290	1	1	AAS-F	Mech. tests	Warm
X axis low & intermediate levels & SC checks	292	2	1	AAS-F	Mech. tests	Warm
X axis acceptance & qualif. , low levels & SC checks	294	2	1	AAS-F	Mech. tests	Warm
SC transfer to VIS & shaker orientation change	296	2	1	AAS-F	Mech. tests	Warm
SC transfer to shaker & accelr. cnx	299	1	1	AAS-F	Mech. tests	Warm
Y axis low & intermediate levels & SC checks	300	2	1	AAS-F	Mech. tests	Warm
Y axis acceptance & qualif. , low levels & SC checks	302	2	1	AAS-F	Mech. tests	Warm
SC transfer to shaker & accelr. cnx	304	1	1	AAS-F	Mech. tests	Warm
Z axis low & intermediate levels & SC checks	306	1	1	AAS-F	Mech. tests	Warm
Z axis acceptance & qualif. , low levels & SC checks	307	2	1	AAS-F	Mech. tests	Warm
Acoustic tests	310	4	1	AAS-F	Mech. tests	Warm
SC transfer & accelr cnx (3x3 shifts) & low level	309	2	1	AAS-F	Mech. tests	Warm
Intermed. acceptance Qualif low levels & SC checks	311	2	1	AAS-F	Mech. tests	Warm
Clamp Band release test	314	2	1	AAS-F	Mech. tests	Warm
RCS Draining & Drying Test	316	3	1	AAS-F	Mech. tests	Warm
RCS LV status / gaz flow tests, valves, thrusters leak Test	320	2	1	AAS-F	Mech. tests	Warm
Alignment check	322	3	1	AAS-F	Mech. tests	Warm
SFT	325	3	1	AAS-F	SFT	Warm
Accelerometer instrumentation removal (around 50)	325	2	1	AAS-F	Intégration	Warm
Thermocouples instrumentation	329	2	1	AAS-F	Intégration	Warm



NOM TACHE	Calendar days after RAA delivery	Duration (d)	Instrument	Location	task	PPLM temperature
<b>Flasher test</b>	445	7	1	AAS-F	Flasher	Warm
<b>Thermal tests (part 2) (2x8 6/7 d 3x8 7/7 d)</b>	409	97	1	CSL	TV	Warm
Transport to CSL	409	7	1	CSL	packing/trans	Warm
SC unpacking & transfer to MPT	416	3	1	CSL	packing/trans	Warm
EGSE validation	416	3	1	CSL	Intégration	Warm
S/C healthcheck	420	3	1	CSL	Intégration	Warm
S/C He filing	423	4	1	CSL	Intégration	Warm
SA exter. & MLI finalisation	428	3	1	CSL	Intégration	Warm
S/C cleaning	432	2	1	CSL	Intégration	Warm
Shrouds installation & S/C cnx	434	10	1	CSL	Intégration	Warm
SC transfer to vac. chamb., inspection, optical cavity pro	434	3	1	CSL	packing/trans	Warm
EGSE validation near vac. chamb.	434	2	1	CSL	Intégration	Warm
SC connection & electrical check	437	2	1	CSL	Intégration	Warm
Optical cover removal, shrouds cover closing, optical shi	440	1	1	CSL	Intégration	Warm
Shroud leak checks & thermal sensors checks	441	3	1	CSL	Leak	Warm
Rails removal & μvib config. check	444	1	1	CSL	Intégration	Warm
S/C survey check	446	3	1	CSL	Intégration	Warm
Cooling leak tests	449	2	1	CSL	Leak	Warm
Vacuum Phase	451	5	1	CSL	TV	Warm
Cooling phase/Thermal balance	456	7	1	CSL	TV	Cold
Instruments test phase	463	25	1	CSL	TV	Cold
Return at Ambient	488	3	1	CSL	TV	Cold
Shrouds removal	491	3	1	CSL	Intégration	Warm
S/C exit	495	2	1	CSL	Intégration	Warm
S/C Functional Tests	497	3	1	CSL	SFT	Warm
Packing	500	5	1	CSL	packing/trans	Warm
<b>IST 2 (2x8 6/7 d) / SVT 2 (5/7 d)</b>	506	83	1	Estec	IST	Warm
Transport from CSL to ESTEC	506	3	1	Estec	packing/trans	Warm
Unpacking	509	3	1	Estec	packing/trans	Warm
Alignment check	512	3	1	Estec	Alignment	Warm
EGSE validation	512	3	1	Estec	Intégration	Warm
FM SA mounting (and STM dismounting)	516	6	1	Estec	Intégration	Warm
SC transfer into LSS	525	1	1	Estec	packing/trans	Warm
SC fine balancing test	528	3	1	Estec	Mech. tests	Warm
SC transfer to cleanroom	532	1	1	Estec	packing/trans	Warm
Mech. & Electrical Fit Check	533	3	1	Estec	check	Warm
Regression tests OBSW ACMS (AAS-I)	537	10	1	Estec	SIT	Warm
IST2 Flight branch	548	20	1	Estec	IST	Warm
LIT initial	563	1	1	Estec	LIT	Warm
LIT additional	569	1	1	Estec	LIT	Warm
SVT2 (5d /7)	572	10	1	Estec	SVT	Warm
Schedule contingency	584	5	1	Estec	margin	Warm
<b>FAR process &amp; S/C activities after delivery</b>	362	244	1	Estec	FAR	Warm
FAR data pack	362	172	1	Estec	FAR	Warm
S/C MILESTONE - FAR Kick-off	570	0	1	Estec	FAR	Warm
FAR Completion	601	0	1	Estec	FAR	Warm
External SA dismounting & MLI	589	1	1	Estec	Intégration	Warm
S/C Inspection / flight-non flight management / Cleaning	590	3	1	Estec	Intégration	Warm
S/C transfer to transport container	595	2	1	Estec	packing/trans	Warm
SC global leak test	597	3	1	Estec	Leak	Warm
Overall GSE packing	597	3	1	Estec	packing/trans	Warm
Transfer to plane1	602	1	1	Estec	packing/trans	Warm
Departure to KRU	602	0	1	Estec	packing/trans	Warm
Transport to KRU (by plane)	603	3	1	Estec	packing/trans	Warm
Arrival to KRU	605	0	1	Estec	packing/trans	Warm
<b>Launch campaign</b>	607	64	1	Kourou	Launch	Warm



For AVM, the core of the IST (commissioning and Reference mission scenario, see below) will be run as a rehearsal for FM.

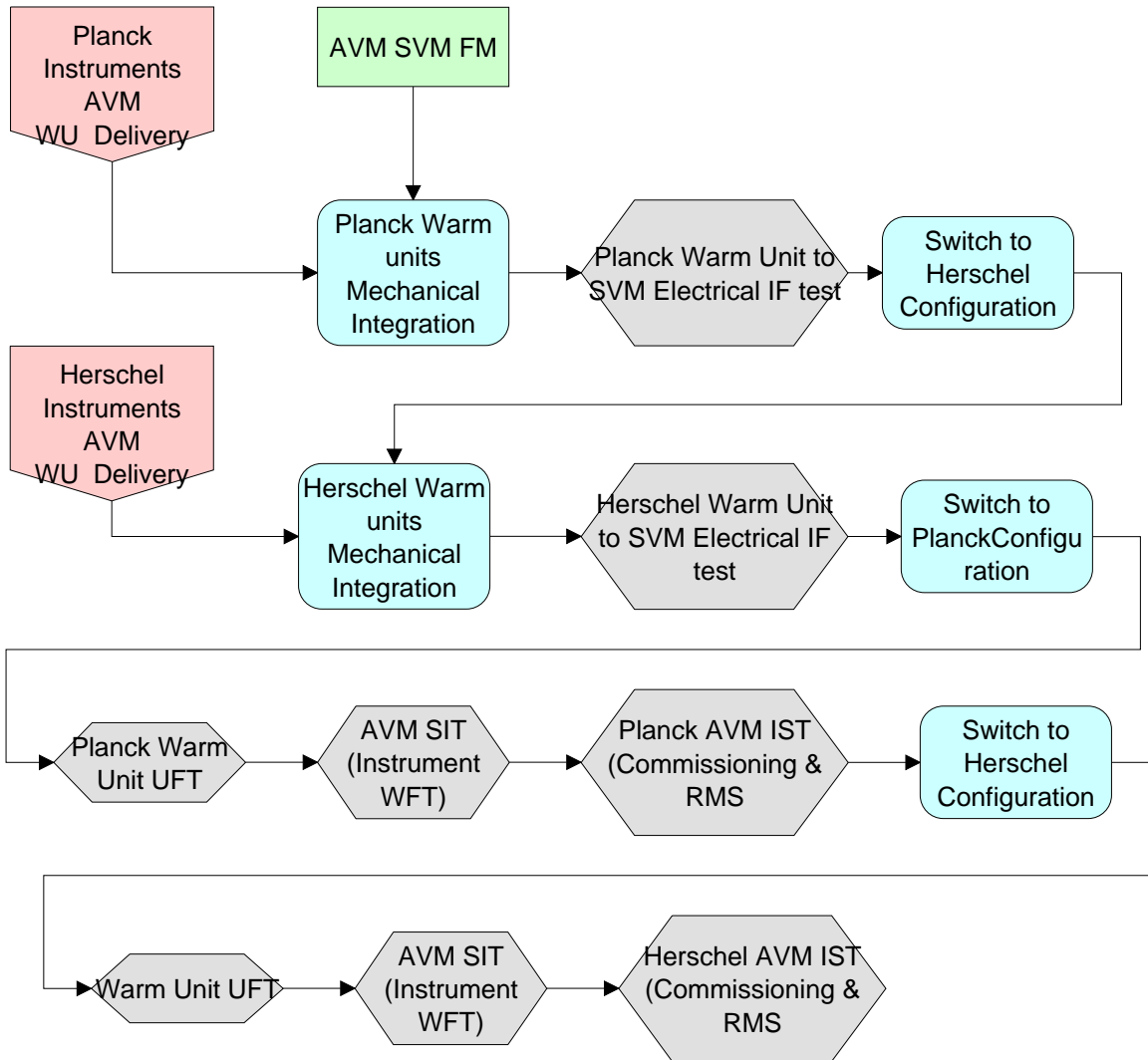
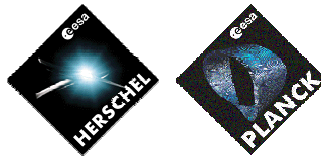


Figure 5-3: Herschel & Planck AVM integration & test sequence flow chart (test order may be modified). For AVM test, the sequence has been modified: The AVM instruments are integrated & tested on the FM satellite. They will be sent back to Torino for further potential test on AVM in Herschel configuration.

## 5.2 Time Allocation for instruments tests

The time allocation for various instruments tests during the satellite FM sequence is the following. All sequences below are in agreement with this, except the HIFI TV test (78h)

	Allocation	type of AIT operation
<b>SFT</b>	2h/Instruments	Normal days 5d/7
<b>Commissioning</b>	1 day	Long days, 6d/7
<b>RMS</b>	<u>48h total</u>	3 shifts, 7d/7
<b>TV</b>	48h/instrument	3 shifts, 7d/7
<b>EMC</b>	<u>3 days total for SC + Instruments</u>	Long days, 6d/7



## 5.3 Incoming Inspection

At reception of instruments, there is usually an incoming inspection aimed to check that the instrument survived the transport, and is still operational.

The inspection (visual inspection) may be followed by an incoming inspection test, where the warm units are connected to each other, and to the I-EGSE, and a verification sequence is run.

## 5.4 Electrical Integration tests, UFT's (Units functional tests), and SIT (Subsystem Integration Test)

Integration test & UFT take place after instrument delivery and incoming inspections, and are performed on warm units only (ie no connection to the FPU yet). Instruments may require to integrate an FPU simulator for the UFT.

Objective is to verify all interfaces with SVM before & during connection, and to verify that the instruments units are working properly together.

At the end, an instrument SFT or FFT is performed to verify instrument health, and a Module SIT (Subsystem Integration Test) is performed in order to verify that all instruments are working together.

### 5.4.1 Electrical Integration tests

Integration tests, to validate the electrical interfaces between the instruments warm units, and the SVM, in a non loaded, then loaded configuration.

They consist in verification of

- 1: the power interface between PCDU, and all warm units connected to primary power lines.
- 2: The 1553 Interface between the CDMU and the instruments DPU's (or ICU)
- 3: The clock interface between the CDMU and any warm unit connected to the clock (PACS DECMEC).

#### 5.4.1.1 Planck AVM Instruments:

The integration specification is the following:

AD-44 - H-P-SP-AI-0083 - HP Warm Units AVM Test Spec  
(includes all Planck (& Herschel) AVM instruments).

#### 5.4.1.2 Planck FM Instruments:

The Integration specifications are the following:

##### **Sorption cooler**

AD-43 - H-P-3-ASP-TS-1131\_01 - FM SVM - SCE Electrical Integration Specification

##### **LFI:**

AD-41 - H-P-3-ASP-TS-1112\_01 - REBA - SVM Electrical Integration Specification

AD-47 - H-P-2-ASP-TS-1220\_01 - LFI-DAE-Power Box -SVM Electrical Integration specification

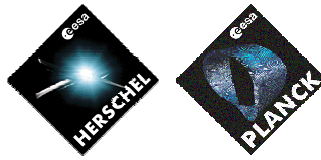
##### **HFI:**

AD-42 - H-P-3-ASP-TS-1113\_01 - HFI-DPU - SVM Electrical Integration Specification

AD-44 - H-P-3-ASP-TS-1149\_01 - 4K CDE & Precharge regulator - SVM Electrical Integration Specification

AD-45 - H-P-3-ASP-TS-1201\_01 - REU - SVM Electrical Integration Specification

AD-46 - H-P-3-ASP-TS-1204\_01 - DCE - SVM Electrical Integration Specification



### **5.4.2 Instruments full software image patch with OBSM (AVM test only)**

This test of the instrument software patching with OBSM will be performed on AVM only, at the end of the Electrical integration tests.

Details have been discussed during the data management working group n° 29.  
This test execution will be under responsibility of [TAS-I](#) (responsible of the OBSM tool).

The main step of the procedure for this test is, for each patchable memory area :

- 1- to upload a small patch to an unused memory area, in RAM, then in EEPROM, if applicable
- 2- to dump the areas and verify correct patching
- 3- remove patch
- 4- to upload a large patch in RAM, if applicable
- 5- to dump the area and verify correct patching
- 6- to upload full new TBD SW in EEPROM
- 7- to dump the area and verify correct patching
- 8- to reload the original SW versions
- 9- to dump the area and verify correct patching

Based on the above, each instrument is therefore requested to :

- provide patch procedures in each case (ie. define the mode in which the instrument shall be in each patch case and provide the relevant TC's+TM
- provide the different patch files in ESOC IMG format, ref SCOS 2000 OBSM external ICD, AD-7)
- attend the test (considered mandatory)

### **5.4.3 UFT's (Unit Functional Test)/ SIT (Subsystem Integration Test)**

#### UFT

During the integration sequence, all units having no direct interface to the SVM, are to be connected usually to the DPU via WIH (data link and/or Secondary Power). [The DPU is still connected to the SVM from the previous electrical integration test.](#)

The sequence shall be such that the warm units are connected one by one, and a sequence is run to check that the unit get the power, and is able to communicate with the DPU

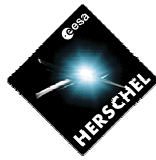
#### SIT

After completion of the instruments warm units electrical integration, a global test on instrument warm units has to be performed to verify that the instruments warm units, as a subsystem, are operational, and ready to execute further tests.. This is the SIT. It is usually a full warm functional test of the instrument operating together, as for flight.

To simplify the sequence, if the integration sequence has been performed many times at ILT without problems, instruments have the possibility to connect all instruments WU with WIH, and run only the SIT at the end.

The UFT/IST sequence have been elaborated by instruments teams with the aim to be common for AVM and for FM.





#### 5.4.3.1 Sorption cooler UFT's:

The Health check test will be performed as UFT.

The Health check procedure is

AD-55 - H-P-3-ASP-TS-1126\_2 - SCS health-check at ambient.

This procedure covers the health check, and the inrush current measurement when testing the beds.

The same procedure will be used for AVM and FM tests.

(NB: For AVM tests, the Look-up table (LUT) has been modified as a consequence of Non conformance (ref NC2588), and therefore becomes specific for AVM test.

For FM, the procedure shall be used for Nominal and redundant cooler.

NB. At the edition of this specification, integration tests on AVM already took place (early septembre 2006 and pre-integration & UFT tests on FM (with tests cables between SVM and SCS panels) in October/November 2006).

Integration tests will be repeated after the mating SVM/SCE

#### 5.4.3.2 HFI UFT 's.

Electrical verification will be performed at each step of the integration sequence:

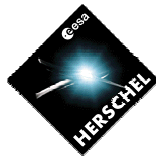
1. DPU -S/C (Nominal) (IPR used on DPU to simulate missing units)
2. DPU -S/C (Redundant)
3. DPU-REU (Nominal/Redundant)
4. DPU-DCCU (Nominal/Redundant) (after pipes connection)
5. REU Harness check
6. DPU-REU-PAU-JFET-FPU = Detection chain UFT (Nominal/Redundant)
7. DPU-4KCDE (Nominal/Redundant)
8. DPU-4K cooler (Nominal/Redundant) (after pipes connection & filling)
9. HFI functional checks (UFT)

For AVM, only step 9 can be performed (as the test has been performed several times at ILT level)

The applicable document for that sequence are indicated in the right column of the table below

The following table indicate the steps to be performed, the duration of the verification, and the related procedure to be used for the corresponding UFT.

Title	Content	Mode	Duration used	Current Time	Procedure / Comments
	<b>HFI Warm units UFTs</b>		9:45:00		Ref FM: PR-PHP450-600735-IAS - Leading procedure for the integration & verification of HFI FM on Planck Spacecraft AVM: PR-PHP450-600736-IAS - Leading procedure for the integration & verification of HFI AVM
	<b>DPU-N (with IPR's) / PCDU UFT</b>		0:15:00		DPU6 - PR-PHB-600334-IAS - DPU C&C verification procedure (UFT)
	DPU N connected to PCDU. IPR's to simulate REU/4KCDE, DCCU				
	run script HFI_EXEC_DPU_UFT		0:15:00		
	<b>DPU-R (with IPR's) / PCDU UFT</b>		0:15:00		DPU6 - PR-PHB-600334-IAS - DPU C&C verification procedure (UFT)
	DPU R connected to PCDU. IPR's to simulate REU/4KCDE, DCCU				
	run script HFI_EXEC_DPU_UFT		0:15:00		
	<b>REU-1: DPU-N DPU/R (with relevant IPR's)/ REU (with cernox plugs) UDT</b>		0:30:00		RU-9 - PR-PHCB-600280-IAS - REU C&C verification procedure (UFT)
	REU connected to DPU, Cernox plugs on REU, IPRs on DPU to simulate 4KCDE & DCCU				
	run script HFI_EXEC_REU_UFT1	Nominal	0:15:00		
	run script HFI_EXEC_REU_UFT1	Redundant	0:15:00		
	<b>DCCU-UFT</b>		1:00:00		DC-12 - PR-PH740-500557-IAS - Electrical procedure for 0.1K Pipes/DCCU connection operation, DCE UFT and valve adressage check
	UFT of Complete Detection chain connected				
	run script HFI_EXEC_DCCU	Nominal	0:30:00		CHECK VALES STATUS
	run script HFI_EXEC_DCCU	Redundant	0:30:00		
	<b>REU / PAU harness check (with PAU simulator)</b>				RU-7 - PR-PH740-500551-IAS - FM PAU-REU-Harness Functional Electrical Verification Procedure
	electrical check of the REU harness integrated only on REU side, with dedicated PAU belt as EGSE				
	<b>REU-2: Detection chain UFT: REU / PAU-JFET-FPU</b>		1:00:00		RU-9 - PR-PHCB-600280-IAS - REU C&C verification procedure (UFT)
	UFT of Complete Detection chain connected				
	run script HFI_EXEC_REU_UFT2	Nominal	0:30:00		
	run script HFI_EXEC_REU_UFT2	Redundant	0:30:00		
	<b>4KCDE UFT1: 4K CDE/DPU UFT</b>		0:30:00		4K-16 - PR-PHD-600165-IAS - 4K C&C verification procedure (UFT)
	4K CDE to DPU communication				
	run script HFI_EXEC_4K_UFT1	Nominal	0:15:00		
	run script HFI_EXEC_4K_UFT1	Redundant	0:15:00		
	<b>4KCDE UFT2: 4K CDE/DPU UFT</b>		6:15:00		4K-16 - PR-PHD-600165-IAS - 4K C&C verification procedure (UFT)
	Complete 4K subsystem electrically & pneumatically connected				
	<b>pneumatic verification of 4K after filling</b>				
	run script HFI_EXEC_DPU_UFT	up to standby	0:15:00		Pneumatical verification
	<b>Electrical verification of 4K</b>				
	run script HFI_EXEC_4K_UFT2	Nominal	3:00:00		
	run script HFI_EXEC_4K_UFT2	Redundant	3:00:00		
	<b>Verification of HFI</b>		10:30:00		For AVM, only this sequence can be used, for nominal instrument only.
	<b>HFI WFFT (N&amp;R)</b>		10:30:00		HFI-7 - PR-PH740-600718-IAS - HFI Warm Short and Full Functional tests (WSFT & WFFT) Specification
	run script HFI_EXEC_WSFT	Nominal	3:45:00	3:45:00	
	run script HFI_EXEC_WSFT	Redundant	3:45:00	7:30:00	
	run script HFI_EXEC_WFFT	Nominal	1:30:00	9:00:00	
	run script HFI_EXEC_WFFT	Redundant	1:30:00	10:30:00	



### 5.4.3.3 LFI UFT's

The procedures to be used for LFI [FM](#) UFT are the following:

AD81 - PL-LFI-PST-PR-015\_1.1 - LFI Electrical Integration REBA on SVM and Functional Tests (UFT) procedure

AD82 - PL-LFI-PST-PR-016\_1.1 - LFI Electrical Integration REBA-DAE Power Box-DAE and Functional Test Procedure (UFT)

AD-91 - PL-LFI-PST-PR-017\_1.1 - LFI Full Warm Functional Test procedure

The AD 82 gives the connection procedure, and refers to AD 91 for the functional test (about 20h of verification).

The test sequences that are run are defined in the following table:

REBA to SVM UFT:

Title	Content	Duration used	Current Time	Comments
	Verification of LFI connected to CCS	1:40:00		
	Electrical Intégration of REBA on SVM & UFT	0:50:00		ref PL-LFI-PST-PR-015
	Start DPU_SUSW	0:00:00	0:00:00	
	Start DPU ASW	0:00:00	0:00:00	
	Start SPU SUSW	0:00:00	0:00:00	
	Start SPU ASW	0:10:00	0:10:00	
	Reba Synchronization	0:30:00	0:40:00	
	Reba "Non Nominal" Synchronization	0:05:00	0:45:00	
	REBA OFF	0:05:00	0:50:00	
	Electrical Intégration of REBA on SVM & UFT (Redu	0:50:00		ref PL-LFI-PST-PR-015
	Start DPU_SUSW	0:00:00	0:00:00	
	Start DPU ASW	0:00:00	0:00:00	
	Start SPU SUSW	0:00:00	0:00:00	
	Start SPU ASW	0:10:00	0:10:00	
	Reba Synchronization	0:05:00	0:15:00	
	Reba "Non Nominal" Synchronization	0:30:00	0:45:00	
	REBA OFF	0:05:00	0:50:00	

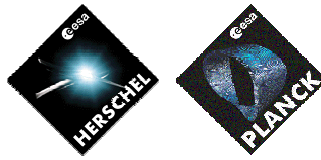
LFI complete UFT:

Refer to LFI [WFFT](#) below [in section 5.5.2](#)

[For LFI AVM, a reduced version of the LFI SFT will be used instead of the above procedures.](#)

[The applicable document is :](#)

[AD-93 - PL-LFI-PST-PR-018 1.0AVM - LFI Short Functional Test procedure \) redlined for AVM tests](#)



[The sequence is the following:](#)

#### 5.4.3.4 Planck PLM SIT

Planck PLM SIT is a verification of all instruments operating together.

It will be similar to the IST/Commissioning test where all instruments are run together.

LFI AVM UFT (reduced SFT)				1:07:00	
AVM UFT		From Off to stand By Mode		0:22:00	
AVM UFT		Start DPU_SUSW		0:02:00	0:02:00
AVM UFT		Start DPU ASW		0:05:00	0:07:00
AVM UFT		Start SPU SUSW		0:05:00	0:12:00
AVM UFT		Start SPU ASW		0:05:00	0:17:00
AVM UFT		Reba Synchronization		0:05:00	0:22:00
AVM UFT		From Stand By Mode to Dae set Up Mode		0:07:00	
AVM UFT		Switch ON RAA	Standby to DAE set up	0:07:00	0:29:00
AVM UFT		From DAE set Up to Normal Science		Nominal Function sequ	0:18:00
AVM UFT		Event Packet Enabling		0:02:00	0:31:00
AVM UFT		Setting Telemetry Rate		0:05:00	0:36:00
AVM UFT		Science Activation	Normal Science	0:07:00	0:43:00
AVM UFT		RCA Activation (All DC/DC converter switched on)		0:02:00	0:45:00
AVM UFT		Configure DAE (Warm temperature Biases)		0:02:00	0:47:00
AVM UFT		Switch off		Switch OFF LFI	0:20:00
AVM UFT		Science De-Activation		0:05:00	0:52:00
AVM UFT		RCA De-Activation		0:05:00	0:57:00
AVM UFT		RAA OFF	DAE Set Up to Standby	0:05:00	1:02:00
AVM UFT		REBA OFF	Standby to OFF	0:05:00	1:07:00

The procedure to be run for that sequence are:

HFI:

HFI-7 PR-PH740-600718-IAS \_1.0 - HFI Warm Short and Full Functional tests (WSFT & WFFT) Specification and HPCCS tcl procedures

LFI:

AD101 - PL-LFI-PST-PR-019\_1draft - ST1 and IST2 (Combined HFI/LFI functional Tests) procedure

SCS:

AD-55 - H-P-3-ASP-TS-1126\_2 - SCS health-check at ambient

Both Sorption cooler FM2 (Nominal) and FM1 (Nominal) will be used for the PLM SIT.

The sequence is the following:

one instrument is in observation mode (normal science) while the other is in functional test sequence for approx 1/2 time. There is a slot in the middle where both instruments are in observation while the Sorption health check is run.

Instruments will be run in nominal mode, while in the middle, sorption cooler health check will be performed with both chains nominal & redundant (as they are completely distinct chains).



	HFI	SCS	LFI	duration	Time	
Switch ON HFI -> Standby	Switch ON HFI	OFF	OFF	00:10	0:10:00	
Switch ON SCS / load LUT	Standby	Switch ON SCS	OFF	00:10	0:20:00	
SCS Go to > health Monitoring	Standby	goto Health monitoring	OFF	0:02:00	0:22:00	
Switch ON LFI --> Normal Science	Standby	Health Monitoring	<b>Switch ON LFI</b>	<b>0:29:00</b>		
	Standby	Health Monitoring	Switch ON REBA	0:22:00	0:44:00	
	Standby	Health Monitoring	Switch ON RAA	0:07:00	0:51:00	
	Standby	Health Monitoring	<b>Nominal Function sequence</b>	<b>0:26:00</b>		
	Standby	Health Monitoring	Event Packet Enabling	0:02:00	0:53:00	
	Standby	Health Monitoring	Setting Telemetry Rate	0:05:00	0:58:00	
	Standby	Health Monitoring	RCA Activation (Room Temperature Biases)	0:05:00	1:03:00	
	Standby	Health Monitoring	Definition of science Processing Parameters	0:02:00	1:05:00	
	Standby	Health Monitoring	Changing Processing Type to 1	0:05:00	1:10:00	
	Standby	Health Monitoring	Science Activation	0:07:00	1:17:00	
	HFI Warm short functional test	run script HFI_EXEC_WSFT	Health Monitoring	Normal Science	3:45:00	5:02:00
	HFI Warm full functional test	run script HFI_EXEC_WFFT	Health Monitoring	Normal Science	1:30:00	6:32:00
HFI go to Observation mode	Science Mode	Health Monitoring	Normal Science	0:10:00	6:42:00	
Sorption cooler FM1 Health check	Science Mode	Goto Health Check	Normal Science	0:40:00	7:22:00	
Sorption cooler FM2 Health check	Science Mode	Goto Health Check	Normal Science	0:40:00	8:02:00	
LFI Reduced Functional Test	Science Mode	Health Monitoring	<b>LFI Reduced Functional Test</b>	<b>1:22:00</b>		
	Science Mode	Health Monitoring	<b>LFI in Normal Science (Warm test Config..)</b>	<b>0:17:00</b>		
	Science Mode	Health Monitoring	Event Packet Enabling	0:02:00	8:04:00	
	Science Mode	Health Monitoring	Setting Telemetry Rate (Room test Values)	0:02:00	8:06:00	
	Science Mode	Health Monitoring	Changing Processing Type to 1	0:02:00	8:08:00	
	Science Mode	Health Monitoring	Definition of science Processing Parameters	0:02:00	8:10:00	
	Science Mode	Health Monitoring	Science Activation	0:07:00	8:17:00	
	Science Mode	Health Monitoring	Configure DAE	0:02:00	8:19:00	
	Science Mode	Health Monitoring	<b>Radiometer Test Sequence</b>	<b>0:22:00</b>		
	Science Mode	Health Monitoring	RCA Activation (Room Temperature Biases)	0:05:00	8:24:00	
	Science Mode	Health Monitoring	Configure DAE (Switch ACA on)	0:02:00	8:26:00	
	Science Mode	Health Monitoring	Update RCA Config. (Change PS status)	0:04:00	8:30:00	
	Science Mode	Health Monitoring	Update RCA Config. (Switch on 4KHz PS)	0:04:00	8:34:00	
	Science Mode	Health Monitoring	Update Channel config. (Switch off the ACA)	0:05:00	8:39:00	
	Science Mode	Health Monitoring	Update Channel config. (Switch on all ACAs in FEM)	0:02:00	8:41:00	
	Science Mode	Health Monitoring	<b>Go to nominal Science</b>	<b>0:43:00</b>		
	Science Mode	Health Monitoring	Set telemetry rate (Normal science)	0:02:00	8:43:00	
	Science Mode	Health Monitoring	Science de-activation	0:02:00	8:45:00	
	Science Mode	Health Monitoring	Changing Processing Type to 5	0:02:00	8:47:00	
	Science Mode	Health Monitoring	Science activation	0:07:00	8:54:00	
	Science Mode	Health Monitoring	Start Calibration channel switching	0:20:00	9:14:00	
	Science Mode	Health Monitoring	Save actual DAE configuration	0:10:00	9:24:00	
Switch OFF LFI	Science Mode	Health Monitoring	<b>Switch OFF LFI</b>	<b>0:20:00</b>		
	Science Mode	Health Monitoring	LFI to DAE Set Up	0:05:00	9:29:00	
	Science Mode	Health Monitoring	LFI to Standby	0:05:00	9:34:00	
	Science Mode	Health Monitoring	RAA Switch OFF	0:05:00	9:39:00	
	Science Mode	Health Monitoring	REBA Switch OFF	0:05:00	9:44:00	
Switch off HFI	HFI Switch off sequence	Health Monitoring	OFF	0:05:00	9:49:00	
Switch off SCS	OFF	Switch OFF SCS	OFF	0:05:00	9:54:00	

## 5.5 (warm) Full Functional Tests, FFT

The full functional test of the Planck instruments are dedicated to validate the complete instrument in warm condition, when integrated on the satellite.

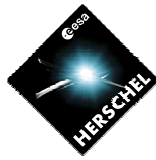
For the sorption cooler, there is no difference between FFT and FFT (health check)

### 5.5.1 HFI FFT

HFI FFT is composed of 2 complementary sequences: The WSFT (3h45) , followed by the WFFT (1h30). This is to be run on both the nominal and the redundant instrument (commanded by Nominal /redundant DPU)

The HFI SFT/FFT test procedure is

HFI-7	HFI Warm Short and Full Functional tests (WSFT & WFFT) Specification and HPPCS tcl procedures	PR-PH740-600718-IAS
-------	---	---------------------



This test verifies most of the HFI TC's and modes.

The test sequence is the following

Title	Content	Mode	Duration used	Current Time	Procedure / Comments
<b>HFI Full Functional Test (warm)</b>			<b>10:30:00</b>		HFI-7 - PR-PH740-600718-IAS - HFI Warm Short and Full Functional tests (WSFT & WFFT) Specification and HPCCS tcl procedures
	run script HFI_EXEC_WSFT	Nominal	3:45:00	3:45:00	
	run script HFI_EXEC_WSFT	Redundant	3:45:00	7:30:00	
	run script HFI_EXEC_WFFT	Nominal	1:30:00	9:00:00	
	run script HFI_EXEC_WFFT	Redundant	1:30:00	10:30:00	

### 5.5.2 LFI FFT

The test procedure for LFI FFT is the following:

AD-91 - PL-LFI-PST-PR-017\_1.1 - LFI Full Warm Functional Test procedure

This test provides an extensive test of all LFI units, and all RCA's.

The duration of the test is about 20h.

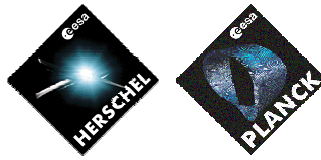
The test sequence is the following:



Title	Content	Duration used	Current Time	Comments
<b>LFI Full Warm Functional Test</b>		<b>19:14:00</b>		ref PL-LFI-PST-PR-017
<b>LFI Single Operation: Full Warm Functional test (Redundant)</b>		<b>19:14:00</b>		
	<b>Switch ON LFI</b>	<b>0:27:00</b>		
	Switch ON REBA	0:22:00	0:22:00	
	Switch ON RAA	0:05:00	0:27:00	
	<b>Switch OFF LFI</b>	<b>0:04:00</b>		
	Switch OFF RAA	0:02:00	0:29:00	
	Switch OFF REBA	0:02:00	0:31:00	
<b>LFI Single Operation: Full Warm Functional test (Nominal)</b>		<b>18:43:00</b>		
	<b>Switch ON LFI</b>	<b>0:29:00</b>		
	Switch ON REBA	0:22:00	0:53:00	
	Switch ON RAA	0:07:00	1:00:00	
	<b>LFI in Normal Science (Warm test Config..)</b>	<b>0:17:00</b>		
	Event Packet Enabling	0:02:00	1:02:00	
	Setting Telemetry Rate (Room test Values)	0:02:00	1:04:00	
	Changing Processing Type to 1	0:02:00	1:06:00	
	Definition of science Processing Parameters	0:02:00	1:08:00	
	Science Activation	0:07:00	1:15:00	
	Configure DAE	0:02:00	1:17:00	
	<b>Radiometer Test Sequence</b>	<b>11:42:00</b>		
	RCA Activation	0:20:00	1:37:00	
	Configure DAE (Switch ACA on)	1:28:00	3:05:00	
	Update RCA Config. (Change PS status)	2:56:00	6:01:00	
	Update RCA Config. (Switch on 4KHz PS)	2:56:00	8:57:00	
	Update Channel config. (Switch off the ACA)	3:40:00	12:37:00	
	Update Channel config. (Switch on all ACAs in FEM)	0:22:00	12:59:00	
	Update Channel config. (Switch off all ACAs in FEM)	1:17:00	14:16:00	
	<b>RCA on</b>	<b>0:07:00</b>		
	RCA Activation	0:05:00	14:21:00	
	Configure DAE (Switch ACA on)	0:02:00	14:23:00	
	<b>Radiometer Test Sequence Chopped-Unchopped</b>	<b>0:30:00</b>		
	Acquiring data with PS Off	0:15:00	14:38:00	
	Acquiring data with PS On	0:15:00	14:53:00	
	<b>Go to extended Science</b>	<b>0:15:00</b>		
	Set telemetry rate (Extended science)	0:02:00	14:55:00	
	Science de-activation	0:02:00	14:57:00	
	Changing Processing Type	0:00:00	14:57:00	
	Definition of science parameters	0:02:00	14:59:00	
	Science activation	0:07:00	15:06:00	
	Aquisition in stable condition	0:15:00	15:21:00	
	<b>Go to nominal Science</b>	<b>0:43:00</b>		
	Set telemetry rate (Normal science)	0:02:00	15:23:00	
	Science de-activation	0:02:00	15:25:00	
	Changing Processing Type to 5	0:02:00	15:27:00	
	Science activation	0:07:00	15:34:00	
	Start Calibration channel switching	0:20:00	15:54:00	
	Save actual DAE configuration	0:10:00	16:04:00	
	<b>Test nominal secondary functions (Fall Back)</b>	<b>0:30:00</b>		
	Fall Back	0:30:00	16:34:00	
	<b>Test non nominal secondary functions</b>	<b>2:20:00</b>		
	Diagnostic and reset	2:20:00	18:54:00	
	<b>Switch OFF LFI</b>	<b>0:20:00</b>		
	Science De-Activation	0:05:00	18:59:00	
	RCA De-Activation	0:05:00	19:04:00	
	LFI to Standby	0:05:00	19:09:00	
	Switch OFF	0:05:00	19:14:00	

### 5.5.3 SCS FFT

The sorption cooler SFT, and is similar to FFT (health check = dedicated mode in the SCE).  
AD-55 - H-P-3-ASP-TS-1126\_2 - SCS health-check at ambient



## 5.6 Short Functional test - SFT

SFT (short functional tests) is a test sequence (short, as indicated by the name), aimed to verify the health check of the instrument by a reduced set of test. (objective <2h)

This test will be performed at various stage of the satellite integration and test:

- During the integration, (SWT warm)
- Before and after any environment test: EMC, Vibration, and TV test.
- Before the IST

The SFT should be able to be run (as far as possible) by Industry AIT team only, and preferably without using the I-EGSE. (to avoid multiple transfer of instrument teams). This can be done either by training (during the first SFT), or by a proper diagnostic included in the SFT test scripts (for each test step, a visual statement OK or NOK).

[LFI indicate that they want the Instrument Operation team to be present each time the SFT is to be run.](#)

The SFT [is a](#) subsets of the FFT

### 5.6.1 HFI SFT

The HFI SFT/FFT test procedure is

HFI-7	HFI Warm Short and Full Functional tests (WSFT & WFFT) Specification and HPCCS tcl procedures	PR-PH740-600718-IAS
-------	---	---------------------

The test sequence for the HFI SFT is the following:

Title	Content	Mode	Duration used	Current Time	Procedure / Comments
<b>HFI SFT (warm &amp; cold)</b>			<b>7:30:00</b>		HFI-7 - PR-PH740-600718-IAS - HFI Warm Short and Full Functional tests (WSFT & WFFT) Specification and HPCCS tcl procedures
	run script HFI_EXEC_WSFT	Nominal	3:45:00	3:45:00	
	run script HFI_EXEC_WSFT	Redundant	3:45:00	7:30:00	

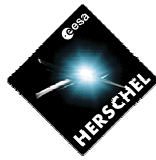
### 5.6.2 LFI SFT

The LFI SFT test procedure is:

AD-92 - PL-LFI-PST-PR-018 \_1.0 - LFI Short Functional Test procedure )

The test sequence that will be run for SFT is:





Title	Content	Duration used	Current Time	Comments
<b>LFI SFT (warm &amp; cold)</b>		<b>2:21:00</b>		
	<b>LFI SFT warm (redundant Unit)</b>	<b>2:21:00</b>		ref PL-LFI-PST-PR-018
	<b>Switch ON LFI</b>	<b>0:27:00</b>		
	Switch ON REBA	0:22:00	0:22:00	
	Switch ON RAA	0:05:00	0:27:00	
	<b>Switch OFF LFI</b>	<b>0:04:00</b>		
	Switch OFF RAA	0:02:00	0:29:00	
	Switch OFF REBA	0:02:00	0:31:00	
	<b>LFI SFT warm</b>	<b>1:50:00</b>		ref PL-LFI-PST-PR-018
	<b>Switch ON LFI</b>	<b>0:29:00</b>		
	Switch ON REBA	0:22:00	0:22:00	
	Switch ON RAA	0:07:00	0:29:00	
	<b>Nominal Function sequence</b>	<b>0:59:00</b>		
	Event Packet Enabling	0:02:00	0:31:00	
	Setting Telemetry Rate	0:05:00	0:36:00	
	RCA Activation (Room Temperature Biases)	0:05:00	0:41:00	
	Definition of science Processing Parameters	0:02:00	0:43:00	
	Changing Processing Type to 1	0:05:00	0:48:00	
	Science Activation	0:07:00	0:55:00	
	RCA Activation (All DC/DC converter switched on)	0:00:00	0:55:00	
	Configure DAE (zero Biases)	0:00:00	0:55:00	
	Configure DAE (Warm temperature Biases)	0:00:00	0:55:00	
	<b>Radiometer Test Sequence Chpped-Unchopped</b>	<b>0:35:00</b>		
	Acquiring data with PS Off	0:15:00	1:10:00	
	Acquiring data with PS On	0:20:00	1:30:00	
	<b>Switch OFF LFI</b>	<b>0:20:00</b>		
	Science De-Activation	0:05:00	1:00:00	
	RCA De-Activation	0:05:00	1:05:00	
	LFI to Standby	0:05:00	1:10:00	
	Switch OFF	0:05:00	1:15:00	

### 5.6.3 SCS SFT

The sorption cooler SFT is the health check, and is similar to FFT (dedicated mode in the SCE).  
AD-55 - H-P-3-ASP-TS-1126\_2 - SCS health-check at ambient.

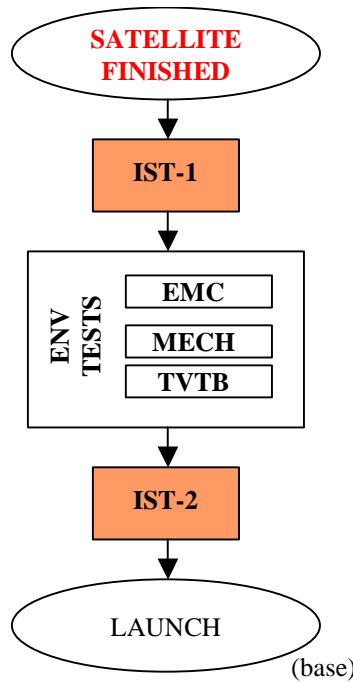
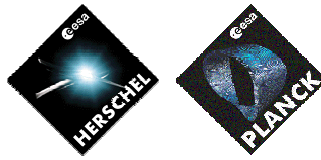
The sequence is to be run on both nominal & redundant coolers

## 5.7 Integrated system test: IST

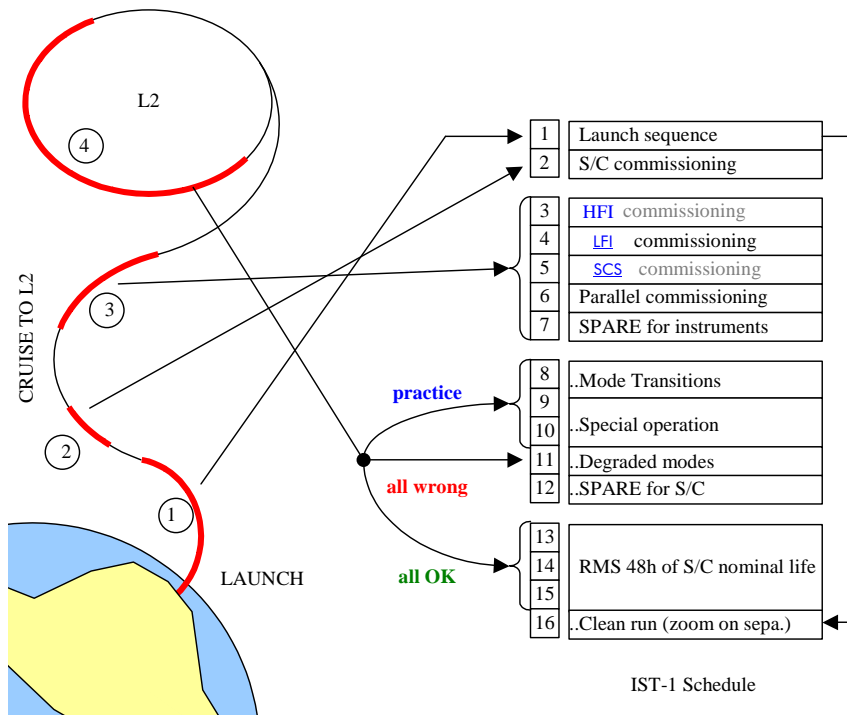
### 5.7.1 IST overall description

Integrated System test is a satellite level verification, aimed to verify in an accelerated manner the main satellite functions that will be used during launch , commissioning, and operation. The IST will be performed 2 times: before (IST1) and after (IST2) the satellite environment tests.

A short summary of the IST is given here. For more details, refer to  
AD-21 – H-P-3-ASP-TS-0881\_3 - Planck IST test specification



The complete IST sequence is summarized on the following figure:

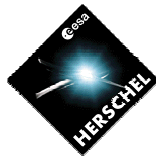


The following table (from AD21) is a summary of the IST, and give instrument usage and time scales. (A/B units are related to Nominal/Redundant).



Set	Day	PM	Units	Sequence	§	LFI	HFI	SCS	Comment
1	1	A1	A	Launch sequence	5.8.2	none	none	none	
	2	A1	AB	S/C commissioning	5.8.3	none	none	none	
		B1	AB						
3	AB1	AB	SPARE (pre reserved for S/C commissioning)		none	none	none		
2	1	A1	A	SCS - 4k - dilution	5.8.4.5 5.8.4.6	STBY	STBY	10h	
	2	A1	B	LFI commissioning	5.8.4.7	10h	STBY	10h	
	3	B1	A	HFI commissioning	5.8.4.8	STBY	10h	10h	
	4	B1	B	Full configuration commissioning	5.8.4.9	5h	5h	5h	
				SPARE	5.8.4.10				
5	AB1	AB	SPARE (pre reserved for instrument commissioning)						
3	1	A1	A	Mode transition	5.8.5	1h	1h	1h	all those sequences can be easily splitted and concatenated, then daily planning and sub-sequences order is very flexible
	2	AB1	B	S/C reconfiguration	5.8.6	1h	1h	1h	
				NOM mode robustness	5.9.3				
	3	AB1	A	Launch sequence robustness	5.9.2	none	none	none	
				SPARE					
	4	AB1	AB	SPARE (pre reserved for transition and alarm tests)					
	5	A2	A	CDMS management	5.8.3	8h	8h	8h	some daily margin shall offer some spare for mode transition sub-sequence test
6	B2	B	DTCP worst case scenario	5.8.3	8h	8h	8h		
7	AB1	AB2	SPARE (pre reserved for CDMS DTCP tests)						
4	1	B1	B	<u>SPARE</u>		none	none	none	
	2	A1	A	Reference Mission Scenario	5.8.9	48h	48h	48h	48h at L2 test 3 simulated OD 4 DTCP 1 OD of 27h
	3								
	4								
	5	A1	A	Launch clean run	5.8.10	none	none	none	needs a long SCOE reconfiguration

Instruments will be mainly involved in the commissioning phase, and in the Reference Mission scenario (described in AD 14 & AD 21).



**Commissioning phase** objective is to verify the S/C ability to support the instrument commissioning and performance verification operations.

So instruments have to prepare typical sequences that will be used during this phase, compacted to fit in the 10h allocated per instrument.

Commissioning phase sequence can be build with standard test scripts to generate the TC's (no MTL)

The objective of the **Reference Mission Scenario** is to test the satellite during its nominal long term operation, especially comprising the scientific instruments operations.

It is organised around the Reference Mission Scenario (AD14) which defines the activities to be carried out during a typical operational day.

It will be a 48h continuous operation, controlled by mission timeline (MTL=time tagged sequences).

The instruments will be in observation mode during the 48h. The sorption cooler will be in health monitoring mode (does not need MTL)

HFI will receive the End-of Slew Commands to allow the management of the amount of data.

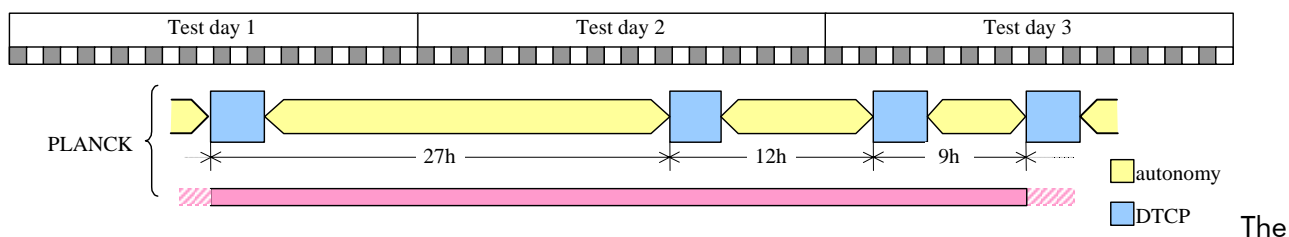
During DTCP, after reception of dedicated TM, TC's will be sent to LFI to allow optimisation of REBA

The switch ON/Switch off sequence will be outside of the MTL

During the 30 first minutes, instruments shall be configured such as to fill up the TM packets with as much data as possible, to get enough data for the first DTCP.

Then the MTL sequence is the following.

- HFI/LFI in observation mode (30mn)
- DTCP1 I (3h)
- HFI/LFI in observation mode (24h)
- DTCP2 : (3h) includes optimisation of REBA parameters by manual TC
- HFI/LFI in observation mode (9h)
- DTCP3 : (3h)
- HFI/LFI in observation mode (6h)
- DTCP4 : (1h)



detailed sequence of RMS is given in section 5.8.9.3 of AD 21.

For Commissioning, RMS, and SPT phases, instrument shall provide dedicated test procedures.

For the Mission Time line for RMS will be prepared by ESOC.

The sequence will be run with the time set to a future date (14/5/2008)

A similar sequence will be used for SVT (bur run at current date).

The test sequences to be performed on instruments during the IST are defined in the next sections.



For AVM, the similar sequences will be run.

### 5.7.2 IST / Commissioning

The Planck Instruments commissioning is organised in 3 days:

Sorption cooler Commissioning

HFI Alone Commissioning

LFI Alone Commissioning

LFI + HFI + SCS Commissioning

#### 5.7.2.1 Sorption cooler alone IST Commissioning

The SCS alone Commissioning is the health check, and is similar to FFT (dedicated mode in the SCE).

AD-55 - H-P-3-ASP-TS-1126\_2 - SCS health-check at ambient

The sequence is to be run on both Nominal & redundant sorption coolers.

#### 5.7.2.2 HFI alone IST Commissioning

Similar to HFI FFT

Title	Content	Mode	Duration used	Current Time	Procedure / Comments
<b>HFI Commissioning</b>			<b>10:30:00</b>		HFI-7 - PR-PH740-600718-IAS - HFI Warm Short and Full Functional tests (WSFT & WFFT) Specification and HPCCS tcl procedures
<b>IST Commissioning</b>			<b>10:30:00</b>		
	run script HFI_EXEC_WSFT	Nominal	3:45:00	3:45:00	
	run script HFI_EXEC_WSFT	Redundant	3:45:00	7:30:00	
	run script HFI_EXEC_WFFT	Nominal	1:30:00	9:00:00	
	run script HFI_EXEC_WFFT	Redundant	1:30:00	10:30:00	
<b>Parallele Operation with LFI</b>			<b>10:25:00</b>		
	run script HFI_EXEC_WSFT	Nominal	3:45:00	3:45:00	
	run script HFI_EXEC_WFFT	Nominal	1:30:00	5:15:00	
	HFI in observation mode	Nominal	0:40:00	5:55:00	during Sorption cooler Health check
	HFI in observation mode	Nominal	4:30:00	10:25:00	During LFI Parallele commissioning test

#### 5.7.2.3 LFI alone IST Commissioning

The applicable procedure is

AD101 - PL-LFI-PST-PR-019\_1draft - ST1 and IST2 (Combined HFI/LFI functional Tests) procedure

The test sequence that will be run during that phase is a reduced version of the LFI FFT to fit to 10h.



Title	Content	Duration used	Current Time	Comments
<b>LFI Commissioning</b>		<b>10:44:00</b>		ref PL-LFI-PST-PR-019
<b>LFI Single Operation: Commissioning Functional test (V)</b>		<b>8:23:00</b>		ref PL-LFI-PST-PR-019
<b>LFI Alone Test</b>		<b>0:59:00</b>		ref PL-LFI-PST-PR-019
	Switch On REBA (Start DPU)	0:07:00	0:07:00	
	Start Event Packets trans.	0:02:00	0:09:00	
	Commissioning SPU memories	0:30:00	0:39:00	
	Switch on REBA (Start SPU)	0:10:00	0:49:00	
	Reba Synchronization	0:05:00	0:54:00	
	RAA connection to REBA	0:05:00	0:59:00	
	RAA Synchronization	0:02:00	1:01:00	
	Commissioning of DAE SPU Link memory	0:30:00	1:31:00	
	Set Telemetry Rate	0:02:00	1:33:00	
	Definition of science parameters	0:02:00	1:35:00	
	Changing processing to Type 1	0:05:00	1:40:00	
	Science Activation	0:07:00	1:47:00	
	Configure DAE	0:02:00	1:49:00	
<b>Radiometer Test Sequence</b>		<b>5:22:00</b>		ref PL-LFI-PST-PR-019
	RCA Activation	0:10:00	1:59:00	During simulation of commissioning the ACAs will be switched on one by one, but the test will be not performed for all the ACAs. Se the reference doc for details
	Configure DAE (Switch ACA on)	0:40:00	2:39:00	
	Update RCA Config. (Change PS status)	1:20:00	3:59:00	
	Update RCA Config. (Switch on 4KHz PS)	1:20:00	5:19:00	
	Update Channel config. (Switch off the ACA)	1:40:00	6:59:00	
	Update Channel config. (Switch on all ACAs in FEM)	0:02:00	7:01:00	
	Update Channel config. (Switch off all ACAs in FEM)	0:10:00	7:11:00	
<b>RCA on</b>		<b>0:07:00</b>		ref PL-LFI-PST-PR-019
	RCA Activation	0:05:00	7:16:00	
	Configure DAE (Switch ACA on)	0:02:00	7:18:00	
<b>Radiometer Test Sequence Chopped-Unchopped</b>		<b>0:30:00</b>		ref PL-LFI-PST-PR-019
	Acquiring data with PS Off	0:15:00	7:33:00	The LFI is tested in fully on condition (All the radiometers are on and biased->)
	Acquiring data with PS On	0:15:00	7:48:00	
<b>Test nominal secondary functions (Fall Back)</b>		<b>0:30:00</b>		ref PL-LFI-PST-PR-019
	Fall Back	0:30:00	8:18:00	
<b>Switch OFF LFI</b>		<b>0:05:00</b>		ref PL-LFI-PST-PR-019
	Science De-Activation	0:00:00	8:18:00	
	RCA De-Activation	0:00:00	8:18:00	
	LFI to Standby	0:00:00	8:18:00	
	Switch OFF	0:05:00	8:23:00	

For AVM, the LFI sequence is similar

#### 5.7.2.4 HFI + LFI + SCS IST Commissioning

This test is similar to Planck PLM SIT

The procedure to be run for that sequence are:

HFI:

HFI-7 PR-PH740-600718-IAS\_1.0

HFI Warm Short and Full Functional tests (WSFT & WFFT)

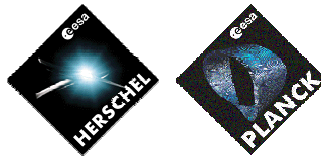
Specification and HPCS tcl procedures

LFI:

AD101 - PL-LFI-PST-PR-019\_1draft - ST1 and IST2 (Combined HFI/LFI functional Tests) procedure

SCS:

AD-55 - H-P-3-ASP-TS-1126\_2 - SCS health-check at ambient



The sequence is the following:

one instrument is in observation mode (normal science) while the other is in functional test sequence for approx 1/2 time. There is a slot in the middle where both instruments are in observation while the Sorption health check is run.

Sequence to be used for Planck PLM SIT, and for IST/Commissioning parallel mode HFI/LFI

	HFI	SCS	LFI	duration	Time
Sxitch ON HFI - > Standby	Switch ON HFI	OFF	OFF	00:10	0:10:00
Sxitch ON SCS / load LUT	Standby	Switch ON SCS	OFF	00:10	0:20:00
SCS Go to > health Monitoring	Standby	goto Health monitoring	OFF	0:02:00	0:22:00
Switch ON LFI --> Normal Science	Standby	Health Monitoring	<b>Switch ON LFI</b>	<b>0:29:00</b>	
	Standby	Health Monitoring	Switch ON REBA	0:22:00	0:44:00
	Standby	Health Monitoring	Switch ON RAA	0:07:00	0:51:00
	Standby	Health Monitoring	<b>Nominal Function sequence</b>	<b>0:26:00</b>	
	Standby	Health Monitoring	Event Packet Enabling	0:02:00	0:53:00
	Standby	Health Monitoring	Setting Telemetry Rate	0:05:00	0:58:00
	Standby	Health Monitoring	RCA Activation (Room Temperature Biases)	0:05:00	1:03:00
	Standby	Health Monitoring	Definition of science Processing Parameters	0:02:00	1:05:00
	Standby	Health Monitoring	Changing Processing Type to 1	0:05:00	1:10:00
	Standby	Health Monitoring	Science Activation	0:07:00	1:17:00
HFI Warm short functional test	run script HFI_EXEC_WSFT	Health Monitoring	Normal Science	3:45:00	5:02:00
HFI Warm full functional test	run script HFI_EXEC_WFFT	Health Monitoring	Normal Science	1:30:00	6:32:00
HFI go to Observation mode	Science Mode	Health Monitoring	Normal Science	0:10:00	6:42:00
Sorption cooler Health check	Science Mode	Goto Health Check	Normal Science	0:40:00	7:22:00
LFI Reduced Functional Test	Science Mode	Health Monitoring	<b>LFI Reduced Functional Test</b>	<b>1:22:00</b>	
	Science Mode	Health Monitoring	<b>LFI in Normal Science (Warm test Config..)</b>	<b>0:17:00</b>	
	Science Mode	Health Monitoring	Event Packet Enabling	0:02:00	7:24:00
	Science Mode	Health Monitoring	Setting Telemetry Rate (Room test Values)	0:02:00	7:26:00
	Science Mode	Health Monitoring	Changing Processing Type to 1	0:02:00	7:28:00
	Science Mode	Health Monitoring	Definition of science Processing Parameters	0:02:00	7:30:00
	Science Mode	Health Monitoring	Science Activation	0:07:00	7:37:00
	Science Mode	Health Monitoring	Configure DAE	0:02:00	7:39:00
	Science Mode	Health Monitoring	<b>Radiometer Test Sequence</b>	<b>0:22:00</b>	
	Science Mode	Health Monitoring	RCA Activation (Room Temperature Biases)	0:05:00	7:44:00
	Science Mode	Health Monitoring	Configure DAE (Switch ACA on)	0:02:00	7:46:00
	Science Mode	Health Monitoring	Update RCA Config. (Change PS status)	0:04:00	7:50:00
	Science Mode	Health Monitoring	Update RCA Config. (Switch on 4KHz PS)	0:04:00	7:54:00
	Science Mode	Health Monitoring	Update Channel config. (Switch off the ACA)	0:05:00	7:59:00
	Science Mode	Health Monitoring	Update Channel config. (Switch on all ACAs in FEM)	0:02:00	8:01:00
	Science Mode	Health Monitoring	<b>Go to nominal Science</b>	<b>0:43:00</b>	
	Science Mode	Health Monitoring	Set telemetry rate (Normal science)	0:02:00	8:03:00
	Science Mode	Health Monitoring	Science de-activation	0:02:00	8:05:00
	Science Mode	Health Monitoring	Changing Processing Type to 5	0:02:00	8:07:00
	Science Mode	Health Monitoring	Science activation	0:07:00	8:14:00
Science Mode	Health Monitoring	Start Calibration channel switching	0:20:00	8:34:00	
Science Mode	Health Monitoring	Save actual DAE configuration	0:10:00	8:44:00	
Switch OFF LFI	Science Mode	Health Monitoring	<b>Switch OFF LFI</b>	<b>0:20:00</b>	
	Science Mode	Health Monitoring	LFI to DAE Set Up	0:05:00	8:49:00
	Science Mode	Health Monitoring	LFI to Standby	0:05:00	8:54:00
	Science Mode	Health Monitoring	RAA Switch OFF	0:05:00	8:59:00
Science Mode	Health Monitoring	REBA Switch OFF	0:05:00	9:04:00	
Switch off HFI	HFI Switch off sequence	Health Monitoring	OFF	0:05:00	9:09:00
Switch off SCS	OFF	Switch OFF SCS	OFF	0:05:00	9:14:00

### 5.7.3 IST RMS

For the Reference Mission scenario, the 3 instruments are in observation mode, and the sorption cooler in health monitoring mode.

Instruments will be switched on & off manually, from the CCS

Optimisation of LFI REBA TM will be performed manually during DTCP, after reception of dedicated science packets

End of slew commands will be sent directly by MTL to HFI for data amount optimisation

#### 5.7.3.1 HFI IST RMS

TBD (no input from HFI)



MTL to be provided by ESOC  
 HFI in observation mode all the time  
 End of slew command sent to HFI by the MTL to manage the amount of data

### 5.7.3.2 LFI IST RMS

TBD  
 MTL to be provided by ESOC  
 Optimisation of REBA to be performed during DTCP

## 5.8 TV test

[Refer to AD-22 – H-P-3-ASP-TS-0893\\_1 - Planck TV test specification .](#)

TV test will be performed at CSL, with representative PPLM and instruments temperatures.  
 After room temperature verifications (SFT's) , the test sequence will simulate the post transient operation :  
 FPU & reflectors decontamination (reduced to 12h) in parallel with passive and active cooling of the instruments (HFI dilution stage) accelerated by the pre-cooling loop).  
 When instruments are at operating temperature, functional tests will be performed.  
 Some cooler failure tests will be performed.  
 In parallel, SVM Thermal balance tests will be performed (warm & cold cases + Survival mode)  
 In parallel SVM Thermal vacuum tests will be performed (SVM operation at extreme cold and warm temperature).  
 A real SVM switch to Safe mode will be experienced before warming up the satellite to ambient.  
 SFT will be performed at ambient after the test.

[Summary TV test table:](#)

[This sequence still needs to be agreed / Negotiated with ESA, as its 48 days exceed the 40 days "contractual" duration.](#)

Phase	Step	duration estimation (Days)
<b>PrTV-1</b>	<b>Functionnal tests pre-tv activities</b>	<b>3</b>
<b>Phase 1</b>	<b>Final check before chamber closure</b>	<b>3</b>
<b>Phase 2</b>	<b>PUMP DOWN</b>	<b>3</b>
<b>Phase 3</b>	<b>Launch Simulation + Leak Checks + 4K Cleaning</b>	<b>3</b>
<b>Phase 4</b>	<b>SHROUDS &amp; PPLM Passive cooling</b>	<b>5</b>
<b>Phase 5</b>	<b>CRYO CHAIN active Cooling (nominal setting) &amp; LFI cold functional test</b>	<b>17</b>
<b>Phase 6</b>	<b>HFI FUNCTIONAL TESTING</b>	<b>4</b>
<b>Phase 7</b>	<b>HFI &amp; LFI COMBINED FUNCTIONAL TESTING</b>	<b>3</b>
<b>Phase 8</b>	<b>SVM TB Warm &amp; S/C TV Warm</b>	<b>2</b>
<b>Phase 9</b>	<b>4K Heatlift &amp; Coolers failure tests (4K &amp; Sorption cooler)</b>	<b>2</b>
<b>Phase 10</b>	<b>SVM transition to Safe Mode</b>	<b>1</b>
<b>Phase 11</b>	<b>FPU &amp; reflectors warm up</b>	<b>1</b>
<b>Phase 12</b>	<b>PPLM &amp; Facility &amp; SVM Warm up</b>	<b>6</b>
<b>Phase 13</b>	<b>Pressure Recovery &amp; Opening</b>	<b>1</b>
<b>PsTV-1</b>	<b>Functional test after TV test</b>	<b>2.0</b>





The test phasing and summary table is given here:

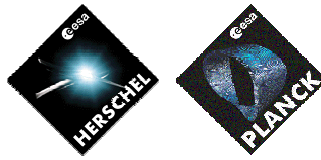
<u>Phase</u>	<u>Step</u>	<u>duration estimation (Days)</u>
<b><u>PrTV-1</u></b>	<b><u>Functionnal tests pre-tv activities</u></b>	<b><u>3</u></b>
<u>PrTV-1-1</u>	<u>SVM Short Functional check</u>	-
<u>PrTV-1-2</u>	<u>HFI WSFT</u>	-
<u>PrTV-1-3</u>	<u>LFI (Reduced) Warm Functional test</u>	-
<u>PrTV-1-4</u>	<u>SCS Heat Check</u>	-
<b><u>Phase 1</u></b>	<b><u>Final check before chamber closure</u></b>	<b><u>3</u></b>
<u>Ph-1-01</u>	<u>Facility Check</u>	-
<u>Ph-1-02</u>	<u>ISSS-PGSE pipes connection &amp; verification</u>	-
<u>Ph-1-03</u>	<u>SVM Short Functional check</u>	-
<u>Ph-1-04</u>	<u>Final check before pumping &amp; Close door</u>	-
<b><u>Phase 2</u></b>	<b><u>PUMP DOWN</u></b>	<b><u>3</u></b>
<u>Ph-2-01</u>	<u>Pumping phase up-to 5 10<sup>-5</sup>mb</u>	-
<u>Ph-2-02</u>	<u>Facility Leak under vacuum</u>	-
<u>Ph-2-03</u>	<u>Sorption Cooler Leak check</u>	-
<u>Ph-2-04</u>	<u>ISSS-PGSE pipes leak check (+ PGSE Lines)</u>	-
<u>Ph-2-05</u>	<u>Global leak check (background)</u>	-
<u>Ph-2-99</u>	<u>Microvibration check during pump-down</u>	-
<b><u>Phase 3</u></b>	<b><u>Launch Simulation + Leak Checks + 4K Cleaning</u></b>	<b><u>3</u></b>
<u>Ph-3-01</u>	<u>Start SVM Launch Mode + Solar Array heating + Test adapter Thermal control - Launch mode test in real conditions</u>	-
<u>Ph-3-02</u>	<u>4K cooler cleaning</u>	-
<u>Ph-3-02-a</u>	<u>SVM Shrouds adjustment</u>	-
<u>Ph-3-02-b</u>	<u>Setting SVM for 4K operation (Start HFI DPU &amp; 4KCDE &amp; 4KCRU 4KCCU)</u>	-
<u>Ph-3-02-c</u>	<u>4K Cooler Cleaning for 48h (2mm Stroke, getter activated)</u>	-
<u>Ph-3-03</u>	<u>HFI - 4K Cooler leak Check (increase 4K stroke to get 8 bars in HP)</u>	in //
<u>Ph-3-04</u>	<u>HFI - Dilution cooler isotopes leak check</u>	-
<u>Ph-3-04-a</u>	<u>Setting SVM for DCCU operation</u>	-
<u>Ph-3-04-b</u>	<u>HFI - Dilution cooler isotopes leak check (dilution to be evacuated after)</u>	in //
<u>Ph-3-99</u>	<u>Microvibration check</u>	-
<b><u>Phase 4</u></b>	<b><u>SHROUDS &amp; PPLM Passive cooling</u></b>	<b><u>5</u></b>
<u>Ph-4-01</u>	<u>SVM LN2 &amp; LN2 Guard &amp; He shrouds filling (+ leak test &amp; mass spectro monitoring)</u>	-
<u>Ph-4-01-a</u>	<u>SVM LN2 filling</u>	-
<u>Ph-4-01-b</u>	<u>LN2 Guard &amp; He shrouds filling (+ leak test &amp; mass spectro monitoring)</u>	-
<u>Ph-4-02</u>	<u>Optical shield Filling + Leak check</u>	-
<u>Ph-4-03</u>	<u>Charcoal Panel Filling + Leak check (then warm charcoal to 20K to avoid saturation)</u>	-
<u>Ph-4-04</u>	<u>FPU and Reflectors decontamination heating (in parallel)</u>	in //
<u>Ph-4-05</u>	<u>SVM TB Cold (Survival Mode)</u>	in //



<u>Phase</u>	<u>Step</u>	<u>duration estimation (Days)</u>
<a href="#">Ph-4-06</a>	<a href="#">SVM TV Cold</a>	<a href="#">in //</a>
<a href="#">Ph-4-06-a</a>	<a href="#">SVM TV Cold: SVM Setting</a>	<a href="#">in //</a>
<a href="#">Ph-4-06-b</a>	<a href="#">SVM TV Cold: TV Avionics (IST spec §5.8.6 except 5.8.6.7 including SVM RF Activation)</a>	<a href="#">in //</a>
<a href="#">Ph-4-06-c</a>	<a href="#">SVM TV Cold: SVM Setting</a>	<a href="#">in //</a>
<a href="#">Ph-4-07</a>	<a href="#">PPLM Passive cooling</a>	<a href="#">in //</a>
<a href="#">Ph-4-99</a>	<a href="#">Microvibration check</a>	-
<b>Phase 5</b>	<b><i>CRYO CHAIN active Cooling (nominal setting) &amp; LFI cold functional test</i></b>	<b>17</b>
<a href="#">Ph-5-01</a>	<a href="#">LVHX2 Pasive cooling up to @100K)</a>	-
<a href="#">Ph-5-02</a>	<a href="#">Switch ON Sorption Cooler (When PPLM/LVHX2 @100K) - LUT Cold case (Incl TSA Tuning)</a>	-
<a href="#">Ph-5-03</a>	<a href="#">Switch-on HFI</a>	-
<a href="#">Ph-5-03-a</a>	<a href="#">Switch-on HFI Pre-cooling loop circulation (control from PGSE, stop at 10K)</a>	-
<a href="#">Ph-5-03-b</a>	<a href="#">Switch ON HFI Detection Chain</a>	-
<a href="#">Ph-5-04</a>	<a href="#">Switch ON LFI</a>	-
<a href="#">Ph-5-04-a</a>	<a href="#">Charcoal panel cooling when LFI is at 30K</a>	-
<a href="#">Ph-5-04-b</a>	<a href="#">Switch ON LFI when RAA @20K</a>	-
<a href="#">Ph-5-05</a>	<a href="#">Functional Tests LFI I (=failure mode test without HFI, 4K Load not at 4K)</a>	-
<a href="#">Ph-5-05-a</a>	<a href="#">Full Functional test in Cryogenics Conditions: RCA Functionality, Temperature Distribution, Receiver Noise performance in failure scenario (knee frequency)</a>	-
<a href="#">Ph-5-05-b</a>	<a href="#">Phase shifter biases verification (P/S Tuning)</a>	-
<a href="#">Ph-5-05-c</a>	<a href="#">LNA Bias verification VG1 &amp; VG2 tuning (step 1)</a>	-
<a href="#">Ph-5-06</a>	<a href="#">Increase 4K cooler at Nominal Stroke (ramp up from 2 to 4mm wrt cold end temperature)</a>	-
<a href="#">Ph-5-07</a>	<a href="#">LFI verification during 4K load Cooling (20K to 4K)</a>	-
<a href="#">Ph-5-08</a>	<a href="#">0.1 K Cooling</a>	-
<a href="#">Ph-5-08-a</a>	<a href="#">Switch-off HS2</a>	-
<a href="#">Ph-5-08-b</a>	<a href="#">Start 0.1 K cooler when 4K @ 5K, up to dilution @ 0.1K (boost or not boost Dilution flow ?)</a>	-
<a href="#">Ph-5-08-c</a>	<a href="#">Switch-off HS1</a>	-
<a href="#">Ph-5-09</a>	<a href="#">LFI Functional test II (with 4K Load @ 4K) in parallele to 0.1K Cooling</a>	-
<a href="#">Ph-5-09-a</a>	<a href="#">LNA Bias verification VG1 &amp; VG2 tuning (step 2)</a>	-
<a href="#">Ph-5-09-b</a>	<a href="#">REBA Science Parameter tuning/verification, noise perfo verification, radiometer stability check</a>	-
<a href="#">Ph-5-09-c</a>	<a href="#">Noise &amp; stability check + Long term measurements + EM interference between receivers</a>	-
<a href="#">Ph-5-10</a>	<a href="#">TB S/C Cold</a>	<a href="#">in //</a>
<a href="#">Ph-5-10-a</a>	<a href="#">TB S/C Cold: SVM Setting</a>	-
<a href="#">Ph-5-10-b</a>	<a href="#">TB S/C Cold: DTCP Simulation</a>	-
<a href="#">Ph-5-10-c</a>	<a href="#">TB S/C Cold: OP Simulation</a>	-
<a href="#">Ph-5-11</a>	<a href="#">HFI FPU Thermal control tests</a>	-
<a href="#">Ph-5-11-a</a>	<a href="#">HFI FPU Thermal control</a>	-
<a href="#">Ph-5-11-b</a>	<a href="#">4K stage thermal control</a>	-
<a href="#">Ph-5-11-c</a>	<a href="#">1.6K stage thermal control</a>	-
<a href="#">Ph-5-11-d</a>	<a href="#">Electrical cross talk</a>	-
<a href="#">Ph-5-99</a>	<a href="#">Microvibration check</a>	-
<b>Phase 6</b>	<b><i>HFI FUNCTIONAL TESTING</i></b>	<b>4</b>
<a href="#">Ph-6-01</a>	<a href="#">Charracterisation of HFI performances at Warm Operating Temperatures</a>	-
<a href="#">Ph-6-01-a</a>	<a href="#">Regulation of 100mK Cold End with PID1</a>	-
<a href="#">Ph-6-01-b</a>	<a href="#">Regulation of 100mK Bolometer Plate with PID2</a>	-
<a href="#">Ph-6-01-c</a>	<a href="#">Performances Characterisation with temperature regulation ON</a>	-
<a href="#">Ph-6-01-d</a>	<a href="#">Performances Characterisation without temperature regulation</a>	-
<a href="#">Ph-6-02</a>	<a href="#">TV Instruments Cold</a>	<a href="#">in //</a>



<u>Phase</u>	<u>Step</u>	<u>duration estimation (Days)</u>
<a href="#">Ph-6-02-a</a>	<a href="#">TV Instruments Cold: SVM RF Activated</a>	-
<a href="#">Ph-6-02-b</a>	<a href="#">TV Instruments Cold: DTCP simulation</a>	-
<a href="#">Ph-6-02-c</a>	<a href="#">TV Instruments Cold: SVM Setting</a>	-
<a href="#">Ph-6-03</a>	<a href="#">TSA Failure test</a>	-
<a href="#">Ph-6-99</a>	<a href="#">Microvibration check</a>	-
<b>Phase 7</b>	<b><i>HFI &amp; LFI COMBINED FUNCTIONAL TESTING</i></b>	<b>3</b>
<a href="#">Ph-7-01</a>	<a href="#">Switch off LFI step by stem (Phase switches, analog acquisition (DAE), digital acquisition (REBA), DAE power box)</a>	-
<a href="#">Ph-7-02</a>	<a href="#">HFI Compatibility test</a>	-
<a href="#">Ph-7-03</a>	<a href="#">Switch on LFI step by stem (Phase switches, analog acquisition (DAE), digital acquisition (REBA), DAE power box)</a>	-
<a href="#">Ph-7-04</a>	<a href="#">HFI EMI-EMC test: Conducted Emission &amp; Susceptibility (check LFI Also)</a>	-
<a href="#">Ph-7-05</a>	<a href="#">LFI Interference &amp; susceptibility tests (stop HFI acquisition)</a>	-
<a href="#">Ph-7-06</a>	<a href="#">HFI &amp; LFI Nominal operation together</a>	-
<a href="#">Ph-7-99</a>	<a href="#">Microvibration check</a>	-
<b>Phase 8</b>	<b><i>SVM TB Warm &amp; S/C TV Warm</i></b>	<b>2</b>
<a href="#">Ph-8-01</a>	<a href="#">SVM TB Warm</a>	-
<a href="#">Ph-8-01-a</a>	<a href="#">SVM TB Warm: SVM Seeting (Nominal case, and SCS to hot case (LUT))</a>	-
<a href="#">Ph-8-01-b</a>	<a href="#">SVM TB Warm: DTCP Simulation</a>	-
<a href="#">Ph-8-01-c</a>	<a href="#">SVM TB Warm: Switch-on the 2 STR</a>	-
<a href="#">Ph-8-02</a>	<a href="#">Satellite TV Warm</a>	-
<a href="#">Ph-8-02-a</a>	<a href="#">Satellite TV Warm: Adjust LN2 Shrouds and SVM Heaters heater for warm case</a>	-
<a href="#">Ph-8-02-b</a>	<a href="#">Satellite TV Warm: DTCP simulation</a>	-
<a href="#">Ph-8-02-c</a>	<a href="#">Satellite TV Warm: SVM Avionics (IST spec §5.8.6 except 5.8.6.7)</a>	-
<a href="#">Ph-8-02-d</a>	<a href="#">Satellite TV Warm: SVM Setting</a>	-
<a href="#">Ph-8-99</a>	<a href="#">Microvibration check</a>	-
<b>Phase 9</b>	<b><i>4K Heatlift &amp; Coolers failure tests (4K &amp; Sorption cooler)</i></b>	<b>2</b>
<a href="#">Ph-9-01</a>	<a href="#">HFI coolers recovery systems test and 4K cooler margin</a>	-
<a href="#">Ph-9-01-a</a>	<a href="#">4K Cooler heat lift margin</a>	-
<a href="#">Ph-9-01-b</a>	<a href="#">Dilution cooler defrost system test</a>	-
<a href="#">Ph-9-01-c</a>	<a href="#">4K cooler defrost system test</a>	-
<a href="#">Ph-9-02</a>	<a href="#">HFI coolers failure test phase</a>	-
<a href="#">Ph-9-02-a</a>	<a href="#">HFI 4K Cooler failure test</a>	-
<a href="#">Ph-9-02-b</a>	<a href="#">SCC failure test</a>	-
<a href="#">Ph-9-03</a>	<a href="#">Microvibration check during Instrument Functional test</a>	-
<b>Phase 10</b>	<b><i>SVM transition to Safe Mode</i></b>	<b>1</b>
<a href="#">Ph-10-01</a>	<a href="#">SVM transition to Safe Mode (change battery charge threshold)</a>	-
<a href="#">Ph-10-02</a>	<a href="#">Satellite reconfiguration, coolers reconfiguration (spec IST 5.8.5.16)</a>	-
<b>Phase 11</b>	<b><i>FPU &amp; reflectors warm up</i></b>	<b>1</b>
<a href="#">Ph-11-01</a>	<a href="#">Stop coolers (Purge the PACE lines)</a>	-
<a href="#">Ph-11-02</a>	<a href="#">FPU &amp; Reflectors Warm-up (Decontamination process)</a>	-
<b>Phase 12</b>	<b><i>PPLM &amp; Facility &amp; SVM Warm up</i></b>	<b>6</b>
<a href="#">Ph-12-01</a>	<a href="#">PPLM Warm up &amp; Facility Warm up (PPLM PART + tuning on SVM part)</a>	-
<a href="#">Ph-12-02</a>	<a href="#">HFI (DPU-4KCDE) 4K Cooler Cleaning (2mm Stroke, getter activated) 2days</a>	-
<a href="#">Ph-12-03</a>	<a href="#">S/C Switch-Off</a>	-
<a href="#">Ph-12-04</a>	<a href="#">End of Facility Warm up (parts of SVM shrouds)</a>	-



<u>Phase</u>	<u>Step</u>	<u>duration estimation (Days)</u>
<b>Phase 13</b>	<b><u>Pressure Recovery &amp; Opening</u></b>	<b><u>1</u></b>
<b>PsTV-1</b>	<b><u>Functional test after TV test</u></b>	<b><u>2.0</u></b>
PsTV-1	SVM Short Functional check	-
PsTV-2	HFI WSFT	-
PsTV-3	LFI (Reduced) Warm Functional test	-
PsTV-4	SCS Heat Check	-

### 5.8.1 SCS TV test

The Nominal (FM2) sorption cooler will be used during Planck FM TV test to provide the 20K on HFI and LFI, in a similar way to the flight (ie cooler started when the PPLM/LVHX2 temperature is  $\leq 100K$ )

Redundant Sorption cooler TMU (FM1) (with SCE QM) has been tested during Planck PFM1 test early 2006.

The sorption cooler FM1 shall not be switch to run mode during the TV test, as there are risks to degrade the sorbent beds which are not horizontal).

During the first part of the test (Phases [4 to 7](#)), the Sorption cooler will be run in cold case (dedicated look-up Table LUT)

During the last part of the test (phases [8 to 10](#)) the sorption cooler will be run in hot case (dedicated look-up Table LUT)

[TSA failure test is now included in phase 6 \(during HFI functional test, to check impact on instruments performances\), while cooler failure test remains at the end \(due to the expected perturbation of the system\)](#)

During Phase [10](#), the SCS shall be compatible with a SVM transition to safe mode (by adjustment of the battery charge threshold), where the cooler will be stopped without notice. The sorption cooler shall be compatible with this, and should be able to be reconfigured after to transit safely to the gentle stop in phase 6.

The procedures to be used for SCS during TV test are:

AD-55 - H-P-3-ASP-TS-1126\_2 - SCS health-check at ambient

AD-56: TBD (see PFM1) SCS Operation and test procedure for TV test [\(TBW\)](#)

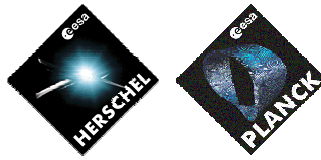
[The regeneration test on SCS nominal is not included \(regeneration functional test on SCS redundant has been performed during PFM1 test.](#)

### 5.8.2 HFI TV Test

TV test will start with warm functional test before cooling the shrouds (Phase [PTV-1](#)).

HFI/4K asks to have a 2 days session of 4K cooler gas cleaning [\(to be re-discussed, as the cause of the pressure drop in the 4K is not the contamination\)](#), before the 4K pipes are cold, by activating the getter, and run the compressor at a stroke of 2mm. This can be done only when the S/C is under vacuum (getter warms to 400K), with the SVM ON, (minimal configuration). This will be performed during the phase [3](#), just after a simulation of the SVM launch configuration.

This 4K cleaning will be performed again (1 day only) at the end of the TV test, to make sure to trap in the getter all the gas that would have condensed [in the cold areas.](#)



**Remark:** As this warm getter 4K cleaning is not possible before launch (needs vacuum) or after launch (needs spacecraft ON before 4K pipes are cold), a room temperature gas cleaning (10 days [TBC](#)) will have to be performed prior to launch.

During the PPLM passive cooling (Phase [4](#)), the FPU heaters will be activated (duration 12h). A priori, the 4K Cooler will be stopped during that phase to be more representative of flight conditions.

Phase [5](#) is dedicated to the sequential switch on of the active coolers, whose starting criteria depend of the temperature. SVM is set to the cold case)

HFI pre-cooling loop will be started (from PGSE) when the 20K cooler is started, to accelerate the cooling of the internal part of HFI (0.1K Stage).

The 4K cooler will be started when the 20K cooler reaches 20K.

[HFI shall clarify if continuous circulation is necessary in the dilution from the beginning of the test \(not foreseen\)](#)

The dilution cooler will be started when the 100mK plate is at 19K, and will be run all over the test

In parallel with the 4K cooler cooling, LFI will perform functional tests (difference 4K load at 20K & 4K). At the end of this phase, the SVM will go through Thermal balance test, and thermal vacuum tests.

Phase [6](#) is dedicated to HFI (alone) tests.

LFI will be switched-off step by step.

The test procedure applicable for TV test are:  
(all of them still to be written)

HFI-7	PR-PH740-600718-IAS_1.0	HFI Warm Short and Full Functional tests (WSFT & WFFT) Specification and HPCCS tcl procedures
HFI-10	(SP-PH740-500596-IAS)_1.3	HFI FM CSL CRYOTEST PHASES
HFI-11	TBD_	HFI CSL CRYOTEST HPCCS tcl procedures
HFI-12	(PR-PH740-500609-IAS)_1.0	HFI FM CSL Cryo-Test DC Failure Modes Macro-sequence
HFI-13	(PR-PH740-500610-IAS)_1.0	HFI FM CSL CRYOTEST 4K COOLER FAILURE MODES MACROSEQUENCES
HFI-14	(PR-PH740-500611-IAS)_1.1	HFI FM CSL Cryo-Test RU Failure Modes Macro-sequence
HFI-15	(PR-PH740-500612-IAS)_1.1	HFI FM CSL Cryo-Test DPU Failure Modes Macro-sequence
HFI-16	(PR-PH740-500585-IAS)_	HFI Ambient return procedure
HFI-18	(PR-PH740-500617-IAS)_1.0	HFI FM & AVM Monitoring parameters

[HFI proposed TV test sequence \(CSL\\_FM\\_4.xls\) is not included here and still under discussion](#)

### 5.8.3 LFI TV Test

The LFI test procedure for TV test is:

AD-121 - PL-LFI-PST-PR-021 - TV Tests (LFI Functional Test Under Vacuum) procedure (TBW)

The test sequence that will be run during TV test is:



LFI TB/TV Testing			202:15:00		ref PL-LFI-PST-PR-020
LFI SFT warm (before cooling)			202:15:00		to be performed before closing the chamber
Switch ON LFI			0:20:00		
	Switch ON REBA	OFF to standby	0:15:00	0:15:00	ref PL-LFI-PST-PR-015_1_0
	Switch ON RAA	Standby to DAE set up	0:05:00	0:20:00	LFI UM "RAA Switch On" Table 13-42
Nominal Function sequence			0:30:00		
	Event Packet Enabling		0:05:00	0:25:00	TBD
	Setting Telemetry Rate		0:05:00	0:30:00	LFI UM "Setting the telemetry Rate" Table 13-36
	RCA Activation (Room Temperature Biases)		0:05:00	0:35:00	LFI UM "RCA Activation" Table 13-21
	Definition of science Processing Parameters		0:15:00	0:50:00	LFI UM "Definition of the science Processing Parameter" Table 13-29
	Science Activation	Normal Science	0:05:00	0:55:00	LFI UM "Science Activation" Table 13-25
	Check Telemetry		0:00:00	0:55:00	ref PL-LFI-PST-PR-017_1_0
	TQL Monitor		0:00:00	0:55:00	
Switch OFF LFI			0:20:00		
	Science De-Activation		0:05:00	1:00:00	LFI UM "Science De-activation" Table 13-27
	RCA De-Activation		0:05:00	1:05:00	LFI UM "RCA Activation" Table 13-21
	LFI to Standby	DAE Set Up to Standby	0:05:00	1:10:00	LFI UM "RAA Switch Off" Table 13-42
	Switch OFF	Standby to OFF	0:05:00	1:15:00	ref PL-LFI-PST-PR-015_1_0
LFI test during Cool down			24:10:00		there will be no stabilisation of HFI or of the sky load at 20K during TV
Switch ON LFI			0:10:00		
	Switch ON REBA	OFF to standby	0:05:00	1:20:00	
	Switch ON RAA	Standby to DAE set up	0:05:00	1:25:00	
	Cryo Functional Test LFI @20K	Test	8:00:00	9:25:00	ref PL-LFI-PST-PR-017_1_0
	Phase shift Bias Verification	Test	8:00:00	17:25:00	ref PL-LFI-PST-PR-017_1_0
	LNA Bias (VG1) Verification (1st step)	Test	8:00:00	25:25:00	ref PL-LFI-PST-PR-017_1_0
Knee frequency variation from 20K to 4K (PH01-006)			0:00:00		
	LFI In listening	Extended Science	0:00:00	25:25:00	Data are acquired along the cool down and they will be analyzed with two different objectives: Knee frequency and 4K cooler susceptibility
LFI Performance test during HFI 0.1 Cooldown (PH01-007)			0:00:00		
	LFI In listening	Extended Science	0:00:00	25:25:00	Data are acquired along the cool down and they will be analyzed with two different objectives: Knee frequency and 4K cooler susceptibility
LFI functional test at operating temperature (PH01-008)			16:05:00		
LFI Functional tests in flight like conditions			8:00:00		
	LNA Bias (VG1) Verification (2st step)	Extended Science	8:00:00	33:25:00	At the end of the cooldown when the 4K is stable
	Noise temperature and Linearity input offset and Isolation	Extended Science	0:00:00	33:25:00	Data are acquired along the cool down
REBA Specific functional test			8:05:00		
	Check of REBA parameters at "stable" Temperature	Extended Science	8:00:00	41:25:00	durations to be reduced & refined
	Go to Normal Science	Normal science	0:05:00	41:30:00	
LFI Performance tests (PH01-008)			24:00:00		
Noise & Stability test			24:00:00		
	Acquire data	Normal Science	24:00:00	65:25:00	HFI OFF
Long term measurements			0:00:00		
	Acquire Data at stable condition		0:00:00	65:25:00	HFI OFF
EM interference tests between receivers			24:00:00		
	TBD		24:00:00	89:25:00	HFI OFF
HFI Functional Test			108:25:00		
Long term Tests on LFI			48:00:00		
	TBD		24:00:00	24:00:00	durations to be reduced & refined



Title	Content	Mode	Duration used	Current Time	Comments
	EMC Between two Instruments (PH03-001)		87:25:00		
	Long term Tests on LFI		24:00:00		
	TBD		24:00:00	89:25:00	durations to be reduced & refined
	LFI Interferences & susceptibility tests		63:25:00		
	LFI Susceptibility to SCS radiator change		24:00:00		
	detail here the test sequence		24:00:00	113:25:00	durations to be reduced & refined
	LFI PID Controller test		24:00:00		
	detail here the test sequence		24:00:00	137:25:00	durations to be reduced & refined
	20K Cooler failure test		12:00:00		
	detail here the test sequence		12:00:00	149:25:00	durations to be reduced & refined
	Switch OFF LFI		0:15:00		
	LFI to DAE Set Up	Normal science to DAE Set Up	0:05:00	149:30:00	
	LFI to Standby	DAE Set Up to Standby	0:05:00	149:35:00	
	Switch OFF	Standby to OFF	0:05:00	149:40:00	
	Switch ON LFI		0:10:00		
	Switch ON REBA	OFF to standby	0:05:00	149:45:00	
	Switch ON RAA	Standby to DAE set up	0:05:00	149:50:00	
	4K Cooler failure test		3:00:00		
	detail here the test sequence		3:00:00	152:50:00	
			0:00:00	152:50:00	
	LFI SFT Cold		1:20:00		
	Switch ON LFI		0:00:00		
	Switch ON REBA	OFF to standby	0:00:00	152:50:00	no need to switch ON
	Switch ON RAA	Standby to DAE set up	0:00:00	152:50:00	
	LFI SFT sequence		1:05:00		
	detail here the SFT sequence		1:05:00	153:55:00	
			0:00:00	153:55:00	
			0:00:00	153:55:00	
			0:00:00	153:55:00	
	Switch OFF LFI		0:15:00		
	LFI to DAE Set Up	Normal science to DAE Set Up	0:05:00	154:00:00	
	LFI to Standby	DAE Set Up to Standby	0:05:00	154:05:00	
	Switch OFF	Standby to OFF	0:05:00	154:10:00	

## 5.9 EMC test

### 5.9.1 HFI EMC Test

[During EMC tests, the HFI WSFT will be used.](#)

[The test script will be stopped during Observation mode during the EMC excitation \(conductive or radiative\).](#)

### 5.9.2 LFI EMC Test

[Refer to AD-111 - PL-LFI-PST-PR-020\\_draft - EMC/RF tests \(Combined EMC Tests & Ambient RF FM Tests\) procedure](#)



LFI EMC Testing		24:00:00		ref PL-LFI-PST-PR-020
<b>CE Test</b>		<b>8:00:00</b>		
<b>Switch ON LFI</b>		<b>0:10:00</b>		
	Switch ON REBA	0:05:00	0:05:00	
	Switch ON RAA	0:05:00	0:10:00	
<b>LFI EMC sequence</b>		<b>7:35:00</b>		
	set LFI to Normal Science	0:30:00	0:40:00	
	<a href="#">LFI Observation in Normal science Mode</a>	7:05:00	7:45:00	
	<a href="#">detail here the EMC sequence</a>	0:00:00	7:45:00	
		0:00:00	7:45:00	
<b>Switch OFF LFI</b>		<b>0:15:00</b>		
	LFI to DAE Set Up	0:05:00	7:50:00	
	LFI to Standby	0:05:00	7:55:00	
	Switch OFF	0:05:00	8:00:00	
<b>RE Test</b>		<b>8:00:00</b>		
<b>Switch ON LFI</b>		<b>0:10:00</b>		
	Switch ON REBA	0:05:00	0:05:00	
	Switch ON RAA	0:05:00	0:10:00	
<b>LFI EMC sequence</b>		<b>7:35:00</b>		
	set LFI to Normal Science	0:30:00	0:40:00	
	<a href="#">LFI Observation in Normal science Mode</a>	7:05:00	7:45:00	
	<a href="#">detail here the EMC sequence</a>	0:00:00	7:45:00	
		0:00:00	7:45:00	
<b>Switch OFF LFI</b>		<b>0:15:00</b>		
	LFI to DAE Set Up	0:05:00	7:50:00	
	LFI to Standby	0:05:00	7:55:00	
	Switch OFF	0:05:00	8:00:00	
<b>RS Test</b>		<b>8:00:00</b>		
<b>Switch ON LFI</b>		<b>0:10:00</b>		
	Switch ON REBA	0:05:00	0:05:00	
	Switch ON RAA	0:05:00	0:10:00	
<b>LFI EMC sequence</b>		<b>7:35:00</b>		
	set LFI to Normal Science	0:30:00	0:40:00	
	<a href="#">LFI Observation in Normal science Mode</a>	7:05:00	7:45:00	
	<a href="#">detail here the EMC sequence</a>	0:00:00	7:45:00	
		0:00:00	7:45:00	
<b>Switch OFF LFI</b>		<b>0:15:00</b>		
	LFI to DAE Set Up	0:05:00	7:50:00	
	LFI to Standby	0:05:00	7:55:00	
	Switch OFF	0:05:00	8:00:00	

The test sequence is the following:

### 5.9.3 SCS EMC test

The Health check procedure will be used during EMC CE/RE tests (ref to AD-55 - H-P-3-ASP-TS-1126\_2 - SCS health-check at ambient)

The sorption cooler will be in standby (health monitoring) mode during RS test

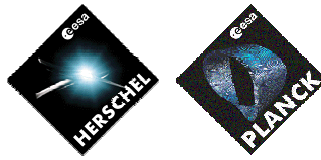
## 6. SUCCESS CRITERIA

(Similar to AD21)

Considering that the present specification is a top level document which call after many sequences, the detailed success criteria are listed for each step of the sequence and sub sequence as part of the test definition, and shall be included in each test procedures.

For each instrument test step, the Instrument support team shall analyse the results (HK+Science) with the I-EGSE/QLA or dedicated science data analysis tool, and give the go ahead to proceed with the next step of the test.





## 6.1 "out of limit" and TC checking

### 6.1.1 BASIC Principle

The test success relies except for few test step specificity, on the automated checking realised by the CCS based on HPSDB settings, and specifically the TC checks associated with each TC command.

The baseline is that the TC checking is realised by the CCS in real time whenever possible.

The process is straightforward when simulating operation in "visibility". For the others: as:

- launch sequence,
- operation from MTL,

The real time control relies on the real time spying of S/C generated TM from the umbilical connection (for MTL operation the hypothesis is that the CSS will run a copy of the MTL in parallel to S/C to keep its model of the status up to date).

Nevertheless, each test success shall be determined from TM acquired in a flight representative way. This means that most tests shall end by a simulation of a TM downlink session (DTCP) or specific phase to recover the available stored telemetry in SSMM.

When this telemetry has been already analysed from the umbilical line for test success (that is usually in a non flight representative way), the test success shall be verified by at least comparing the SSMM stored telemetry with the real time acquired one, for being identical. This comparison may be done bit level, packet per packet, which is expected quicker than a "replay" of the test (the comparison method is TBC-37).

For a remaining set of test sequences and test steps, a real time control will not be possible:

- the clean run (by test principle),
- a few case of saturation or filtering of the real-time TM sent onto the umbilical.

For those later cases, the test success will rely on a test session "replay" on the CCS from the retrieved SSMM data (note: test timeline at §5.1.2 does not include the time necessary fore those full or partial replays).

### 6.1.2 "soft" and "hard" limits

CCS monitoring considers 5 classes of monitoring limits: "soft OOL", "hard OOL", "delta OOL" and "consistency" and "event".

- a "event" limit triggering shall be associated with an automated emergency stop procedure run by the CCS.
- a "HARD OOL" and "consistency" limit triggering shall be associated with a test sequence abort (operator led procedure).
- a "SOFT" or "DELTA OOL" limits triggering, shall call upon the responsibility of the supporting engineering team for deciding in real time either the test abort or its continuation. A SOFT limit is a test failure indicator in any case, but not critical with respect to immediate safety of units under test. Real time decision shall considers if there is a danger for the S/C health (abort), and if not (shall be the case with a soft limit), the decision shall consider with respect to the test objective:
  - if there is no more way to consider the test successful, then test is worth to abort to save time or,



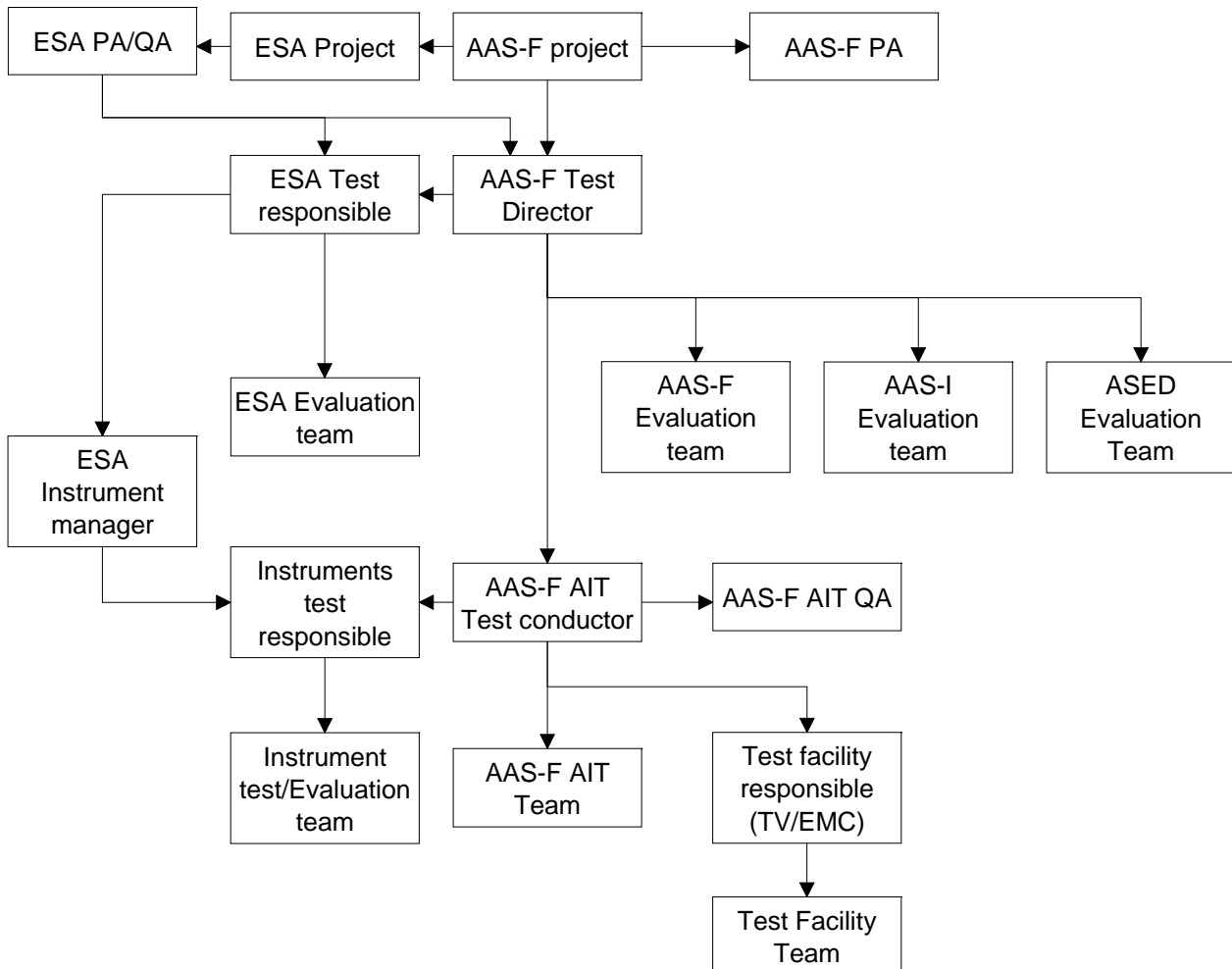
- if the alarm open (likely) only minor anomaly on test results, then test is worth to continue (NB. from available real time data, as only post analysis will determine if sequence is acceptable or shall be re-run).

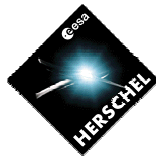
## 7. ORGANISATION & RESPONSABILITIES

### 7.1 Organisation

The test organisation and review will follow the rules defined in the PA plan (AD-6) and PA  
The overall organisation during the test is as follows:

#### Organisation for Planck FM AIT (IST, EMC, TV)





## 7.2 Test organisation

During the FM satellite / instrument test, the organisation of the working day will change with the test phase:

Integration & UFT: Normal working days (8h/day, 5j/7)

IST commissioning, SPT, EMC: Long working days (10h/day, 6j/7)

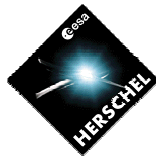
TV test + IST RMS: 3 shift operation: 24h/day, 7j/7)

## 7.3 Responsibilities

The overall responsibility during the test is as follows:

The responsibilities linked to the test progress shall be mentioned in the [TAS-F](#) test leading procedure.

Organization	Name (TBC)	Responsibility
<a href="#">TAS-F</a> Project Representative	xxx	<a href="#">Thales</a> project interface Represents <a href="#">TAS-F</a> during the test and he is also the I/F point with the ESA representative
ESA Project Representative	<a href="#">O.Piersanti</a>	ESA project interface Represents ESA during the test and he is also the I/F point with the <a href="#">TAS-F</a> representative
<a href="#">TAS-F</a> PA	<a href="#">L.Diaz</a>	<a href="#">TAS-F</a> Project Assurance Manager
<a href="#">TAS-F</a> Test Director	(depend of test phase <a href="#">Integration/UFT:</a> <a href="#">IST:</a> <a href="#">TV:</a> <a href="#">EMC</a> )	Issue the test specification of the relevant test to be performed Go ahead for the test reviews (TRR, key point, PTR) Single point of contact with the <a href="#">TAS-F</a> Evaluation team concerning the test result status.
ESA Test Responsible	<a href="#">J.Patterson</a> <a href="#">F.de Bruin</a>	ESA point of contact I/F with ESA project I/F with <a href="#">TAS-F</a> test director & ESA Payload Engineering Co-ordination
<a href="#">ESA PA/QA</a>	<a href="#">P.Olivier / A.Aarts</a>	<a href="#">TAS-F Project/Quality Assurance Manager</a> <a href="#">Interacts with the Test director, and ESA test responsible</a>
ESA Instruments I/F	<a href="#">S.Madden / L.Perez Cuevas</a>	I/F with <a href="#">TAS-F</a> test director & Instruments evaluation teams
<a href="#">TAS-F</a> AIT Conductor	<a href="#">N.Sivelle</a>	Responsible of the <a href="#">TAS-F</a> AIT Team Issue the leading procedure of all activities Manage all activities done during the test including "key point" meeting. I/F point with the Test Facility Team Responsible I/F point with the Instrument AIT Team Responsible Organize the Daily meeting Initialize NCR...
<a href="#">TAS-F</a> AIT Team	<a href="#">P.Rihet +</a>	Realize all S/C AIT activities within the arrival and the leaving Issue of the relevant test procedures Operate the GSE (except I-EGSE) Provide the test data



Organization	Name (TBC)	Responsibility
		Issue the test report.
Instruments <u>TAS-F</u> I/F	<u>J.P.Chambelland / B.Collaudin</u>	Issue section of the test specification relevant to the instrument. <u>TAS-F</u> instrument expert
<u>TAS-F</u> QA	<u>D.Berte</u>	Organize the review (TRR/PTR...) Minute the running meeting (Key point)
Instrument AIT Team Responsible	<u>LFI: L.Stringhetti</u> <u>HFI: Th.Maciaszek</u> <u>CSE: G.Morgante</u>	Is in charge of I/F point with the test conductor Provide relevant test data in order to help the test director concerning the "Key point" status.
Instrument AIT Team	<u>E.Franceschi</u> ±	I. EGSE full use Issue the relevant test procedures Process the instrument test data and Test data analysis Issue the test report.
Evaluation teams		Evaluate the test results (depending of test: electrical integration, IST, TV, EMC, ....)

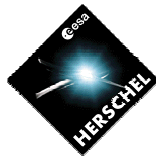
	Planck Satellite					
	Test Specification	Test Procedure	Test Execution	test report (filled procedure)	Instrument test report	Test Evaluation report
WU + WIH + test harness (mechanical integration)	TAS-I (from ICD+ connector list)	TAS-I	TAS-I	TAS-I	-	-
Electrical Intégration test (WU having I/F with SVM)	TAS-I (AVM) TAS-F (FM)	TAS-I (AVM) TAS-F (FM)	TAS-I (AVM) TAS-F (FM)	TAS-I (AVM) TAS-F (FM)	-	TAS-I (AVM) TAS-F (FM)
UFT (functional tests WU together)	TAS-F (leading)	TAS-F + Instrument	TAS-F AIT	TAS-F AIT	Instrument	TAS-F
SFT (Short functional tests WU+FPU)	TAS-F	TAS-F + Instrument	TAS-F AIT	TAS-F AIT	Instrument	TAS-F
IST (functional tests WU+FPU)	TAS-F	TAS-F + Instrument	TAS-F AIT	TAS-F AIT	Instrument	TAS-F
TV test	TAS-F	TAS-F + Instrument	TAS-F AIT	TAS-F AIT	Instrument	TAS-F
EMC tests	TAS-F	TAS-F + Instrument	TAS-F AIT	TAS-F AIT	Instrument	TAS-F

## 7.4 Tasks distribution

### 7.4.1 General Tasks breakdown

TAS-F is in charge of Planck FM AIV

- the satellite activities and test management:



- Responsible of the test management and for interfaces between the satellite, instruments and facility.

[TAS-F AIT](#) is in charge of [Planck](#) FM AIT

- Preparation (tests definition, except for instruments) and execution
- S/C Cleaning, handling, mechanical mounting, electrical checkout, instruments modes set-up.
- Test management (reviews, leading procedure, daily meeting, key points , ...)
- Dedicated GSE installation/validations and use
- S/C data analysis.
- Running the test (Satellite & Instruments Operator)

[TAS-I](#) is in charge of SVM FM & AVM AIT

Instruments teams are in charge of:

- Preparation, tests definition for the instruments
- Dedicated GSE installation/validations and use (I.EGSE)
- Responsible for interfaces between the instrument GSE and test facility.
- Execution and interpretation of instrument performance data
- Provide relevant test data in order to help the test director concerning the "Key point" status.
- Instrument test report

## 8. DOCUMENTATION

### 8.1 Documents required before the test

S/C configuration (CIDL, etc)  
Test set-up configuration (CIDL, Definition drawings)  
Test Set-up validation and calibration status  
Test specification  
Test predictions  
Instrumentation plan  
Test leading procedure + elementary procedures

### 8.2 Data acquired during the test

#### 8.2.1 S/C housekeeping

A listing (paper format) will provide the following information (output frequency TBD) about each type of specimen sensors (thermal,  $\mu$ -vibration):

- Test phase designation
- Acquisition date/time
- Temperature sensor number
- Sensor designation
- Measured value (time & frequency domain for  $\mu$ -vib)
- Alarms status



An excel file grouping information <Time, Temperature> of all specimen thermal sensors will be updated at a given frequency (TBD) and delivered on request to [TAS-F](#) thermal team.

An excel file grouping information <Time, Time domain> of all  $\mu$ -vib sensors will be updated at a given frequency (TBD) and delivered on request to [TAS-F](#) evaluation team.

An excel file grouping <Time, Power / Amperage> of all specimen heating lines (including RAA Dummy) will be updated at a given frequency (TBD) and delivered on request to [TAS-F](#) evaluation team.

### 8.2.2 Instrument housekeeping

A listing (paper format) will provide the following information (output frequency TBD) about each type of specimen sensors (thermal,  $\mu$ -vibration):

- Test phase designation
- Acquisition date/time
- Temperature sensor number
- Sensor designation
- Measured value
- Alarms status

An excel file grouping information <Time, Temperature> of all specimen thermal sensors will be updated at a given frequency (TBD) and delivered on request [TAS-F/ESA](#) evaluation team.

## 8.3 Documents issued after the test

### 8.3.1 Test Reports

#### 8.3.1.1 Specimen AIT reports ([TAS-F AIT](#) (FM), [TAS-I](#) (AVM))

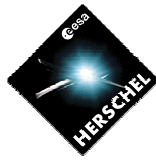
As a minimum, the specimen AIT reports shall include:

Filled test procedure  
Test progress description  
Contamination control report  
Logbook reporting all significant events about specimen  
Pictures taken on the specimen in test configuration  
Record (CD-ROM) of all acquired data during test  
Test measurements devices calibration reports

#### 8.3.1.2 Test environment (EMC, TV)

As a minimum, the specimen AIT reports shall include:

Test progress description  
Pictures taken on the test set-up  
Logbook reporting all significant events about test set-up  
Record (CD-ROM) of all acquired data during test  
Test measurements devices calibration reports



## **8.3.2 Evaluation reports**

### 8.3.2.1 Evaluation report for satellite test

The deliverable are :

Logbook reporting all significant events about each sequence success criteria,

SFT, IST, TV/TB, EMC report including :

- measured values for success criteria associated with analogue values (ex. DoD, pointing errors, at key steps etc.),

- test results processing for all phases (plots and specific data processing possibly required step per step).

### 8.3.2.2 Evaluation report for instrument test

As a minimum, the instrument evaluation reports (provided by the instrument support team) shall include:

- Logbook reporting all significant events about each sequence success criteria, and specifically the ones only available from monitoring at IEGSE level,

- a short S/C test report including:

  - measured values for success criteria associated with analogue values (ex. DoD, pointing errors, at key steps etc.),

  - test results processing for all phases (plots and specific data processing possibly required step per step), specifically for the ones only available from processing at IEGSE level.

## **9. ANNEXES**

LFI: LFI user manual & procedures applicability table for AVM

From LFI AVM EIDP

Planck LFI ADP 1597 - Sect. 14 User Manual table.pdf

**END OF DOCUMENT**

**AVM applicability of the LFI FM user manual and the integration procedures**

**User Manual (PL-LFI-PST-MA-001 issue 2.0)**

Chapter 1	is applicable to the AVM
Chapter 2	is applicable to the AVM
Chapter 3.1	is partially applicable to the AVM
Chapter 3.2	is partially applicable to the AVM
Chapter 3.3	is applicable to the AVM
Chapter 3.4	is NOT applicable to the AVM
Chapter 4	is partially applicable to the AVM
Chapter 5	is applicable to the AVM
Chapter 6.1.1 to 6.1.9	is NOT applicable to the AVM
Chapter 6.10 to 6.1.12	is applicable to the AVM
Chapter 6.1.13	is NOT applicable to the AVM
Chapter 6.1.14 to 6.1.15	is partially applicable to the AVM
Chapter 6.2	is partially applicable to the AVM
Chapter 7	is NOT applicable to the AVM
Chapter 8	is applicable to the AVM
Chapter 9	is NOT applicable to the AVM
Chapter 10	is applicable to the AVM
Chapter 11	is applicable to the AVM
Chapter 12	is applicable to the AVM
Chapter 13	is applicable to the AVM
Chapter 14	is partially applicable to the AVM
Chapter 15	is applicable to the AVM
ANNEX A	is applicable to the AVM
ANNEX B	is applicable to the AVM
ANNEX 3	is NOT applicable to the AVM



**Electrical Integration REBA on SVM and Functional tests (UFT)**  
**(PL-LFI-PST-PR-015 issue 1 draft)**

This procedure can be used directly for the electrical integration and checkout of the REBA in the satellite AVM. The fact that the REBA is not form and fit has no obvious effect on the procedure.

**Electrical Integration REBA / DAE Power Box / DAE (UFT)**  
**(PL-LFI-PST-PR-016 issue 1 draft)**

This procedure is applicable to the electrical integration of the REBA to DAE and DAE Power Box to DAE (AVM units). Note that the procedure makes reference to the RAA Mechanical Integration Procedure on the satellite not be applicable here as the DAE AVM is not mechanically mounted in the RAA.

The functional testing after connection of the units makes reference to PL-LFI-PST-PR-017 entitled Planck LFI Warm Functional Test which is currently in production and discussion with AAS(F), and a red-marked copy of this would suffice.

Concerning IST replication, we are expecting to produce PL-LFI-PST-PR-019 for the IST (PL-LFI-PST-PR-018 is for the Short Functional Test), and presumably a red-marked copy of this would suffice as the AVM is capable of producing all the instrument telemetry packet types (both housekeeping and scientific packets) even if the contents is only zeros or noise in some cases.

**List of the features mounted on the AVM differently from the FM**

**Scientific channels:**

On the AVM only the Telecommand and Telemetry channels referring to RCA 24, 23, 28 and 18 are mounted.

These channels are identified as detector ID 0x04 to 0x07, 0x10 to 0x13, 0x18 to 0x1B and 0x24 to 0x27

**Other analog HK:**

On the AVM no FPU temperature sensors and no BEM temperature sensors are present.

On the REBA AVM the temperature sensors are substituted with fixed resistors.