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Authors	GREGORIO, Anna, CUTTAIA, FRANCESCO, MENNELLA, ANIELLO
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Planck LFI

TITLE: # Quick Look Data Analysis Of LFI PLM SIT Test

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Prepared by	**A. GREGORIO** **F. CUTTAIA** **A. MENNELLA** **On Behalf of LFI IOT**	**Date:** **Signature:**	February, 2009
Agreed by	**C. BUTLER** **LFI Program Manager**	**Date:** **Signature:**	February, 2009
Approved by	**N. MANDOLESI** **LFI Principal Investigator**	**Date:** **Signature:**	February, 2009

DISTRIBUTION LIST

Recipient	Company / Institute	E-mail address	Sent
N. MANDOLESI	INAF/IASF – Bologna	mandolesi@iasfbo.inaf.it	Yes
R.C. BUTLER	INAF/IASF – Bologna	butler@iasfbo.inaf.it	Yes
M. BERSANELLI	UNIMI – Milano	marco.bersanelli@mi.infn.it	Yes
M. BALASINI	TAS-I – Milan	maurizio.balasini@thalesaleniaspace.com	Yes
R. SILVESTRI	TAS-I – Milan	roberto.silvestri@thalesaleniaspace.com	Yes
P. LEUTENEGGER	TAS-I – Milan	paolo.leutenegger@thalesaleniaspace.com	Yes
M. MICCOLIS	TAS-I – Milan	maurizio.miccolis@thalesaleniaspace.com	Yes
G. CAFAGNA	TAS-I – Milan	gaetano.cafagna@thalesaleniaspace.com	Yes
A. MENNELLA	UNIMI – Milano	aniello.mennella@fisica.unimi.it	Yes
J. PATTERSON	ESA	Janice.Patterson@esa.int	Yes
L. PEREZ CUEVAS	ESA	leticia.perez.cuevas@esa.int	Yes
O. PIERSANTI	ESA	Osvaldo.Piersanti@esa.int	Yes
J.P. CHAMBELLAND	TAS-F Cannes	jean-philippe.chambelland@thalesaleniaspace.com	Yes
B. COLLAUDIN	TAS-F Cannes	Bernard.Collaudin@thalesaleniaspace.com	Yes
P. RIHET	TAS-F Cannes	Patrick.Rihet@thalesaleniaspace.com	Yes
N. SEVILLE	TAS-F Cannes	Norbert.Seville@thalesaleniaspace.com	Yes
J.P. HAYET	TAS-F Cannes	Jean-pierre.hayet@thalesaleniaspace.com	Yes
LFI System PCC	INAF/IASF – Bologna	lfispcc@iasfbo.inaf.it	Yes

CHANGE RECORD

Issue	Date	Sheet	Description of Change	Release
1.0	February 09	All	First Draft of Document	Draft

TABLE OF CONTENTS

1 ACRONYMS

AIV	Assembly, Integration, Verification
ASW	Application Software
BEM	Back End Module
BEU	Back End Unit
CCS	Central Check-out System
CDMU	Central Data Management Unit
DAE	Data Acquisition Electronics
DPU	Digital Processing Unit
EGSE	Electrical ground Support Equipment
FEM	Front End Module
I-EGSE	Instrument EGSE
IST	Integrated Satellite Test
OBC	On Board Clock
RAA	Radiometer Array Assembly
REBA	Radiometric Electronic Box Assembly
S/C	Spacecraft
SCOE	Spacecraft Control and Operation System
SPU	Signal Processing Unit
SUSW	Start- Up Software
SVM	Service Module
TBC	To Be Checked
TBW	To Be Written
TC	Telecommand
TM	Telemetry
UFT	Unit Functional Test

2 INTRODUCTION

This document has been issued in the frame of ASI contract that has been released for the activities of Planck-LFI Phase E2

2.1 Purpose and Scope

Scope of this document is to give a first quick look analysis response of the functionality of the LFI instrument during the IST Test Campaign.
The objective of Planck IST is two fold:
- to verify the correct performance of the satellites and the compatibility between all the integrated electrical subsystems and instruments,
- to mimic the operation procedures which will be exercised during the different phases of the satellite mission.

The document is divided in two sections. The first section is related to the description of the work done that is to say the description of the LFI Log Book and the description of the performed tests. The second section is the summary of the results of each test coming from both real time and offline data analysis.

2.2 Test configuration

The test configuration is the following

SCOS 2 K HPCCS Version
LFI Gateway Version
TQL TBC
LIFE Machine version OM

LFI Personnel involved during the test is:

LFI IOT	Anna Gregorio UNITS anna.gregorio@ts.infn.it Aniello Mennella UNIMI aniello.mennella@fisica.unimi.it Francesco Cuttaia IASF Bologna cuttaia@iasfbo.inaf.it

3 APPLICABLE AND REFERENCE DOCUMENTS

3.1 Applicable Documents

[AD1] Herschel/Planck Instrument Interface document Part A
SCI-PT-IIDA-04624 Issue 3.3

[AD2] Herschel/Planck Instrument Interface document Part B
SCI-PT-IIDB-04142 Issue 3.1

[AD3] Herschel/Planck Instrument Interface document Part B
SCI-PT-IIDB-04142 Issue 3.1, Annex 3, ICD 750800115

[AD4] Herschel/Planck Instrument Interface document Part A
SCI-PT-IIDA-04624 Issue 3.3 Annex 10

3.2 Reference Documents

[RD1] Planck Instrument Testing at PFM S/C levels
H-P-3-ASP-TN-0676, Issue 1.0

[RD2] Planck LFI User Manual
PL-LFI-PST-MA-001 Issue 3.0

[RD3] Planck LFI REBA Herschel PACS SPU: LFI REBA FMs User's Manual
FPL-MA-1214-04 CRS Issue 1.0

[RD4] LFI- REBA application Software User Manual (SUM)
DS/UM_FIR/178v.4

[RD5] LFI Warm Functional Test Procedure (WFT)
PL-LFI-PST-PR-017_2_1

[RD6] PLM SIT Test Specification
H-P-3-ASP-TS-1421 Issue 2.0

[RD7] IST1 and IST2 Combined LFI HFI tests
PL-LFI-PST-PR-019 Issue 3.1

[RD8] Quick Look Data Analysis Of LFI performed during SIT
PL-LFI-PST-RP-024 Issue 1.0

4 IST Test Execution

For each modular block of procedure test results and conclusions are presented.

4.1 PLM SIT - Switch on LFI in nominal science (Nominal Unit)

4.1.1 Procedure/ Test sequence

LFI SIT: Switch on (Nominal Unit)					1:00:00	
Switch ON LFI				1	0:39:00	
	Go to Stand By Mode	OFF to standby	0:32:00	1	0:32:00	0:32:00
	Go to DAE Set Up Mode	Standby to DAE set up	0:07:00	1	0:07:00	0:39:00
LFI in Normal Science (Warm test Config..)				1	0:21:00	
	Setting Telemetry Rate	Nominal Values	0:02:00	1	0:02:00	0:41:00
	Event Packet Enabling		0:02:00	1	0:02:00	0:43:00
	Definition of science Processing Parameters	Naverage set to 256	0:02:00	1	0:02:00	0:45:00
	Changing Processing Type to 1		0:05:00	1	0:05:00	0:50:00
	Spu Connection		0:02:00	1	0:02:00	0:52:00
	Science Activation Type 1		0:04:00	1	0:04:00	0:56:00
	RCA Activation		0:02:00	1	0:02:00	0:58:00
	Set DAE Default configuration		0:02:00	1	0:02:00	1:00:00

At the end of the Procedure LFI will stay in listening mode with HFI and SCS had performed WFT and Health check.

4.1.2 Results and Conclusions

The procedure was run on January the 30th without any problem and the test was finished successfully.

Pass and Fail Criteria

No errors from the REBA HW Self check	
No un-expected event Packets	
REBA Power Consumption within the ranges of expected values	
EEPROM Check Sum passed	
REBA synchronization achieved	
DAE Power Consumption within the ranges of expected values	
DAE Synchronization achieved	
The FEM I Drain Currents obtained from Telemetry are within the ranges expected (5%)	

The DC voltages Outputs (Science Telemetry) are within the ranges expected. (10%)	
No unexpected features in FFT spectrum (Spike, Pop corn noise, currents drops…)	

No NCRs have been raised.

4.2 PLM SIT - Nominal Science with nominal unit

During this step HFI and SCS are performing their WFT. LFI stays in nominal acquisition acquiring data for analysis.

4.2.1 Procedure/ Test sequence

No test sequence for LFI is requested to be applied here.

4.2.2 Results and Conclusions

Pass and Fail Criteria

No un-expected event Packets	
REBA Power Consumption within the ranges of expected values	
DAE Power Consumption within the ranges of expected values	
No unexpected features during HFI activity in Scientific signal	
No unexpected features during SCS activity in Scientific signal	

No NCRs have been raised.

4.2.2.1 Currents monitoring during HFI WFT and during SCS-N HC

No evident changes in the drain currents are observed during the activities of other instruments: all changes are well within the standard deviation measured during the LFI AMB_02 itself.

4.3 PLM SIT - LFI Execution of AMB02

4.3.1 Procedure/ Test sequence

LFI SIT: AMB02 execution (Nominal Unit)					3:24:00	
Switch ON LFI - AMB-02				1	3:24:00	
	RCA Activation		0:05:00	1	0:05:00	0:05:00
	Perform DAE Initialization		0:10:00	1	0:10:00	0:15:00
	Wait for thermalization of power groups		0:30:00	1	0:30:00	0:35:00
	Configure DAE (Scwitch ACA on)		0:02:00	1	0:02:00	0:37:00
	Wait for thermalization of FPU		0:25:00	1	0:25:00	1:02:00
	Enable 4KH switching A/C		0:02:00	1	0:02:00	1:04:00
	Acquire data		0:30:00	1	0:30:00	1:34:00
	Change PS stauts to one on B/D		0:02:00	1	0:02:00	1:36:00
	Acquire data		0:30:00	1	0:30:00	2:06:00
	Disable 4KH switching A/C		0:02:00	1	0:02:00	2:08:00
	Enable 4KHz switching B/D		0:02:00	1	0:02:00	2:10:00
	Change PS status to zero on A/C		0:02:00	1	0:02:00	2:12:00
	Acquire data		0:30:00	1	0:30:00	2:42:00
	Change PS status to one on A/C		0:02:00	1	0:02:00	2:44:00
	Acquire Data		0:30:00	1	0:30:00	3:14:00

4.3.2 Results and Conclusions

The procedure was run on January the 30th and the test was finished successfully. Due to the change in the test sequence with respect to the previous “Nominal PLM SIT” [RD-6] (now “Extended PLM SIT”), there is an inconsistency between the new "extended PLMSIT" procedure and the LFI document [RD-7] that is still referring only to the nominal PLMSIT. This caused that an unforeseen procedure (from the LFI point of view) has been applied at the very beginning of the AMB-02: the DAE has been switched off and back on. This operation is not required during the "Extended PLM SIT" since the switch from the Nominal to the Redundant (REBA) Unit switch is not foreseen.

From the LFI side no impact on the PLM SIT execution (we did something not necessary but we have all the required data).

Pass and Fail Criteria

No un-expected event Packets	
The FEM I Drain Currents obtained from Telemetry are within the ranges expected (5%)	
The DC voltages Outputs (Science Telemetry) are within the ranges expected. (10%)	
No unexpected features in FFT spectrum (Spike,	

Pop corn noise, currents drops…)	
Every ACA and every P/S is responding to Biases stimulus as expected.	

One NCR was raised:

NCR	Description
4888	LFI : DAE has been switched off and back on

DATA are contained in the file AMB202

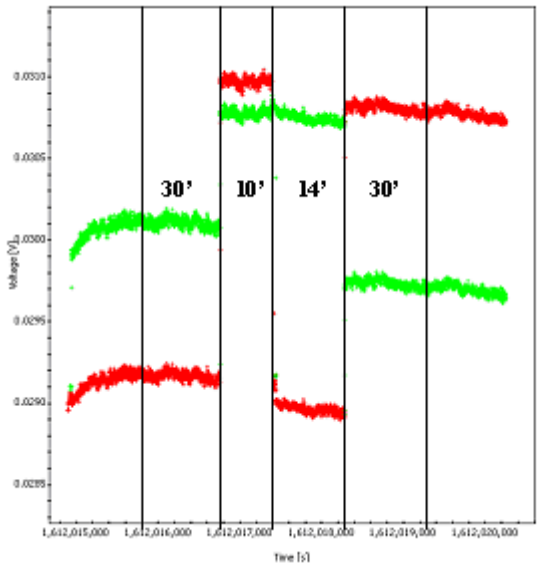

Figure 1 Representative scientific output during AMB02

4KHz		STEP1	STEP2	STEP3	STEP4
P/S	A/C	1	1	0	0
	B/D	0	0	1	1
	A/C	0	0	0	1
	B/D	0	1	0	0
DURATION		30'	10'	14'	30'

Figure 2 Test duration per each step and bias configuration exercised

RCA #	Detector ID	SCOS Parameter	Measured AMB_202
CH27	00	LM051322	15.45
	01	LM052322	15.12
	02	LM053322	15.67
	03	LM054322	15.2
CH24	04	LM055322	28.84
	05	LM056322	28.55
	06	LM057322	29.44
	07	LM058322	29.41
CH21	08	LM059322	20.29
	09	LM060322	17.85
	0A	LM061322	17.88
	0B	LM062322	19.39
CH22	0C	LM063322	19.16
	0D	LM064322	18.73
	0E	LM065322	18.84
	0F	LM066322	18.79
CH23	10	LM067322	18.15
	11	LM068322	19.34
	12	LM069322	17.87
	13	LM070322	18.26
CH25	14	LM071322	26.84
	15	LM072322	26.33
	16	LM073322	27.37
	17	LM074322	27.75
CH28	18	LM075322	17.08
	19	LM076322	16.81
	1A	LM077322	16.94
	1B	LM078322	16.61
CH20	1C	LM079322	19.92
	1D	LM080322	19.93
	1E	LM081322	19.71
	1F	LM082322	20.04
CH19	20	LM083322	19.12
	21	LM084322	19.94
	22	LM085322	19.84
	23	LM086322	20.08
CH18	24	LM087322	20.04
	25	LM088322	17.97
	26	LM089322	16.33
	27	LM090322	17.96
CH26	28	LM091322	27.06
	29	LM092322	26.52
	2A	LM093322	26.77
	2B	LM094322	26.37

Figure 3 drain currents during AMB02

Id w.r.t IST				
CH	<00>	<01>	<10>	<11>
CH27	0.06	0.07	0.19	0.13
CH24	0.00	0.11	0.17	0.10
CH21	0.15	0.28	0.39	0.31
CH22	0.42	0.27	0.43	0.48
CH23	0.50	0.42	0.45	0.38
CH25	0.07	0.08	0.07	0.18
CH28	0.18	0.06	0.12	0.12
CH20	0.45	0.25	0.31	0.30
CH19	0.31	0.20	0.10	0.10
CH18	9.33	-0.33	-0.24	-0.22
CH26	-0.04	-0.15	-0.15	-0.19

Id w.r.t WFT				
CH	<00>	<01>	<10>	<11>
CH27	0.13	0.73	0.26	0.13
CH24	0.21	0.25	0.34	0.31
CH21	0.25	0.39	0.39	0.47
CH22	0.58	0.38	0.43	0.70
CH23	0.61	0.62	0.56	0.50
CH25	0.26	0.30	0.29	0.29
CH28	0.06	0.00	-0.06	0.00
CH20	0.45	0.25	0.31	0.35
CH19	0.26	0.25	0.20	0.10
CH18	0.15	-0.50	-0.37	-0.28
CH26	0.11	-0.04	-0.04	-0.08

Figure 4 FEM drain currents comparison w.r.t. SIT reference test (LEFT) and WFT test (right) : the drain current of RCA 18 S2 seems to have suffered an evolution from tests performed in CANNES and the setup in CSL: the PRE-TV test showed instabilities in this HK (from 18.5 mA to 20 mA about) and but stabilized along the test campaign in the highest value (20 mA about) .

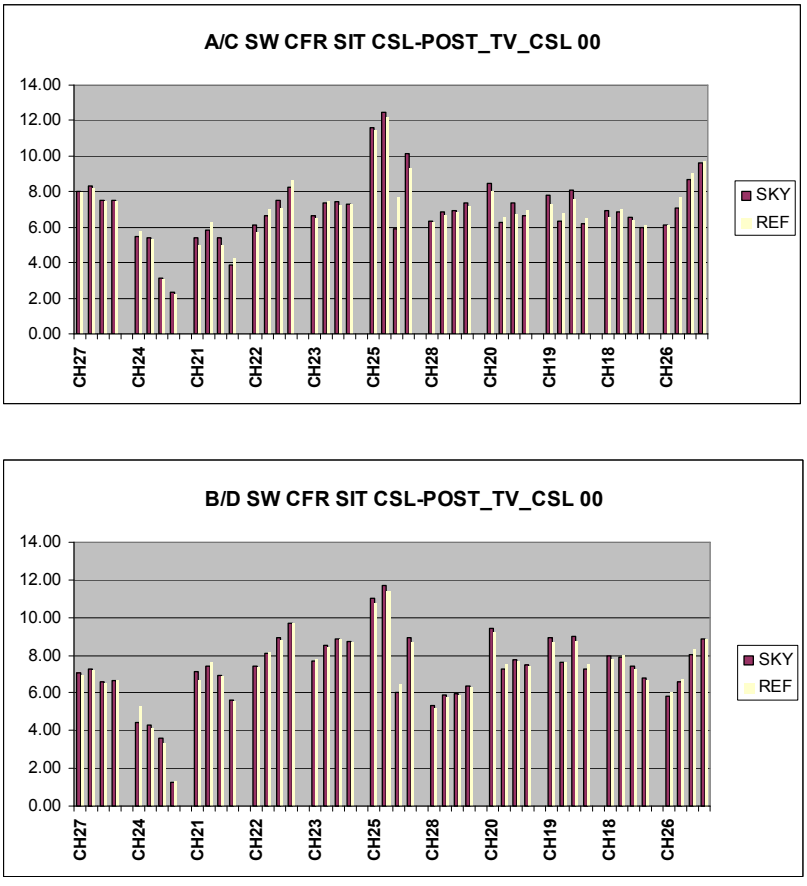

Figure 5 Vout during AMB_02: comparison with POST-TV WFT test.

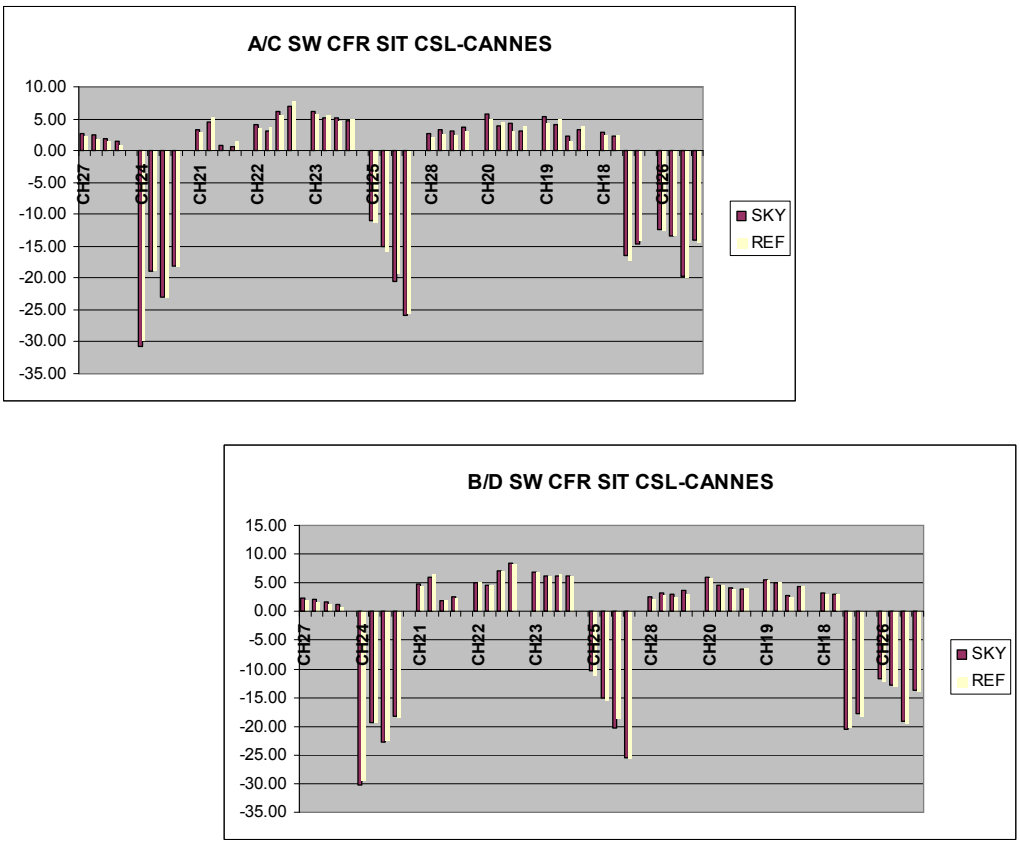

Figure 6 Vout during AMB_02: comparison with SIT test.

From Figure 6 it is apparent that there is a significant deviation of the voltage outputs from the requirement of ±10% for all the 44 GHz channels and for two channels in LFI18, namely the channels LFI18S-10 and LFI18S-11, connected to the side arm of the OMT. Although a problem in the FEMs can be excluded in principle from the data shown in Figure 5 that shows proper signal separation and switching, we have performed an additional analysis to better isolate the nature of the discrepancy.

From the datasets acquired during the PLM-SIT in Cannes and in CSL (AMB_0164 and AMB_0203) we have calculated the difference between the voltage output after and before the front-end LNA biasing, in order to remove any effect due to the BEM offset.

The result is shown in Figure 7, that shows the variation in the FEM response between PLM-SIT in Cannes and in CSL. Data in the figure show that the difference is much more reduced, indicating a dominant effect due to a different BEM offset.

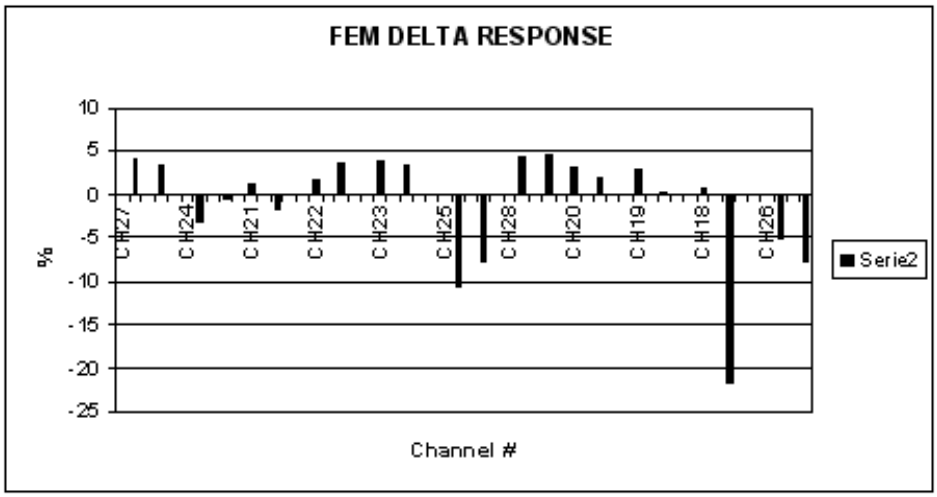

Figure 7 Variation in FEM response (with BEM offset removed) between PLM-SIT at Cannes and at CSL

This is further confirmed in Figure 8 that shows the difference in the BEM level (with FEMs off) in the two PLM SITs tests where it is possible to see that the 44 GHz show a smaller BEM Voltage output that explain the difference in the total voltage output.

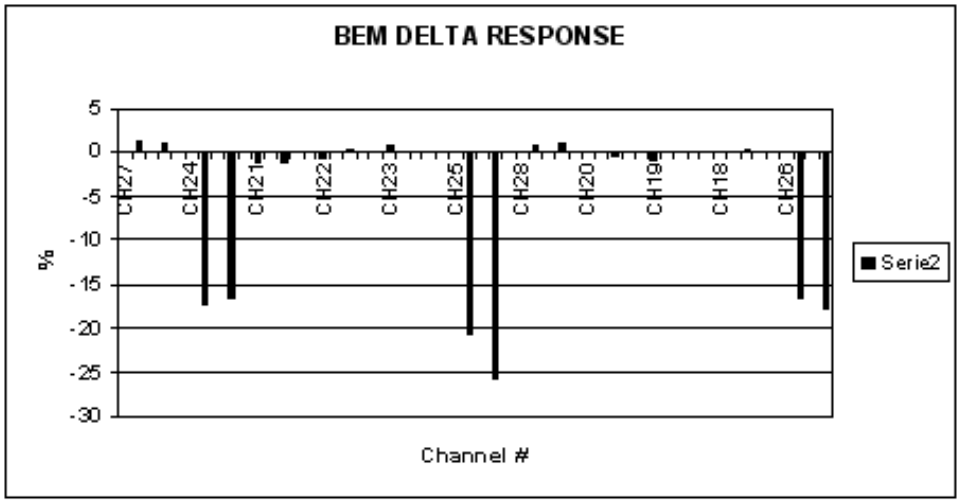

Figure 8 Variation in BEM voltage output between PLM-SIT at Cannes and at CSL

Figure 7 and Figure 8 show that the BEM offset is not enough to explain the discrepancy in output voltage for the LFI18S-10 and LFI18S-11 channels. This discrepancy is very likely to be correlated with the anomalous drain current reported in Figure 6 that has been observed in warm conditions since the SOVT1 tests.

RCA #	Detector ID		SCOS Parameter	VG1		VG2		Vd		I1		I2	
				DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX
CH27	00	00	LP001320	250	FA	130	82	200	C8	205	CD	205	CD
	01	01	LP002320	250	FA	130	82	200	C8	205	CD	205	CD
	02	10	LP003320	250	FA	130	82	200	C8	205	CD	205	CD
	03	11	LP004320	250	FA	130	82	200	C8	205	CD	205	CD
CH24	04	00	LP005320	241	E6	241	E5	255	FF	205	CD	205	CD
	05	01	LP006320	241	E6	241	E5	255	FF	205	CD	205	CD
	06	10	LP007320	241	E6	241	E6	255	FF	205	CD	205	CD
	07	11	LP008320	241	E6	241	E6	255	FF	205	CD	205	CD
CH21	08	00	LP009320	217	D9	178	B2	255	FF	255	FF	255	FF
	09	01	LP010320	218	DA	163	A3	255	FF	255	FF	255	FF
	0A	10	LP011320	133	85	178	B2	255	FF	255	FF	255	FF
	0B	11	LP012320	151	97	163	A3	255	FF	255	FF	255	FF
CH22	0C	00	LP013320	166	A6	172	AC	255	FF	255	FF	255	FF
	0D	01	LP014320	142	8E	124	7C	255	FF	255	FF	255	FF
	0E	10	LP015320	154	9A	124	7C	255	FF	255	FF	255	FF
	0F	11	LP016320	142	8E	121	79	255	FF	255	FF	255	FF
CH23	10	00	LP017320	162	A2	130	82	255	FF	255	FF	255	FF
	11	01	LP018320	148	94	127	7F	255	FF	255	FF	255	FF
	12	10	LP019320	141	8D	133	85	255	FF	255	FF	255	FF
	13	11	LP020320	183	B7	177	B1	255	FF	255	FF	255	FF
CH25	14	00	LP021320	242	F2	242	F2	255	FF	205	CD	205	CD
	15	01	LP022320	242	F2	242	F2	255	FF	205	CD	205	CD
	16	10	LP023320	242	F2	242	F2	255	FF	205	CD	205	CD
	17	11	LP024320	242	F2	242	F2	255	FF	205	CD	205	CD
CH28	18	00	LP025320	247	F7	128	80	200	C8	206	CE	205	CD
	19	01	LP026320	247	F7	128	80	200	C8	205	CD	206	CE
	1A	10	LP027320	246	F6	128	80	200	C8	205	CD	206	CE
	1B	11	LP028320	247	F7	128	80	200	C8	206	CE	205	CD
CH20	1C	00	LP029320	151	97	127	7F	255	FF	255	FF	255	FF
	1D	01	LP030320	112	70	172	AC	255	FF	255	FF	255	FF
	1E	10	LP031320	127	7F	154	9A	255	FF	255	FF	255	FF
	1F	11	LP032320	145	91	172	AC	255	FF	255	FF	255	FF
CH19	20	00	LP033320	109	6D	114	72	255	FF	255	FF	255	FF
	21	01	LP034320	157	9D	148	94	255	FF	255	FF	255	FF
	22	10	LP035320	172	AC	174	AE	255	FF	255	FF	255	FF
	23	11	LP036320	115	73	168	A8	255	FF	255	FF	255	FF
CH18	24	00	LP037320	177	B1	132	84	255	FF	255	FF	255	FF
	25	01	LP038320	135	87	180	B4	255	FF	255	FF	255	FF
	26	10	LP039320	156	9C	147	93	255	FF	255	FF	255	FF
	27	11	LP040320	165	A5	129	81	255	FF	255	FF	255	FF
CH26	28	00	LP041320	241	F1	242	F2	255	FF	205	CD	205	CD
	29	01	LP042320	242	F2	241	F1	255	FF	205	CD	205	CD
	2A	10	LP043320	241	F1	241	F1	255	FF	205	CD	205	CD
	2B	11	LP044320	241	F1	241	F1	255	FF	205	CD	205	CD

Figure 9 Bias synoptic frame during AMB02

RCA #	STEP1		SYMM	STEP2		SYMM	STEP3		SYMM	STEP4		SYMM
	A/C SW SKY	00 REF		A/C SW SKY	01 REF		B/D SW SKY	00 REF		B/D SW SKY	10 REF	
CH27	1.132888	1.118571	0.999597	1.138721	1.115542	1.007328	1.127265	1.113295	1.000035	1.133	1.110	1.007
	1.201055	1.185803		1.196235	1.189996		1.193726	1.179836		1.192	1.184	
	1.05995	1.059297	0.991995	1.071226	1.051629	1.009997	1.054478	1.048864	0.997787	1.065	1.050	1.004
	0.883088	0.866887		0.874466	0.874124		0.872367	0.862501		0.875	0.869	
CH24	0.004989	0.005051	0.99277	0.005071	0.005013	1.008027	0.00496	0.005059	0.987589	0.005	0.005	1.012
	0.006291	0.006271		0.006324	0.006357		0.006302	0.00626		0.006	0.006	
	0.004134	0.004158	0.994027	0.004158	0.004137	1.00681	0.004135	0.004136	0.998696	0.004	0.004	1.002
	0.005888	0.005852		0.005848	0.005895		0.005831	0.005819		0.006	0.006	
CH21	0.032575	0.031963	1.024391	0.03259	0.033653	0.972436	0.032146	0.0316	1.021394	0.032	0.033	0.973
	0.029495	0.030382		0.031068	0.030347		0.029212	0.029967		0.031	0.030	
	0.060871	0.059538	1.021212	0.06047	0.061918	0.977206	0.061355	0.060732	1.008428	0.062	0.063	0.990
	0.057379	0.058526		0.059343	0.058027		0.059109	0.059496		0.061	0.060	
CH22	0.081187	0.078972	1.03628	0.080363	0.082984	0.973298	0.081197	0.080451	1.016746	0.083	0.084	0.991
	0.088916	0.092792		0.093858	0.091757		0.090691	0.092811		0.095	0.095	
	0.074988	0.072098	1.038473	0.073588	0.076905	0.957032	0.074204	0.073007	1.013154	0.076	0.077	0.982
	0.089028	0.092337		0.09457	0.090519		0.090362	0.091314		0.095	0.093	
CH23	0.149	0.149	1.001233	0.146745	0.14706	1.000999	0.14306	0.145709	0.983796	0.146	0.143	1.018
	0.177882	0.178285		0.175118	0.175755		0.172986	0.170471		0.170	0.173	
	0.184884	0.186547	0.993002	0.184418	0.183842	1.004744	0.191658	0.193668	0.991211	0.192	0.191	1.006
	0.091253	0.090972		0.089985	0.090708		0.094188	0.093668		0.093	0.094	
CH25	0.02918	0.030119	0.98241	0.030984	0.030789	1.017535	0.028951	0.030733	0.953811	0.031	0.030	1.049
	0.027129	0.027061		0.027838	0.028671		0.027766	0.026846		0.027	0.029	
	0.007519	0.007704	0.973817	0.007738	0.007565	1.026536	0.007582	0.007563	0.993294	0.008	0.008	1.003
	0.005931	0.005759		0.005813	0.005995		0.005858	0.005749		0.006	0.006	
CH28	0.562741	0.554048	0.995731	0.572186	0.557893	1.003803	0.559791	0.556492	0.986766	0.569	0.549	1.013
	0.745897	0.731654		0.750238	0.74092		0.748429	0.727861		0.740	0.737	
	0.705938	0.699073	0.994401	0.713535	0.69733	1.005098	0.70299	0.695872	0.994491	0.709	0.694	1.005
	0.640538	0.626172		0.639292	0.629901		0.638001	0.623535		0.636	0.626	
CH20	0.128313	0.124711	1.030884	0.127549	0.131433	0.971326	0.126791	0.124254	1.022302	0.128	0.131	0.979
	0.114213	0.11799		0.120535	0.117194		0.113836	0.116609		0.120	0.118	
	0.13493	0.131087	1.030538	0.132888	0.136991	0.971187	0.132738	0.131208	1.013123	0.135	0.137	0.988
	0.140014	0.14445		0.146455	0.142391		0.139999	0.142028		0.146	0.144	
CH19	0.092421	0.088548	1.039467	0.0904	0.093657	0.965987	0.092037	0.090656	1.012702	0.095	0.095	0.991
	0.095557	0.09895		0.100358	0.097016		0.097737	0.098749		0.102	0.101	
	0.120782	0.118507	1.019296	0.120806	0.123807	0.980864	0.118857	0.116933	1.017163	0.119	0.122	0.982
	0.114754	0.11698		0.118673	0.117034		0.112222	0.114231		0.116	0.115	
CH18	0.138927	0.136046	1.017202	0.137769	0.140179	0.979801	0.136701	0.134737	1.011396	0.138	0.139	0.985
	0.184213	0.186841		0.189788	0.185533		0.180976	0.18261		0.187	0.184	
	0.077714	0.077616	1.00153	0.076345	0.076619	0.998009	0.074105	0.075669	0.980358	0.076	0.074	1.020
	0.088367	0.088523		0.087086	0.087034		0.085822	0.084214		0.084	0.086	
CH26	0.010475	0.010591	0.998057	0.010832	0.010881	1.006297	0.010492	0.01082	0.976606	0.011	0.011	1.029
	0.012571	0.012642		0.01294	0.013139		0.012861	0.012635		0.013	0.013	
	0.015488	0.015705	0.989976	0.016029	0.015897	1.014153	0.015422	0.015814	0.978488	0.016	0.016	1.025
	0.018015	0.017894		0.01823	0.018581		0.018167	0.017828		0.018	0.018	

Figure 10 Scientific Output: synoptic frame during AMB02

4.4 PLM SIT – Function Status Report

4.4.1 Procedure/ Test sequence

LFI SIT: Function Status Report (Nominal Unit)						0:11:00	
	Function Status Report				1	0:11:00	
		Report Function Status (11 functions)		0:01:00	11	0:11:00	0:11:00

4.4.2 Results and Conclusions

The procedure was run on January the 30th without any problem and the test was finished successfully.

Pass and Fail Criteria

No un-expected event Packets	
No un-expected result of the function status report	

No NCRs have been raised.

4.5 PLM SIT - Switch off the Nominal Unit

4.5.1 Procedure/ Test sequence

LFI SIT: Switch off (Nominal Unit)						0:20:00	
	Switch OFF LFI				1	0:20:00	
		Science De-Activation		0:05:00	1	0:05:00	0:05:00
		RCA De-Activation		0:05:00	1	0:05:00	0:10:00
		LFI to Standby	DAE Set Up to Standby	0:05:00	1	0:05:00	0:15:00
		Switch OFF	Standby to OFF	0:05:00	1	0:05:00	0:20:00

4.5.2 Results and Conclusions

The procedure was run on January the 30th without any problem and the test was finished successfully.

Pass and Fail Criteria

No un-expected event Packets	
No more telemetry coming from LFI	

No NCRs have been raised.

4.6 NON IDEAL FEATURES

4.6.1 TEST DURATION

The duration of the 4 steps during AMB_02 is consistent with the procedure in two cases; in the other two (2nd and 3rd step) durations are 10' and 14' ; however, it does not compromise the test information .

4.6.2 THERMAL DRIFT

A strong thermal drift is observed during the first part of the test (when the other instruments operate). It is measured on the BEU sensors and reflects on the scientific signals, with different shape depending on the channels:
30 and 44 GHz show decreasing Vout 70 GHz show increasing Vout.
It is in agreement with the susceptibility to thermal variations already known from previous tests.
Moreover, this feature impact on the absolute Vout, especially after the DC/DC converters have been switched on again just before AMB_02 (temperature increases on BEU) without waiting for thermalization.

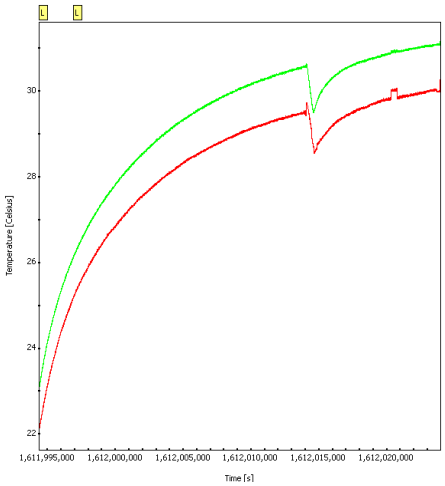

Figure 11 behaviour of readout sensors RBEM1 and LBEM1 on BEU

A digital step is observed in the R-BEM sensor when passing from TYPE 1 to TYPE 5 (no data received during the RBEM step) : this was already observed in the past tests performed in Cannes

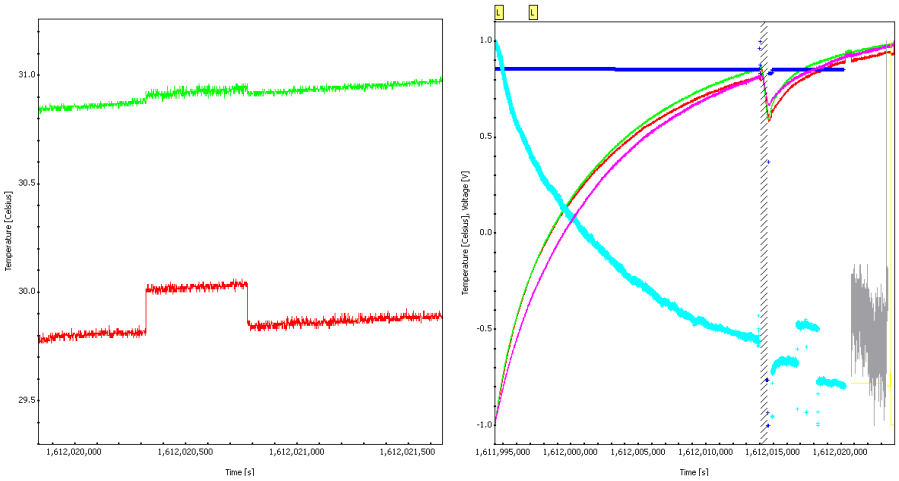

Figure 12 Feature observed on RBEM sensor (increasing) vs signals (decreasing; RCA 25 : TYPE 1 light blue and TYPE5 grey)

4.7 PLM SIT - Switch on LFI in nominal science (Redundant Unit)

4.7.1 Procedure/ Test sequence

LFI SIT: Switch on (Redundant Unit)						**1:00:00**	
	Switch ON LFI				1	**0:39:00**	
		Go to Stand By Mode	OFF to standby	0:32:00	1	0:32:00	0:32:00
		Go to DAE Set Up Mode	Standby to DAE set up	0:07:00	1	0:07:00	0:39:00
	LFI in Normal Science (Warm test Config..)				1	**0:21:00**	
		Setting Telemetry Rate	Nominal Values	0:02:00	1	0:02:00	0:41:00
		Event Packet Enabling		0:02:00	1	0:02:00	0:43:00
		Definition of science Processing Parameters	Naverage set to 256	0:02:00	1	0:02:00	0:45:00
		Changing Processing Type to 1		0:05:00	1	0:05:00	0:50:00
		Spu Connection		0:02:00	1	0:02:00	0:52:00
		Science Activation Type 1		0:04:00	1	0:04:00	0:56:00
		RCA Activation		0:02:00	1	0:02:00	0:58:00
		Set DAE Default configuration		0:02:00	1	0:02:00	1:00:00

At the end of the Procedure LFI will stay in listening mode with HFI and SCS had performed WFT and Health check.

4.7.2 Results and Conclusions

The procedure was run on January the 31st without any problem and the test was finished successfully.

Pass and Fail Criteria

No errors from the REBA HW Self check	
No un-expected event Packets	
REBA Power Consumption within the ranges of expected values	
EEPROM Check Sum passed	
REBA synchronization achieved	
DAE Power Consumption within the ranges of expected values	
DAE Synchronization achieved	
The FEM I Drain Currents obtained from Telemetry are within the ranges expected (5%)	
The DC voltages Outputs (Science Telemetry) are within the ranges expected. (10%)	
No unexpected features in FFT spectrum (Spike, Pop corn noise, currents drops…)	

No NCRs have been raised.

4.8 PLM SIT - Nominal Science with redundant unit

During this step HFI and SCS are performing their WFT. LFI stays in nominal acquisition acquiring data for analysis.
HK parameters (drain currents) are quite stable (within the standard deviation of test AMB_02 performed later with other instruments in monitoring)

4.8.1 Procedure/ Test sequence

No test sequence for LFI is requested to be applied here.

4.8.2 Results and Conclusions

Pass and Fail Criteria

No un-expected event Packets	
REBA Power Consumption within the ranges of expected values	
DAE Power Consumption within the ranges of expected values	
No unexpected features during HFI activity in Scientific signal	
No unexpected features during SCS activity in Scientific signal	

No NCRs have been raised.

4.8.2.1 Currents monitoring during HFI WFT and during SCS-R HC

No evident changes in the drain currents are observed during the activities of other instruments: all changes are well within the standard deviation measured during the LFI AMB_02 itself.

4.9 PLM SIT - LFI Execution of AMB02

4.9.1 Procedure/ Test sequence

LFI SIT: AMB02 execution (Redundant Unit)					3:24:00	
Switch ON LFI - AMB-02				1	3:24:00	
	RCA Activation		0:05:00	1	0:05:00	0:05:00
	Perform DAE Initialization		0:10:00	1	0:10:00	0:15:00
	Wait for thermalization of power groups		0:30:00	1	0:30:00	0:35:00
	Configure DAE (Scwitch ACA on)		0:02:00	1	0:02:00	0:37:00
	Wait for thermalization of FPU		0:25:00	1	0:25:00	1:02:00
	Enable 4KH switching A/C		0:02:00	1	0:02:00	1:04:00
	Acquire data		0:30:00	1	0:30:00	1:34:00
	Change PS stauts to one on B/D		0:02:00	1	0:02:00	1:36:00
	Acquire data		0:30:00	1	0:30:00	2:06:00
	Disable 4KH switching A/C		0:02:00	1	0:02:00	2:08:00
	Enable 4KHz switching B/D		0:02:00	1	0:02:00	2:10:00
	Change PS status to zero on A/C		0:02:00	1	0:02:00	2:12:00
	Acquire data		0:30:00	1	0:30:00	2:42:00
	Change PS status to one on A/C		0:02:00	1	0:02:00	2:44:00
	Acuire Data		0:30:00	1	0:30:00	3:14:00

4.9.2 Results and Conclusions

The procedure was run on January the 31st without any problem and the test was finished successfully.
As for the Nominal Unit (par. 4.3.2), also here for the Redundant Unit, the test sequence the DAE was switched off at the very beginning of the AMB-02.

Pass and Fail Criteria

No un-expected event Packets	
The FEM I Drain Currents obtained from Telemetry are within the ranges expected (5%)	
The DC voltages Outputs (Science Telemetry) are within the ranges expected. (10%)	
No unexpected features in FFT spectrum (Spike, Pop corn noise, currents drops…)	
Every ACA and every P/S is responding to Biases stimulus as expected.	

No NCRs have been raised.

DATA are stored in the three files AMB203 , AMB203 restored, and AMB 204 . The AMB_203_restored contains the part of TQL session was missing because of a TQL switch off. Data have been restored from SCOS session by LFI-DPC

RCA #	Detector ID	SCOS Parameter	Measured AMB_202
CH27	00	LM051322	15.46
	01	LM052322	15.14
	02	LM053322	15.68
	03	LM054322	15.2
CH24	04	LM055322	28.88
	05	LM056322	28.55
	06	LM057322	29.44
	07	LM058322	29.41
CH21	08	LM059322	20.31
	09	LM060322	17.86
	0A	LM061322	17.88
	0B	LM062322	19.4
CH22	0C	LM063322	19.16
	0D	LM064322	18.72
	0E	LM065322	18.85
	0F	LM066322	18.8
CH23	10	LM067322	18.16
	11	LM068322	19.36
	12	LM069322	17.87
	13	LM070322	18.27
CH25	14	LM071322	26.87
	15	LM072322	26.35
	16	LM073322	27.41
	17	LM074322	27.8
CH28	18	LM075322	17.09
	19	LM076322	16.82
	1A	LM077322	16.96
	1B	LM078322	16.62
CH20	1C	LM079322	19.93
	1D	LM080322	19.93
	1E	LM081322	19.71
	1F	LM082322	20.05
CH19	20	LM083322	19.12
	21	LM084322	19.95
	22	LM085322	19.86
	23	LM086322	20.09
CH18	24	LM087322	20.06
	25	LM088322	17.98
	26	LM089322	16.33
	27	LM090322	17.97
CH26	28	LM091322	27.1
	29	LM092322	26.55
	2A	LM093322	26.8
	2B	LM094322	26.4

Figure 13 currents during AMB02

Id w.r.t WFT				
CH	<00>	<01>	<10>	<11>
CH27	0.19	0.87	0.32	0.13
CH24	0.35	0.25	0.34	0.31
CH21	0.35	0.45	0.39	0.52
CH22	0.58	0.32	0.48	0.75
CH23	0.67	0.73	0.56	0.55
CH25	0.37	0.38	0.44	0.47
CH28	0.12	0.06	0.06	0.06
CH20	0.50	0.25	0.31	0.40
CH19	0.26	0.30	0.30	0.15
CH18	0.25	-0.44	-0.37	-0.22
CH26	0.26	0.08	0.07	0.04

Id w.r.t AMB-02-N				
CH	<00>	<01>	<10>	<11>
CH27	0.06	0.13	0.06	0.00
CH24	0.14	0.00	0.00	0.00
CH21	0.10	0.06	0.00	0.05
CH22	0.00	-0.05	0.05	0.05
CH23	0.06	0.10	0.00	0.05
CH25	0.11	0.08	0.15	0.18
CH28	0.06	0.06	0.12	0.06
CH20	0.05	0.00	0.00	0.05
CH19	0.00	0.05	0.10	0.05
CH18	0.10	0.06	0.00	0.06
CH26	0.15	0.11	0.11	0.11

Figure 14 FEM drain currents comparison w.r.t. WFT test (LEFT) and w.r.t. AMB-02 performed with Nominal REBA

RCA #	STEP 0		STEP 1		STEP2		STEP3		STEP4	
CH27	-3.4	-3.3	-3.5	-3.5	-2.8	-2.7	-2.7	-2.7	-2.7	-2.7
	-3.3	-3.3	-3.5	-3.5	-2.8	-2.8	-2.7	-2.7	-2.7	-2.7
	-3.2	-3.1	-3.4	-3.3	-2.7	-2.6	-2.6	-2.5	-2.5	-2.5
	-3.2	-3.2	-3.4	-3.3	-2.7	-2.7	-2.6	-2.6	-2.6	-2.6
CH24	-1.6	-1.5	-1.4	-1.9	-1.6	-1.4	-1.1	-1.4	-1.9	-1.4
	-1.2	-1.5	-2.0	-2.1	-1.1	-1.1	-0.8	-0.8	-1.4	-1.5
	-0.2	0.0	0.2	0.3	0.4	0.3	0.0	0.0	-0.2	-0.1
	-0.3	-0.3	-0.6	-0.6	0.2	0.2	0.2	0.2	-0.4	-0.5
CH21	-3.0	-2.8	-1.1	-0.9	-2.1	-2.0	-2.8	-2.5	-3.0	-2.9
	-2.8	-2.8	-1.1	-1.1	-2.1	-2.0	-2.6	-2.7	-2.7	-2.8
	-2.7	-2.8	-1.1	-1.1	-2.1	-2.0	-2.7	-2.8	-2.6	-2.7
	-2.5	-2.4	-0.7	-0.7	-1.6	-1.7	-2.2	-2.1	-2.4	-2.3
CH22	-2.7	-2.7	-1.1	-1.1	-2.0	-2.0	-2.6	-2.6	-2.6	-2.6
	-3.2	-3.1	-1.5	-1.5	-2.3	-2.4	-2.9	-2.9	-3.0	-2.9
	-3.6	-3.6	-1.8	-1.7	-2.7	-2.6	-3.1	-3.3	-3.4	-3.5
	-3.7	-3.7	-2.1	-2.0	-2.8	-2.8	-3.4	-3.3	-3.5	-3.4
CH23	-2.6	-2.6	-1.5	-1.5	-2.1	-2.1	-2.6	-2.5	-2.6	-2.6
	-3.2	-3.2	-2.0	-2.0	-2.6	-2.6	-3.2	-3.1	-3.1	-3.1
	-3.4	-3.4	-1.7	-1.7	-2.5	-2.5	-3.2	-3.2	-3.2	-3.2
	-3.4	-3.4	-1.9	-1.8	-2.7	-2.7	-3.2	-3.2	-3.3	-3.2
CH25	-5.3	-4.9	-5.6	-5.4	-4.8	-4.8	-5.3	-4.9	-4.8	-4.9
	-6.0	-5.4	-5.6	-5.5	-4.9	-4.8	-5.2	-5.2	-5.1	-4.9
	-1.4	-2.5	-2.1	-2.1	-1.7	-2.1	-0.9	-2.9	-3.0	-0.6
	-1.9	-2.4	-2.6	-3.7	-2.9	-2.0	-2.5	-3.2	-2.6	-2.9
CH28	-3.8	-3.8	-3.7	-3.7	-3.1	-3.0	-3.1	-3.1	-3.1	-3.1
	-3.7	-3.7	-3.6	-3.6	-3.0	-3.0	-3.1	-3.1	-3.1	-3.1
	-3.5	-3.5	-3.5	-3.5	-2.9	-2.9	-2.8	-2.8	-3.0	-3.0
	-3.5	-3.5	-3.5	-3.5	-3.0	-3.0	-2.9	-2.9	-3.1	-3.1
CH20	-2.6	-2.6	-1.4	-1.3	-2.0	-1.9	-2.5	-2.4	-2.5	-2.5
	-2.5	-2.5	-1.4	-1.4	-1.9	-1.9	-2.4	-2.4	-2.4	-2.3
	-2.8	-2.7	-1.8	-1.8	-2.2	-2.1	-2.6	-2.6	-2.7	-2.7
	-3.0	-2.9	-1.9	-1.9	-2.3	-2.1	-2.7	-2.7	-2.8	-2.9
CH19	-2.6	-2.6	-1.2	-1.3	-1.9	-1.9	-2.5	-2.5	-2.7	-2.7
	-2.5	-2.5	-1.3	-1.3	-1.8	-1.8	-2.3	-2.3	-2.4	-2.4
	-2.7	-2.7	-1.6	-1.6	-2.2	-2.1	-2.5	-2.5	-2.7	-2.7
	-2.5	-2.5	-1.5	-1.4	-2.0	-2.0	-2.4	-2.4	-2.6	-2.5
CH18	-2.5	-2.5	-1.4	-1.3	-2.0	-1.9	-2.4	-2.3	-2.6	-2.6
	-2.5	-2.5	-1.5	-1.4	-2.0	-2.0	-2.4	-2.4	-2.5	-2.5
	-2.3	-2.3	-1.2	-1.2	-1.8	-1.8	-2.2	-2.3	-2.4	-2.4
	-2.2	-2.3	-1.3	-1.3	-1.7	-1.7	-2.1	-2.0	-2.2	-2.2
CH26	-4.3	-3.7	-4.3	-4.3	-3.8	-3.8	-4.1	-4.2	-4.3	-4.1
	-3.9	-4.6	-4.6	-5.3	-3.7	-4.2	-3.8	-4.3	-3.9	-4.4
	-4.8	-4.6	-4.3	-4.3	-4.0	-3.9	-4.0	-3.8	-4.4	-4.3
	-4.8	-5.1	-4.4	-4.6	-4.1	-4.2	-3.9	-3.9	-4.2	-4.8

Figure 15 Vout during AMB_02: comparison with AMB_02 NOMINAL

RCA #	Detector ID		SCOS Parameter	VG1		VG2		Vd		I1		I2	
				DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX
CH27	00	00	LP001320	250	FA	130	82	200	C8	205	CD	205	CD
	01	01	LP002320	250	FA	130	82	200	C8	205	CD	205	CD
	02	10	LP003320	250	FA	130	82	200	C8	205	CD	205	CD
	03	11	LP004320	250	FA	130	82	200	C8	205	CD	205	CD
CH24	04	00	LP005320	241	E6	241	E5	255	FF	205	CD	205	CD
	05	01	LP006320	241	E6	241	E5	255	FF	205	CD	205	CD
	06	10	LP007320	241	E6	241	E6	255	FF	205	CD	205	CD
	07	11	LP008320	241	E6	241	E6	255	FF	205	CD	205	CD
CH21	08	00	LP009320	217	D9	178	B2	255	FF	255	FF	255	FF
	09	01	LP010320	218	DA	163	A3	255	FF	255	FF	255	FF
	0A	10	LP011320	133	85	178	B2	255	FF	255	FF	255	FF
	0B	11	LP012320	151	97	163	A3	255	FF	255	FF	255	FF
CH22	0C	00	LP013320	166	A6	172	AC	255	FF	255	FF	255	FF
	0D	01	LP014320	142	8E	124	7C	255	FF	255	FF	255	FF
	0E	10	LP015320	154	9A	124	7C	255	FF	255	FF	255	FF
	0F	11	LP016320	142	8E	121	79	255	FF	255	FF	255	FF
CH23	10	00	LP017320	162	A2	130	82	255	FF	255	FF	255	FF
	11	01	LP018320	148	94	127	7F	255	FF	255	FF	255	FF
	12	10	LP019320	141	8D	133	85	255	FF	255	FF	255	FF
	13	11	LP020320	183	B7	177	B1	255	FF	255	FF	255	FF
CH25	14	00	LP021320	242	F2	242	F2	255	FF	205	CD	205	CD
	15	01	LP022320	242	F2	242	F2	255	FF	205	CD	205	CD
	16	10	LP023320	242	F2	242	F2	255	FF	205	CD	205	CD
	17	11	LP024320	242	F2	242	F2	255	FF	205	CD	205	CD
CH28	18	00	LP025320	247	F7	128	80	200	C8	206	CE	205	CD
	19	01	LP026320	247	F7	128	80	200	C8	205	CD	206	CE
	1A	10	LP027320	246	F6	128	80	200	C8	205	CD	206	CE
	1B	11	LP028320	247	F7	128	80	200	C8	206	CE	205	CD
CH20	1C	00	LP029320	151	97	127	7F	255	FF	255	FF	255	FF
	1D	01	LP030320	112	70	172	AC	255	FF	255	FF	255	FF
	1E	10	LP031320	127	7F	154	9A	255	FF	255	FF	255	FF
	1F	11	LP032320	145	91	172	AC	255	FF	255	FF	255	FF
CH19	20	00	LP033320	109	6D	114	72	255	FF	255	FF	255	FF
	21	01	LP034320	157	9D	148	94	255	FF	255	FF	255	FF
	22	10	LP035320	172	AC	174	AE	255	FF	255	FF	255	FF
	23	11	LP036320	115	73	168	A8	255	FF	255	FF	255	FF
CH18	24	00	LP037320	177	B1	132	84	255	FF	255	FF	255	FF
	25	01	LP038320	135	87	180	B4	255	FF	255	FF	255	FF
	26	10	LP039320	156	9C	147	93	255	FF	255	FF	255	FF
	27	11	LP040320	165	A5	129	81	255	FF	255	FF	255	FF
CH26	28	00	LP041320	241	F1	242	F2	255	FF	205	CD	205	CD
	29	01	LP042320	242	F2	241	F1	255	FF	205	CD	205	CD
	2A	10	LP043320	241	F1	241	F1	255	FF	205	CD	205	CD
	2B	11	LP044320	241	F1	241	F1	255	FF	205	CD	205	CD

Figure 16 Bias synoptic frame during AMB02-RED

RCA #	STEP1		SYMM	STEP2		SYMM	STEP3		SYMM	STEP4		SYMM
	A/C SW SKY	00 REF		A/C SW SKY	01 REF		B/D SW SKY	00 REF		B/D SW SKY	10 REF	
CH27	1.174	1.158	1.000	1.171	1.147	1.007	1.158	1.143	1.000	1.164	1.140	1.007
	1.244	1.228		1.230	1.223		1.226	1.212		1.225	1.217	
	1.096	1.095	0.992	1.100	1.080	1.010	1.082	1.076	0.998	1.092	1.077	1.004
	0.913	0.896		0.899	0.898		0.895	0.885		0.899	0.892	
CH24	0.005	0.005	0.991	0.005	0.005	1.009	0.005	0.005	0.986	0.005	0.005	1.015
	0.006	0.006		0.006	0.006		0.006	0.006		0.006	0.006	
	0.004	0.004	0.994	0.004	0.004	1.007	0.004	0.004	0.999	0.004	0.004	1.003
	0.006	0.006		0.006	0.006		0.006	0.006		0.006	0.006	
CH21	0.033	0.032	1.025	0.033	0.034	0.972	0.033	0.032	1.023	0.033	0.034	0.974
	0.030	0.031		0.032	0.031		0.030	0.031		0.032	0.031	
	0.062	0.060	1.021	0.062	0.063	0.978	0.063	0.062	1.008	0.064	0.065	0.989
	0.058	0.059		0.060	0.059		0.060	0.061		0.062	0.062	
CH22	0.082	0.080	1.036	0.082	0.085	0.973	0.083	0.083	1.017	0.085	0.087	0.991
	0.090	0.094		0.096	0.094		0.093	0.096		0.098	0.098	
	0.076	0.073	1.038	0.076	0.079	0.958	0.077	0.075	1.012	0.078	0.080	0.981
	0.091	0.094		0.097	0.093		0.093	0.094		0.098	0.097	
CH23	0.151	0.151	1.001	0.150	0.150	1.001	0.147	0.149	0.984	0.150	0.147	1.018
	0.182	0.182		0.180	0.180		0.179	0.176		0.175	0.179	
	0.188	0.190	0.993	0.189	0.189	1.005	0.198	0.200	0.991	0.198	0.197	1.006
	0.093	0.093		0.092	0.093		0.097	0.097		0.096	0.097	
CH25	0.031	0.032	0.983	0.033	0.032	1.017	0.031	0.032	0.956	0.032	0.031	1.048
	0.029	0.029		0.029	0.030		0.029	0.028		0.028	0.030	
	0.008	0.008	0.978	0.008	0.008	1.021	0.008	0.008	0.985	0.008	0.008	1.018
	0.006	0.006		0.006	0.006		0.006	0.006		0.006	0.006	
CH28	0.584	0.575	0.996	0.590	0.575	1.004	0.577	0.574	0.987	0.587	0.566	1.013
	0.773	0.758		0.773	0.764		0.772	0.751		0.763	0.760	
	0.731	0.724	0.994	0.735	0.718	1.005	0.723	0.716	0.995	0.731	0.715	1.005
	0.663	0.648		0.659	0.649		0.657	0.642		0.656	0.646	
CH20	0.130	0.126	1.031	0.130	0.134	0.972	0.130	0.127	1.023	0.131	0.134	0.978
	0.116	0.120		0.123	0.119		0.117	0.119		0.123	0.120	
	0.137	0.133	1.030	0.136	0.140	0.971	0.136	0.135	1.013	0.139	0.140	0.988
	0.143	0.147		0.150	0.145		0.144	0.146		0.150	0.149	
CH19	0.094	0.090	1.039	0.092	0.095	0.966	0.094	0.093	1.013	0.097	0.098	0.991
	0.097	0.100		0.102	0.099		0.100	0.101		0.105	0.104	
	0.123	0.120	1.019	0.123	0.126	0.981	0.122	0.120	1.018	0.123	0.125	0.982
	0.116	0.119		0.121	0.119		0.115	0.117		0.119	0.118	
CH18	0.141	0.138	1.017	0.141	0.143	0.980	0.140	0.138	1.012	0.141	0.143	0.985
	0.187	0.190		0.194	0.189		0.185	0.187		0.192	0.188	
	0.079	0.079	1.001	0.078	0.078	0.998	0.076	0.077	0.980	0.078	0.076	1.020
	0.090	0.090		0.089	0.089		0.088	0.086		0.086	0.088	
CH26	0.011	0.011	1.002	0.011	0.011	1.009	0.011	0.011	0.979	0.011	0.011	1.032
	0.013	0.013		0.013	0.014		0.013	0.013		0.013	0.014	
	0.016	0.016	0.991	0.017	0.017	1.016	0.016	0.016	0.979	0.017	0.016	1.029
	0.019	0.019		0.019	0.019		0.019	0.019		0.019	0.019	

Figure 17 Voltage synoptic frame during AMB02-RED

4.10 PLM SIT - Switch off the Redundant Unit

4.10.1 Procedure/ Test sequence

LFI SIT: Switch off (Redundant Unit)					0:20:00	
Switch OFF LFI				1	0:20:00	
	Science De-Activation		0:05:00	1	0:05:00	0:05:00
	RCA De-Activation		0:05:00	1	0:05:00	0:10:00
	LFI to Standby	DAE Set Up to Standby	0:05:00	1	0:05:00	0:15:00
	Switch OFF	Standby to OFF	0:05:00	1	0:05:00	0:20:00

4.10.2 Results and Conclusions

The procedure was run on January the 31st without any problem and the test was finished successfully

Pass and Fail Criteria

No un-expected event Packets	
No more telemetry coming from LFI	

No NCRs have been raised.

THE comparison between AMB_02 performed with Nominal and Redundant REBA showed that:

- Drain currents measured with the Redundant Reba unit are compliant with requirements and with Nominal Reba
- The Vout are consistent with those measured before with the Nominal REBA
- The same thermal drift is observed as in the previous data

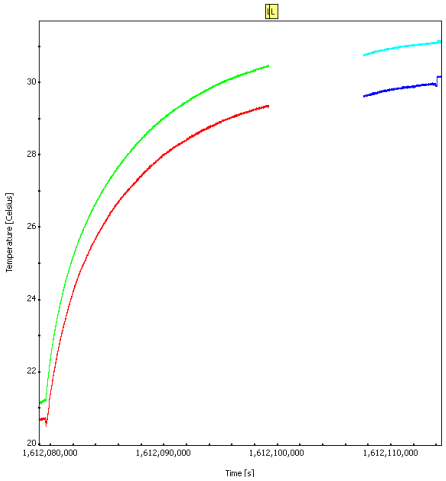

Figure 18 Thermal drift during test AMB_203 and AMB_204: it is consistent with drift during AMB202

4.11 OTHER FEATURES

Here follows some features have been kept under monitoring because observed sometimes in previous tests at ILT in Milan or at Spacecraft Level in Cannes or in CSL.

4.11.1 Current drops in RCA 23

No evidence of drops during the whole PLMSIT

4.11.2 Scientific output crossing in RCA 25

No evidence of signal crossing: crossing was found to be dependent on the signal level: during PLM-SIT the RCA 25 Vout is quite lower than during Tests performed in Cannes and probably this feature has no way to be triggered.

4.11.3 SKY REF separation in RCA 25

In the SIT performed in Cannes RCA25 showed a bad separation (sky-ref) depending on the combination PS/ 4KHz. During PLM-SIT, as demonstrated by figures below, separation is instead very clear

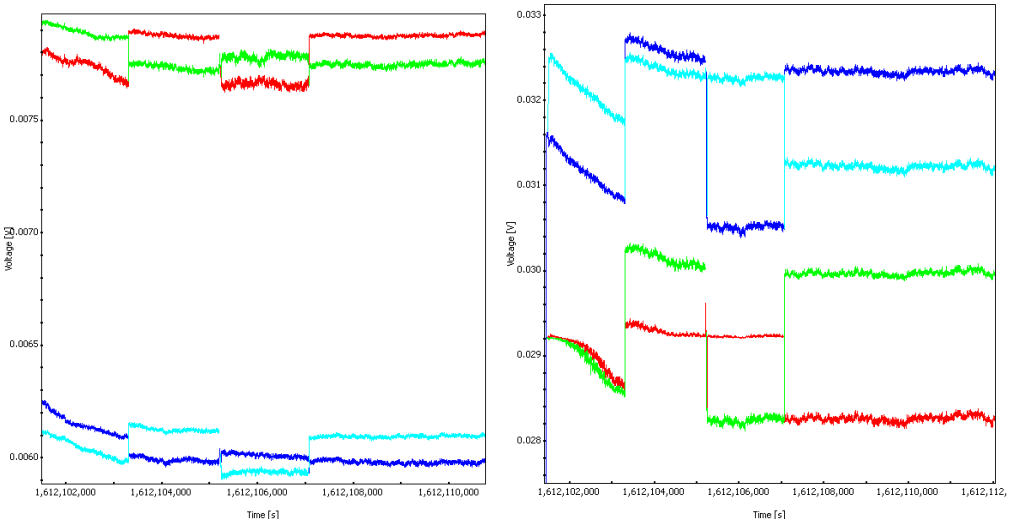

Figure 19 Channel RCA25-Main on the left and RCA25-SIDE on the right. RCA25-00 below Sky ref signals are well separated during the whole AMB-02

4.11.4 signal and housekeeping drift caused by thermal drift

An overall drift is observed on Drain currents (decreasing for all the RCAs) and on Scientific voltage, depending on the channels: in 30 and 44 GHz channels voltage decrease while in 70 GHz channels increase

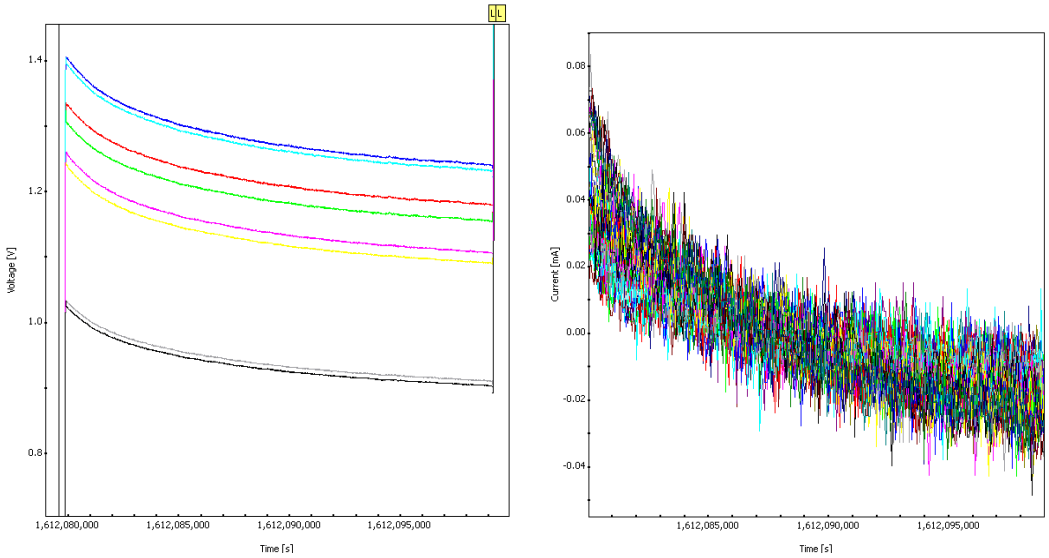

Figure 20 Signal drift (RCA 27) and Id overall drift)(all channels) due to thermalization.

This can impact on the quality of comparison with previous tests although the thermal condition of Back End Unit, apart of the different shape of the thermal curve, is not so far , as displayed by the picture below

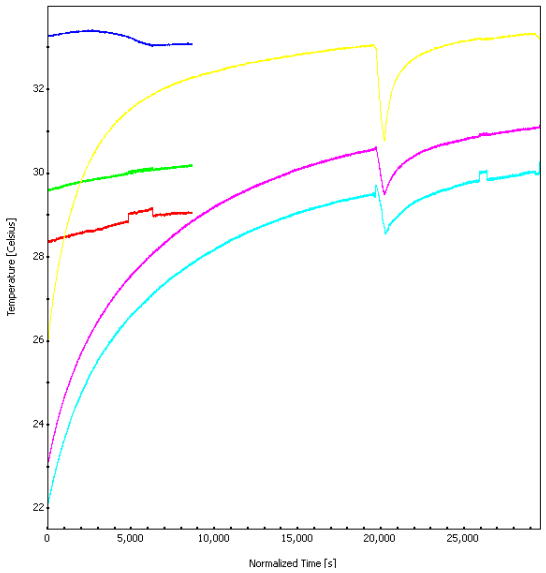

Figure 21 comparison between RBEM, LBEM, SCIENCE 1 readout sensors during SIT in Cannes (green, red and blue curves) and PLM-SIT. It is also evident in both the digital step in LBEM sensor when nominal science is activated and deactivated

4.11.5 POP CORN NOISE ON RCA 24

Observed on diode R0D1: has the same features (amplitude and shape) already observed during previous functional tests at ILT and in CANNES

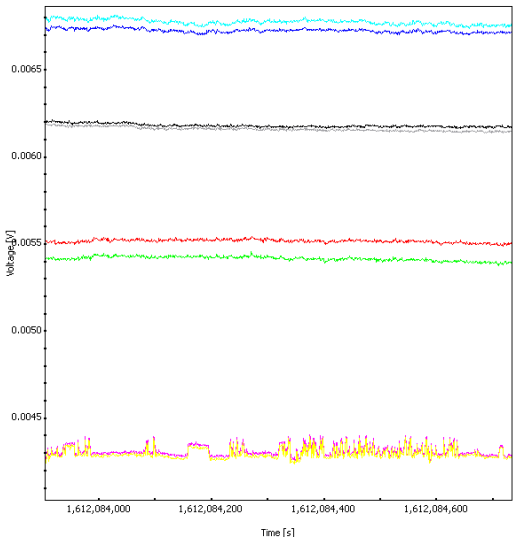

Figure 22 pop corn noise on diode R0D1 of RCA 24

4.11.6 RCA 28 WRONG SKY-REG TAG

As already traced in the previous tests , RCA 28 suffers a wrong assignation of tags when switching from step PS 00 to 01 with 4KHz set to A/C switching . An NC was opened in the past and closed 'use as is' changing the default of the 4KHz / PS combination. This feature is evident in the picture below, where the signal does not change level when changing PS status.

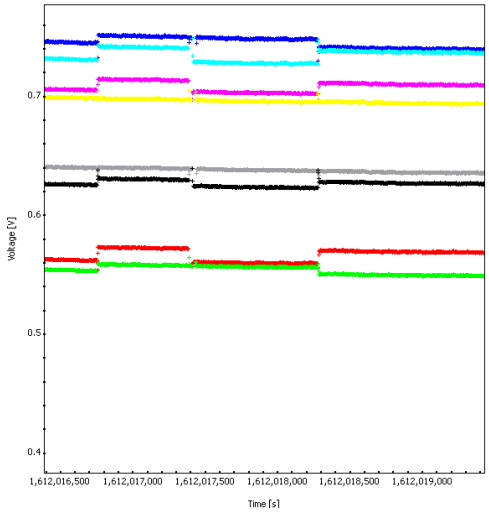

Figure 23 RCA 28: wrong TAG sky/ref assignation when PS and 4KHz are changed

4.11.7 DATA

At first, quick look (from TQL) and offline analysis (by LIFE suite) it seemed that some data were missing in the scientific output, as shown by pictures below: however, a deeper analysis showed that it depends on false problems at TQL level (a function limiting the rate of displayed packets was enabled) and at LIFE level, were the analysis to correct the problem is still ongoing.

However, analysis from Scientific packets has shown no missing data apart where the DAE is switched off because of the procedure (see comment in par. 4.3.2 and 4.9.2, change from TYPE1 to TYPE 5 modes).

This is shown in Figure 26, that shows the Source Sequence Counter versus the On Board Time. This plots highlights just two stops in the SSC that are correlated in the known telemetry stops due to test activity, but shows no sign of missing scientific data during the test.

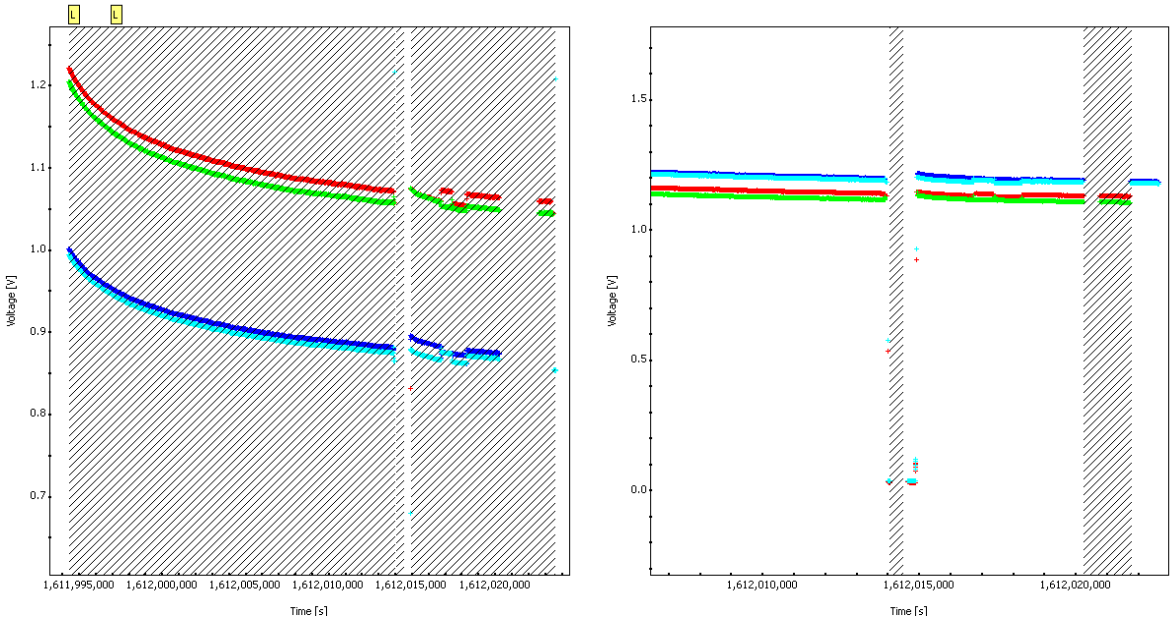

Figure 24 problem in the LIFE suite showing data lost (left side) where they are not missing; correct realization on the right side where DAE was switched off or mode changed from TYPE1 to TYPE5

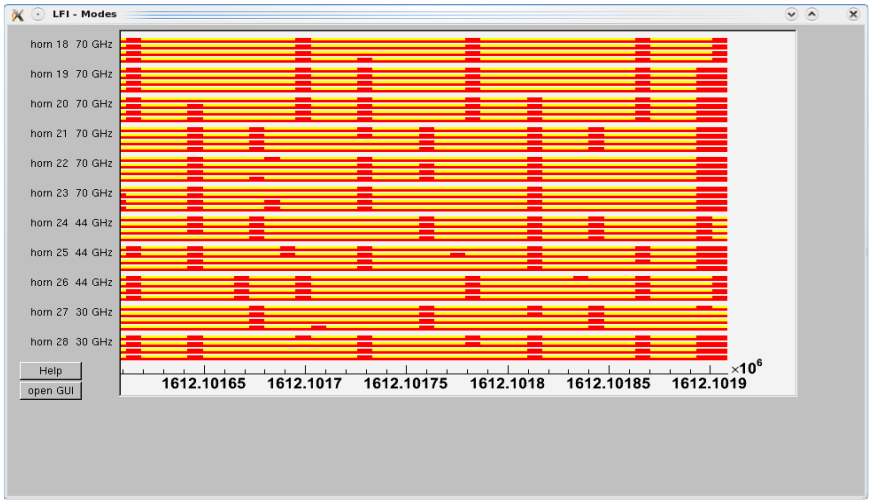

Figure 25 TQL : apparent data LOSS

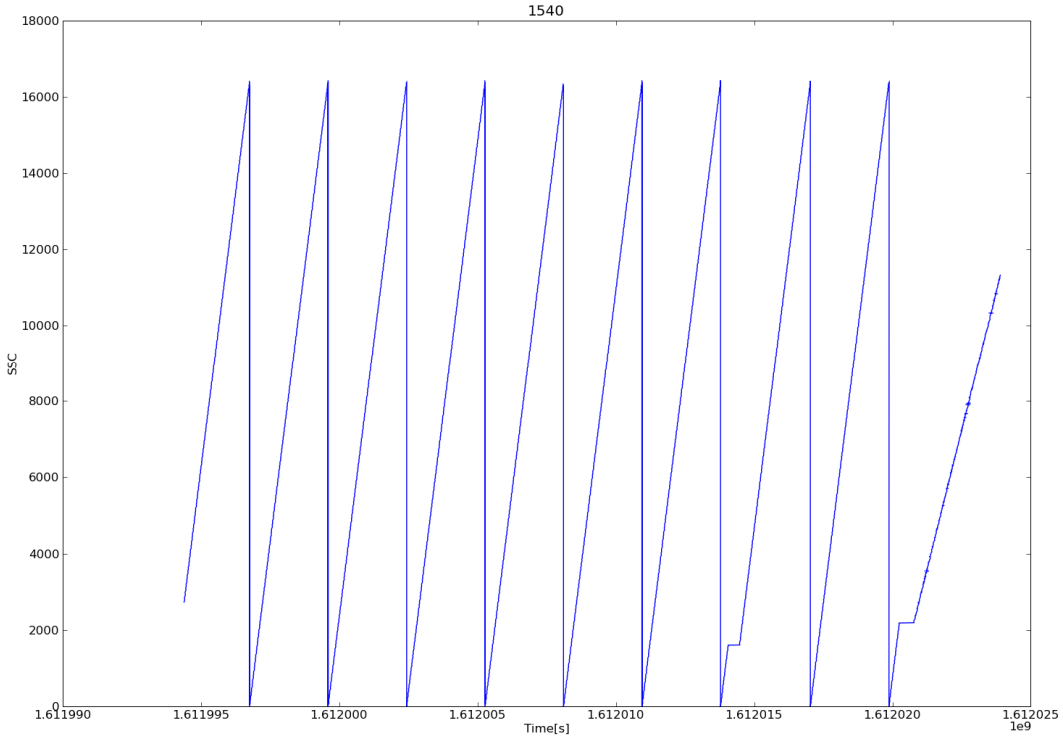

Figure 26 TQL : Source Sequence counter as a function of the OBT

4.11.8 Spurious frequency spikes

Spurious “1 Hz” frequency spikes have been characterised in frequency and amplitude at the beginning and at the end of the PLM-SIT test (sessions

AMB_0202 and AMB_0203), and compared with spikes acquired during Cannes tests and CSL tests (Ph 5-02-c, Spike 02 test).

In attachment to this report we provide amplitude spectra plots acquired in both sessions (see files amb_0202_spikes.pdf and amb_0203_spikes.pdf) that also reports the LIFE script used to generate the plots.

We also provide a series of 44 plots (spike_plots.pdf) that compare spikes from the PLM SIT test to spikes acquired in Cannes and during the CSL TVTB tests.

In summary the main results are:

Main harmonics 1 Hz frequency spikes are stable throughout the PLM SIT test. Higher harmonics show small variability, but this is expected.
Main harmonics of 1 Hz frequency spikes are reproducible between Cannes, CSL TVTB and CSL PLM SIT tests. Higher harmonics in PLM SIT are generally smaller or non-existent with respect to Cannes and CSL TVTB
The anomalous spike in LFI22M-00 and LFI22M-01 is still present and reproducible
Spikes disappear (in few cases they are present, but at a negligible level) in differenced datastreams, as expected.

No unexpected features regarding 1Hz spikes have been found during CSL PLM-SIT tests

4.11.9 Noise / spikes in signal corresponding to some SCS activities

A deeper offline analysis is required to map these features. This paragraph will be completed in the next Issue.

4.11.10 Thermal variation in BEM sensors when science is disabled

As observed in the previous tests performed in Cannes, a like digital variation exhibits in LBEM and RBEM sensors when science is activated – deactivated.
This feature was hence expected (possible explanation given in WFT test report PL-LFI-PST-RP-023) and here is just monitored (displayed in previous Figure 11)

5 Conclusions

The first part of the test (Nominal REBA) was performed without major problems but some procedurals as the duration of AMB_02, the BEU thermalization. No new features have been observed.
At a first look some data losses have been observed, especially on channel RCA 27: however they revealed to be a false problem.
All HK parameters are in agreement with specifications.
LNAs functionality is in agreement with what already known from previous tests.
No major changes are observed in the time the LFI is still with other instruments are operating.

The second part of the test was performed with the Redundant REBA without major problems. No new features have been observed.
All HK parameters are in agreement with specifications.
LNAs functionality is in agreement with what already known from previous tests.
No major changes are observed in the time the LFI is still with other instruments are operating.

For what regards the success criteria of PLMSIT, they can be summarized as follows:

· No generation of (5,1), (5,2), (5,4) and (1,8) telemetry: OK
· No loss of data: OK

· Fulfillment of the instruments success criteria as defined in [RD-5] and [RD-7]:
− No un-expected event Packets: OK
− Power Consumption of REBA within the ranges of expected values: OK
− Power Consumption of RAA within the ranges of expected values: OK

From the AMB 02 execution the following pass/fail criteria are followed:
− The FEM I Drain Currents obtained from Telemetry are within the ranges expected (5%): NOK (See note #1)
− The DC voltages Outputs (Science Telemetry) are within the ranges expected (10%): NOK (See note #2)
− No unexpected features in FFT spectrum (Spike, Pop corn noise, currents drops…): OK

Note #1: drain currents are within the expected limits (±5%) for all the LFI channels apart from LFI18S2 which is about 9% higher compared to the expected value (see Figure 4). This is a known anomaly since the SOVT1 test (before the cryo-test campaign, see NC 17799 closed with "Use as is") that has not been explained yet, but that has not been seen at cold conditions.

From the main features of this anomaly (higher drain current and lower voltage output, see Note #2) it seems possible that the anomaly indicates gain oscillations triggered by still unknown conditions.

Although we do not expect this behaviour to affect nominal cold operations we recommend to run a dedicated test in warm conditions before the PLM SIT at Kourou in which the LFI18S2 LNA is biased in a controlled way in order to pinpoint the conditions at which this anomaly is triggered.

Note #2: Voltage outputs of all the 44 GHz channels and of LFI18S-10 and LFI18S-11 are not within the expected limits of ±10% (see Figure 6).

Results from data analysis shown in Figure 7 and Figure 8 show that for the 44 GHz receivers the effect is largely due to a difference in the BEM offset for these receiver that is consistent with the different BEU temperature compared to Cannes and with the BEM offset temperature response measured at unit level (~ - 0.75 mV/K). After correction for the BEM offset a small discrepancy still remains (< 10%), which is still under investigation but that is considered minor.

The same analysis shows that the discrepancy for LFI18S-10 and LFI18S-11 is not correlated with the BEM offset (which is repeatable between PLM-SIT at Cannes and CSL) but is very likely to be caused by the drain current anomaly described in Note #1.