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LFI Project System Team

Planck LFI

TITLE: **Quick Look Data Analysis Of LFI Spike Tests during EMC tests**

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CHANGE RECORD

Issue	Date	Sheet	Description of Change	Release
0.1	February	All	First Draft of Document	Draft
1.0	22th April	All	First Issue of Document	1.0

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 Spike test requested by LFI IOT at system level. Being the tests foreseen to be performed in two slots during the night shift in the middle of EMC/Autocompatibility tests the document is divided in two sets.
Each set is dedicated to a single shift and it is divided in two different 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 2.0.787
LFI Gateway Version V0R9P1
TQL 3.1.2
LIFE Machine version OM 3.00

LFI Personnel involved during the test is:

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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 2.1

[RD3] LFI Warm Functional Test Procedure (WFT)
PL-LFI-PST-PR-017_2_1

[RD4] Combined LFI EMC Tests at System Level
PL-LFI-PST-PR-020

[RD5] Proposal for LFI test dedicated to characterize New Spikes in the FFT spectrum of Scientific Data
PL-LFI-PST-TN-080

4 Spike Test Execution

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

4.1 First Slot FEU on

The test has been done using the nominal unit but the results could be used also for the redundant unit. The slot starts from the EMC configuration tests and it stops in the same configuration in order to guarantee the continuity of the EMC tests.

4.1.1 Procedure/ Test sequence

Spike Test Part 2					7.52.00	
Preparation to Test configuration				1	**0.17.00**	
	Check DAE Configuration	IOT Confirm	0.05.00	1	0.05.00	0.05.00
	Stop Monitor Function		0.02.00	1	0.02.00	0.07.00
	Stop Calibration Channel		0.02.00	1	0.02.00	0.09.00
	Science De-Activation		0.02.00	1	0.02.00	0.11.00
	Definition of science Processing Parameters	Naverage set to 256	0.02.00	1	0.02.00	0.13.00
	Changing Processing Type to 1		0.02.00	1	0.02.00	0.15.00
	Science Activation Type 1		0.02.00	1	0.02.00	0.17.00
Test Execution (part 2)				1	**7.16.00**	
		Acquire data	1.00.00	1	1.00.00	1.17.00
	Change PS status on A/C	Set P/S to zero status	0.02.00	1	0.02.00	1.19.00
		Acquire data	1.00.00	1	1.00.00	2.19.00
	Disable 4KHz switching on B/D		0.02.00	1	0.02.00	2.21.00
	Enable 4KHz switching on A/C		0.02.00	1	0.02.00	2.23.00
		Acquire data	1.00.00	1	1.00.00	3.23.00
	Change PS Status on B/D		0.02.00	1	0.02.00	3.25.00
		Acquire data	1.00.00	1	1.00.00	4.25.00
	Disable 4KHz switching		0.02.00	1	0.02.00	4.27.00
		Acquire data	1.00.00	1	1.00.00	5.27.00
	Disable HK DAE Sequencer	LC064320 with no parameters	0.02.00	1	0.02.00	5.29.00
		Acquire data	1.00.00	1	1.00.00	6.29.00
	Enable 4KHz switching on B/D		0.02.00	1	0.02.00	6.31.00
	Change Ps Status on A/C	Set Status to 1	0.02.00	1	0.02.00	6.33.00
		Acquire data	1.00.00	1	1.00.00	7.33.00
Recovering EMC configuration				1	**0.19.00**	
	Enable HK DAE Sequencer	LC063320 with no parameters	0.02.00	1	0.02.00	7.35.00
	Science De-Activation		0.02.00	1	0.02.00	7.37.00
	Definition of science Processing Parameters	Naverage set to Nominal	0.02.00	1	0.02.00	7.39.00
	Changing Processing Type to 5		0.02.00	1	0.02.00	7.41.00
	Science Activation Type 5		0.02.00	1	0.02.00	7.43.00
	Start Channel Switching		0.02.00	1	0.02.00	7.45.00
	Start Monitor function		0.02.00	1	0.02.00	7.47.00
	Check DAE Configuration	IOT Confirm	0.05.00	1	0.05.00	7.52.00

During the execution of the procedure LFI IOT checks the functionality of the LFI instrument.

4.1.2 Results and Conclusions

The procedure has run on the 5th of February without any problem and the test has finished successfully.
The data collected are divided in different slots:

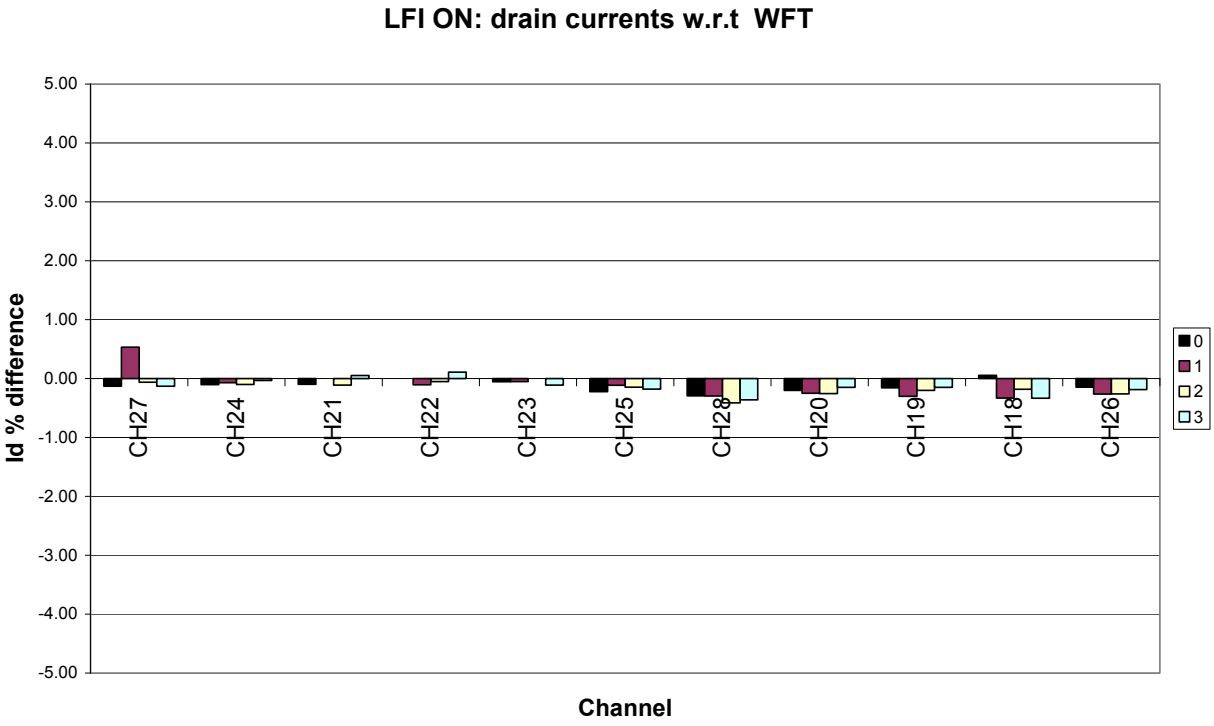
- AMB_0121 (4KHz enabled in B/D and A/C status set to 1)
- AMB_0122 (4KHz enabled in B/D and A/C status set to 0)
- AMB_0124 (4KHz enabled in A/C and B/D status set to 0)
- AMB_0125 (4KHz enabled in A/C and B/D status set to 1)
- AMB_0126 (4KHz disabled)
- AMB_0127 (4KHz disabled and HK sequence disabled)
- AMB_0128 (4KHz enabled in B/D and A/C status set to 1 and HK sequencer disabled)
- AMB_0130 (Back to EMC configuration)

Pass and Fail Criteria

No errors from the REBA HW Self check	Passed
No un-expected event Packets	Passed
REBA Power Consumption within the ranges of expected values	Passed
EEPROM Check Sum passed	Passed
REBA synchronization achieved	Passed
DAE Power Consumption within the ranges of expected values	Passed
DAE Synchronization achieved	Passed
The FEM I Drain Currents obtained from Telemetry are within the ranges expected (5%)	Passed
The DC voltages Outputs (Science Telemetry) are within the ranges expected. (10%)	On going
Data Collection completed	Passed

During the execution of the test the TC007320 failed because for a procedural mistake it was sent two times. The TC failed because the Science was already on and the ASW couldn't switch on science again so it delivered a TM(1,8). So the ASW behaved as expected.

Id w.r.t WFT				
CH	<00>	<01>	<10>	<11>
CH27	-0.13	0.53	-0.06	-0.13
CH24	-0.10	-0.07	-0.10	-0.03
CH21	-0.10	0.00	-0.11	0.05
CH22	0.00	-0.11	-0.05	0.11
CH23	-0.06	-0.05	0.00	-0.11
CH25	-0.22	-0.11	-0.15	-0.18
CH28	-0.29	-0.30	-0.41	-0.36
CH20	-0.20	-0.25	-0.25	-0.15
CH19	-0.16	-0.30	-0.20	-0.15
CH18	0.05	-0.33	-0.18	-0.33
CH26	-0.15	-0.26	-0.26	-0.19



2. Figure Drain currents with LFI – N on

4.2 Second Slot FEMs OFF

The test has been done using the nominal unit but the results could be used also for the redundant unit. The slot starts from the EMC configuration tests and it stops in the same configuration in order to guarantee the continuity of the EMC tests.

4.2.1 Procedure/ Test sequence

Spike Test Part 1						**5.54.00**	
	Preparation to Test configuration				1	**0.17.00**	
		Check DAE Configuration	IOT Confirm	0.05.00	1	0.05.00	0.05.00
		Stop Monitor Function		0.02.00	1	0.02.00	0.07.00
		Stop Calibration Channel		0.02.00	1	0.02.00	0.09.00
		Science De-Activation		0.02.00	1	0.02.00	0.11.00
		Definition of science Processing Parameters	Naverage set to 256	0.02.00	1	0.02.00	0.13.00
		Changing Processing Type to 1		0.02.00	1	0.02.00	0.15.00
		Science Activation Type 1		0.02.00	1	0.02.00	0.17.00
	Test execution (part 1)				1	**5.16.00**	
		Perform DAE Initialization		0.10.00	1	0.10.00	0.27.00
			Wait for thermalization	0.30.00	1	0.30.00	0.57.00
			Acquire data	1.00.00	1	1.00.00	1.57.00
		Disable HK DAE Sequencer	LC064320 with no parameters	0.02.00	1	0.02.00	1.59.00
			Acquire data	1.00.00	1	1.00.00	2.59.00
		RCA Deactivation		0.02.00	1	0.02.00	3.01.00
			Wait for thermalization	0.30.00	1	0.30.00	3.31.00
			Acquire data	1.00.00	1	1.00.00	4.31.00
		Enable HK DAE Sequencer	LC063320 with no parameters	0.02.00	1	0.02.00	4.33.00
			Acquire data	1.00.00	1	1.00.00	5.33.00
	Recovering EMC configuration				1	**0.21.00**	
		RCA Activation		0.02.00	1	0.02.00	5.35.00
		Set DAE Default configuration		0.02.00	1	0.02.00	5.37.00
		Science De-Activation		0.02.00	1	0.02.00	5.39.00
		Definition of science Processing Parameters	Naverage set to Nominal	0.02.00	1	0.02.00	5.41.00
		Changing Processing Type to 5		0.02.00	1	0.02.00	5.43.00
		Science Activation Type 5		0.02.00	1	0.02.00	5.45.00
		Start Channel Switching		0.02.00	1	0.02.00	5.47.00
		Start Monitor function		0.02.00	1	0.02.00	5.49.00
		Check DAE Configuration	IOT Confirm	0.05.00	1	0.05.00	5.54.00

4.2.2 Results and Conclusions

The results are collected in the following tests:

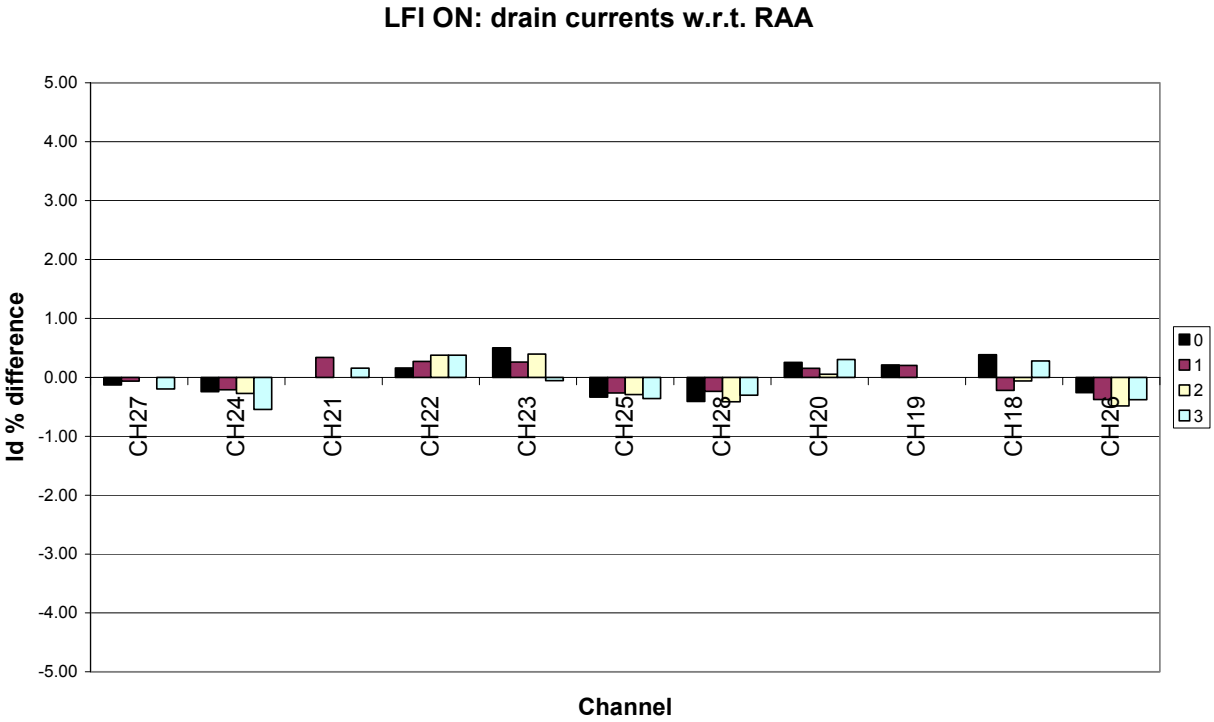
- AMB_0137 (Thermalization)
- AMB_0138 (First and second slots FEMs Off: HK sequencer switched OFF)
- AMB_0139 (Power Groups switched off)
- AMB_0140 (HK Sequencer Switched ON and EMC configuration recovered)

Pass and Fail Criteria

No un-expected event Packets	Passed
The FEM I Drain Currents obtained from Telemetry are within the ranges expected (5%)	Passed
The DC voltages Outputs (Science Telemetry) are within the ranges expected. (10%)	On going
Data Collection completed	Passed

At the beginning of the test a current check has been made.

Id w.r.t WFT				
CH	<00>	<01>	<10>	<11>
CH27	-0.19	0.60	-0.06	-0.26
CH24	-0.10	-0.14	-0.17	-0.48
CH21	-0.05	0.00	-0.11	0.00
CH22	-0.16	-0.11	-0.05	0.05
CH23	0.00	-0.10	0.00	-0.17
CH25	-0.22	-0.15	-0.22	-0.25
CH28	-0.35	-0.36	-0.47	-0.42
CH20	-0.15	-0.30	-0.25	-0.20
CH19	-0.16	-0.30	-0.15	-0.15
CH18	-0.05	-0.44	-0.37	-0.28
CH26	-0.22	-0.30	-0.30	-0.27



3. Figure Drain currents with LFI – N on

NCR Open:

NCR	Description
NC-15816	LFI suffered this failure during the spike tests. The autonomous functions were activated by default so without any TM rate reset the Calibration channel was switched off automatically. Any attempt to switch it off as requested in procedure created a TC failure.
NC-14371	This NC was opened during WFT. During the spike test a analogous failure happened.

4.3 DATA Analysis and NEW FEATURES

4.3.1 Current drops in RCA 23

NA

4.3.2 Scientific output crossing in RCA 25

NA

4.3.3 Noise / spikes in signal

4.3.3.1 General remarks

The objectives of this test were to characterise the presence of frequency spikes in the LFI data and verify their correlation with the status of the DAE HK sequencer. More in particular these are the objectives stated in the test proposal [RD5]:

To verify that the 1 Hz spikes in the DAE output are strictly correlated with the switch on/off of the HK sequencer
To characterise 1 Hz spikes (i.e. measure frequency, amplitude and phase) present in the DAE output when the BEMs are off
To characterise 1 Hz spikes (see above) present in the DAE output when the BEMs are on
To verify that the 1 Hz spikes in the radiometric output are at the same frequencies of the spikes in the DAE output
To verify that the 1 Hz spikes in the radiometric output are strictly correlated with the switch on/off of the HK sequencer
To characterize at the same time the low frequency spikes.

In the following table we summarise the results in relation with the above mentioned objectives

Objective #	Passed	Remarks
1	YES	The majority of the frequency spikes disappear when the HK sequencer is turned off. Nonetheless it was apparent that some channels showed also some features not correlated with the HK sequencer status. In particular LFI22 R0D0 and R0D1 show a strong disturbance in frequency spectrum, while minor features are seen in LFI23 R1D1, LFI24 R0D0 R0D1 and R1D0, LFI25 R1D0 and R0D1, LFI26, LFI27 and LFI28 (all channels)
2	YES	Phase characterisation is ongoing
3	YES	Same remarks as in point 1
4	YES	From visual inspection of spectra. Quantitative analysis ongoing. Many spikes that are visible on the DAE output are not seen in the radiometric output because of the higher noise level
5	YES	Same remarks as in point 1
6	YES	

4.3.3.2 Detailed results

All the data have been acquired with the LFI instrument in Type 1 mode with Naver = 256 on all channels. This implied a sampling frequency of 16 Hz in switched mode and of 32 Hz in unswitched mode, i.e. a maximum frequency of 8 Hz and 16 Hz in switched and unswitched modes, respectively.

The choice of this mode instead of the Type 5 mode (that would have provided information on a larger frequency range) has been dictated by the optimisation of he REBA compression parameters, that in these conditions (room temperature) was not optimal on all channels. Furthermore running the instrument in Type 1 mode with a binning lower than 256 would have been incompatible with the telemetry requirements.

Detailed plots and results are reported in the annex documents listed in the following table

Step number	Power groups	FEM biased?	4 KHz sw.	A/C	B/D	HK seq.	Document
First part (FEMs OFF)							
1	OFF	NO	NO	N/A	N/A	ON	spike_amb_0140.pdf
2	OFF	NO	NO	N/A	N/A	OFF	spike_amb_0139.pdf
3	ON	NO	NO	N/A	N/A	OFF	TBW
4	ON	NO	NO	N/A	N/A	ON	TBW
Second part (FEMs ON)							
5	ON	YES	YES	sw	0	ON	spike_amb_0121.pdf
6	ON	YES	YES	0	sw	ON	spike_amb_0122.pdf
7	ON	YES	YES	1	sw	ON	TBW
8	ON	YES	YES	sw	1	ON	spike_amb_0125.pdf
9	ON	YES	NO	0	1	ON	spike_amb_0126.pdf
10	ON	YES	NO	0	1	OFF	spike_amb_0127.pdf
11	ON	YES	YES	sw	1	OFF	spike_amb_0128.pdf

4.4 Conclusions and recommendations

The test has proven a successful and provided valuable information to characterise spurious effects in the scientific output disentangling different sources. More in particular we could:

- separate effects arising in the back-end electronics from those caused by the front end modules (by acquiring data with FEMs on and off);
- isolate spurious spikes caused by the DAE HK sequencer (by acquiring data with FEMs on and off).

The results obtained from this test can be summarised as follows:

- we have found no particular effects related to the FEMs and very little dependence of the frequency spikes from the phase switch state and switching condition (see, e.g. Fig. 1);
- almost all the frequency spikes disappear when the DAE HK sequencer is deactivated, as was expected (see, e.g., Fig. 2);
- some frequency spikes remain in a limited number of channels even after HK sequencer deactivation (see Fig. 3). In one case (the output of LFI22 R1D0 and R1D1) the effect is quite strong and can be found at a fundamental frequency of ~ 3 Hz. Looking ad data acquired at the nominal sampling frequency of 76.8 Hz this effect can be found at ~ 30 Hz; this indicates that the fundamental of 3 Hz is probably the result of a beating between the frequency of the spurious effect and the sampling frequency (see Fig. 4)

These results call for further investigations to understand the nature of the unexpected spikes uncorrelated with the DAE HK sequencer. Furthermore, the

scientific importance of the control of these systematic effects requires that these tests will be run during the following testing phases of Planck, i.e. during the thermo-vacuum tests at CSL and during the CPV phase in flight.

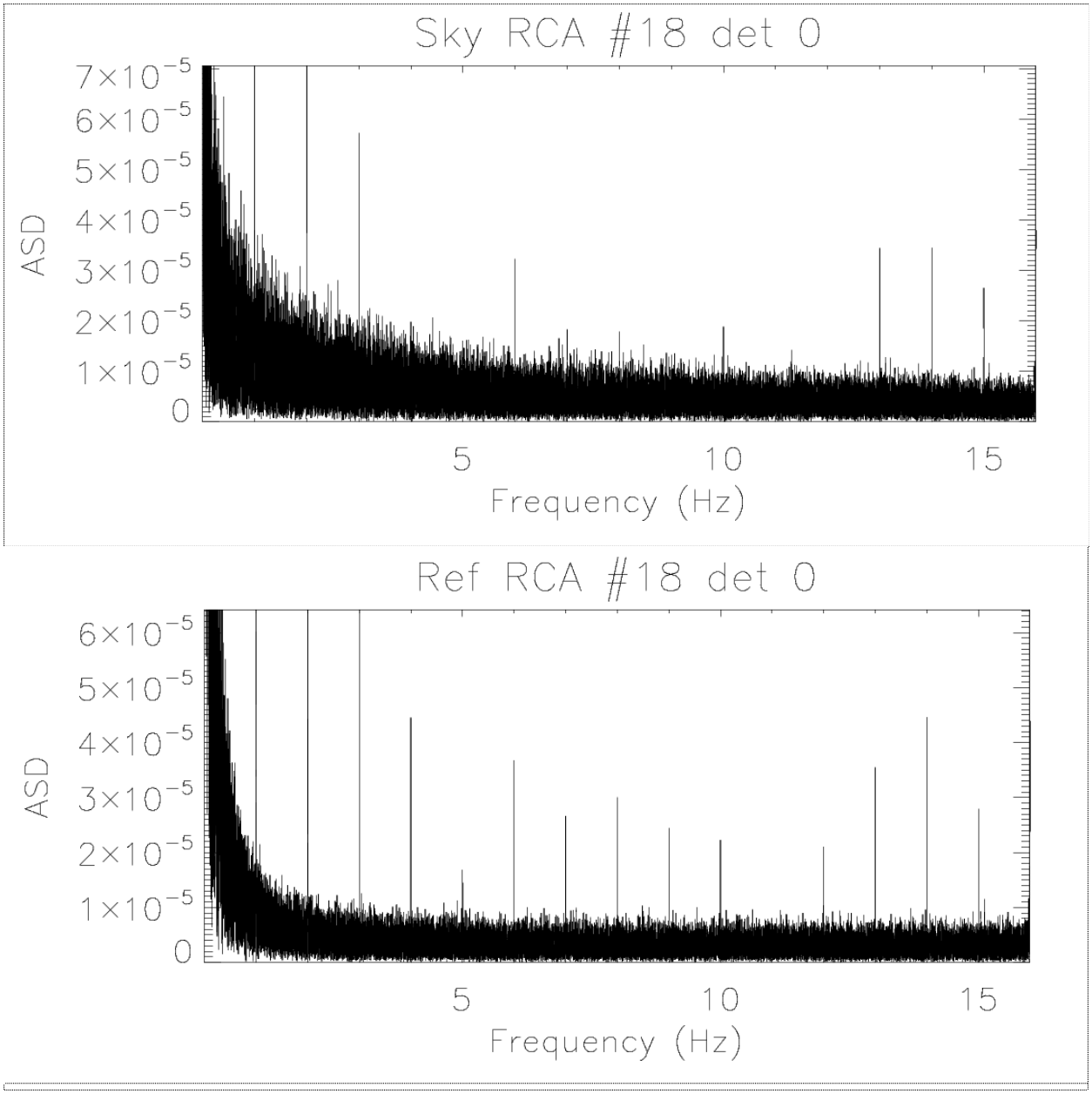


Fig. 1 – Comparison of frequency spectrum with FEMs on (top panel) and off (bottom panel). HK sequencer was on in both cases. Data are relative to detector

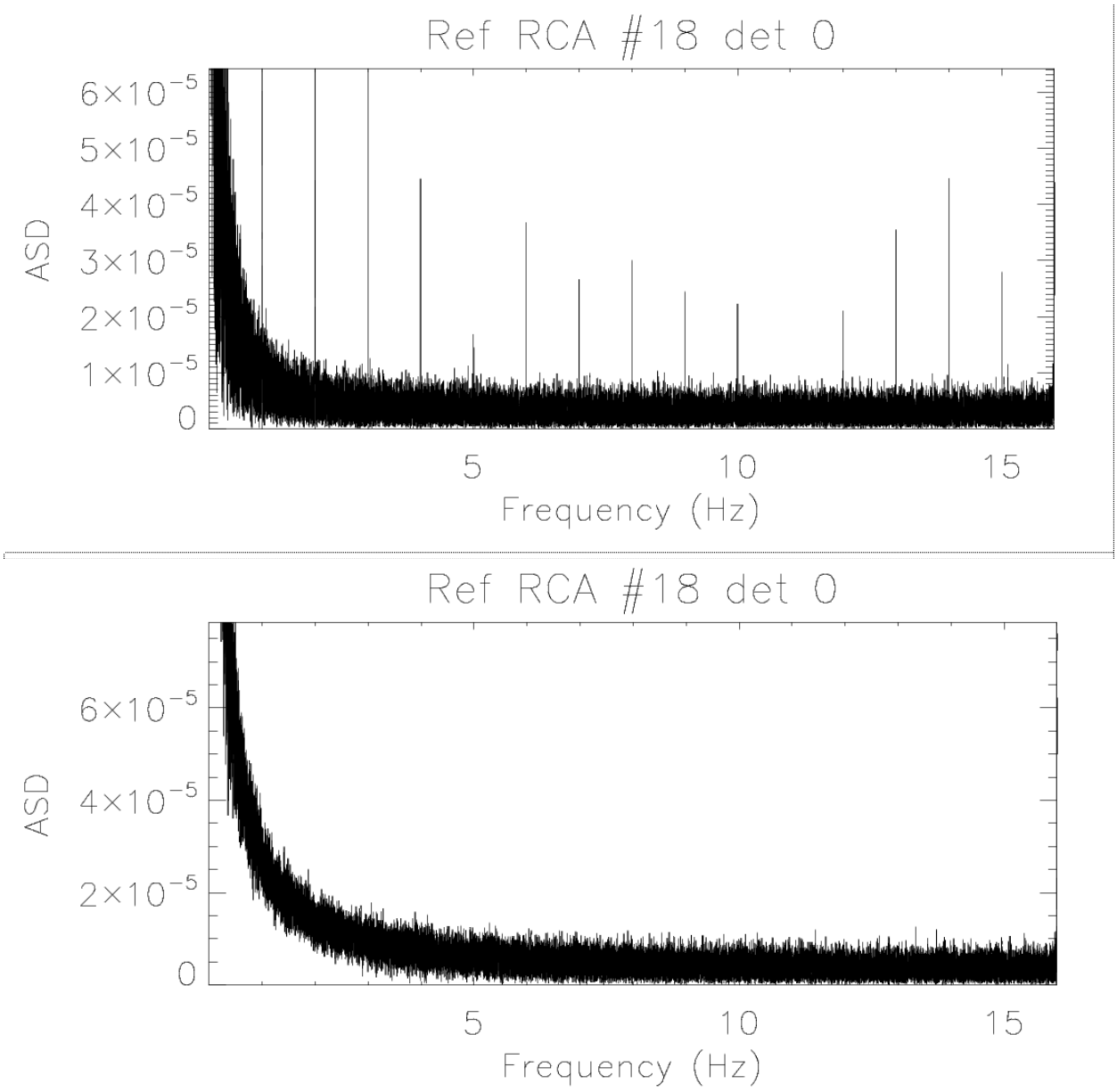


Fig. 2 – Top panel: frequency spectrum of DAE noise with HK on. Bottom panel: frequency spectrum of DAE noise with HK off. Data are relative to detector

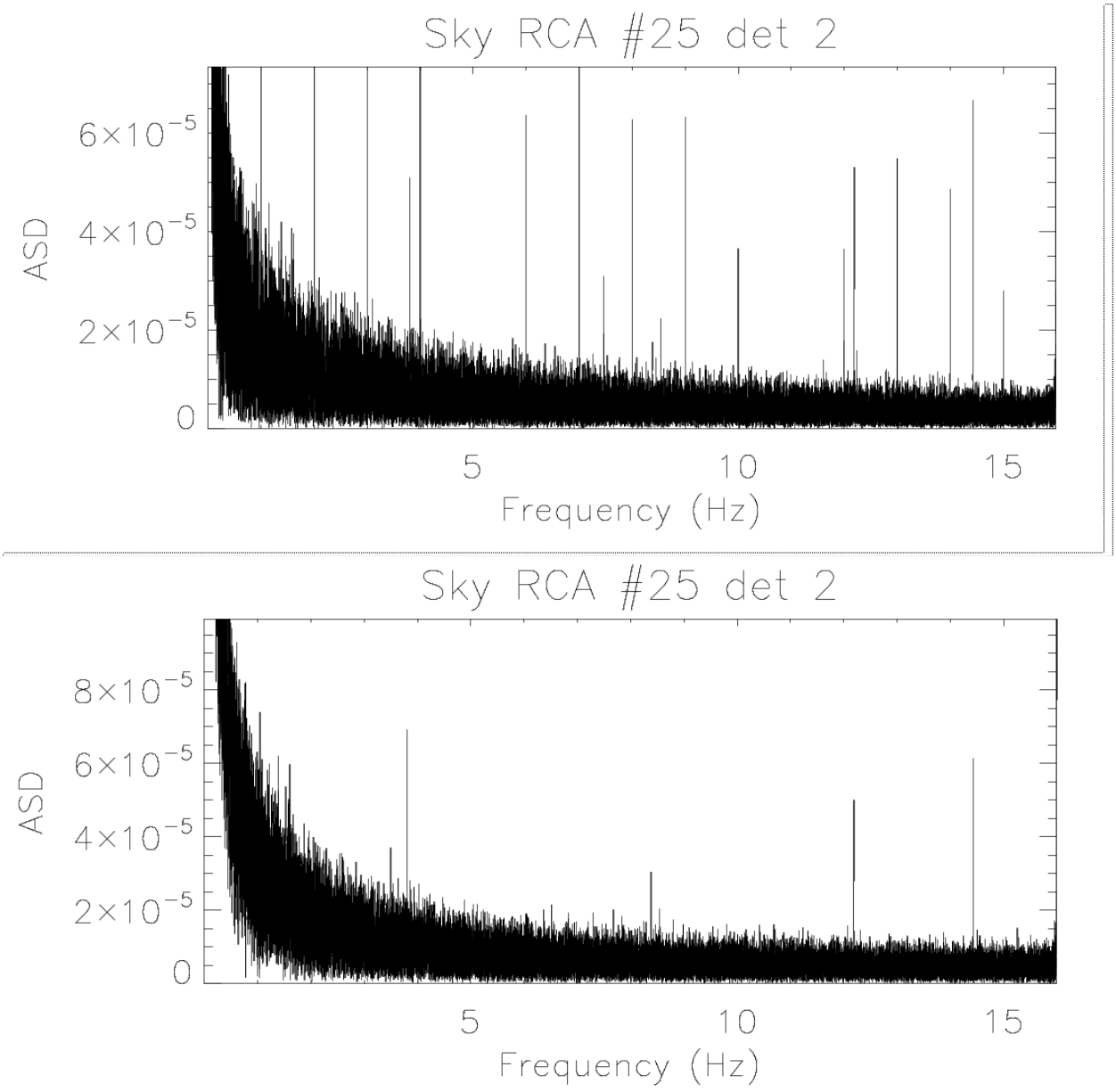


Fig. 3 – For some channels not all the spurious frequency spikes disappear with the switch off of the HK sequencer. This is an example relative to detector LFI25 R1D0 acquired with FEMs off. Top panel: frequency spectrum of DAE noise with HK on. Bottom panel: frequency spectrum of DAE noise with HK off.

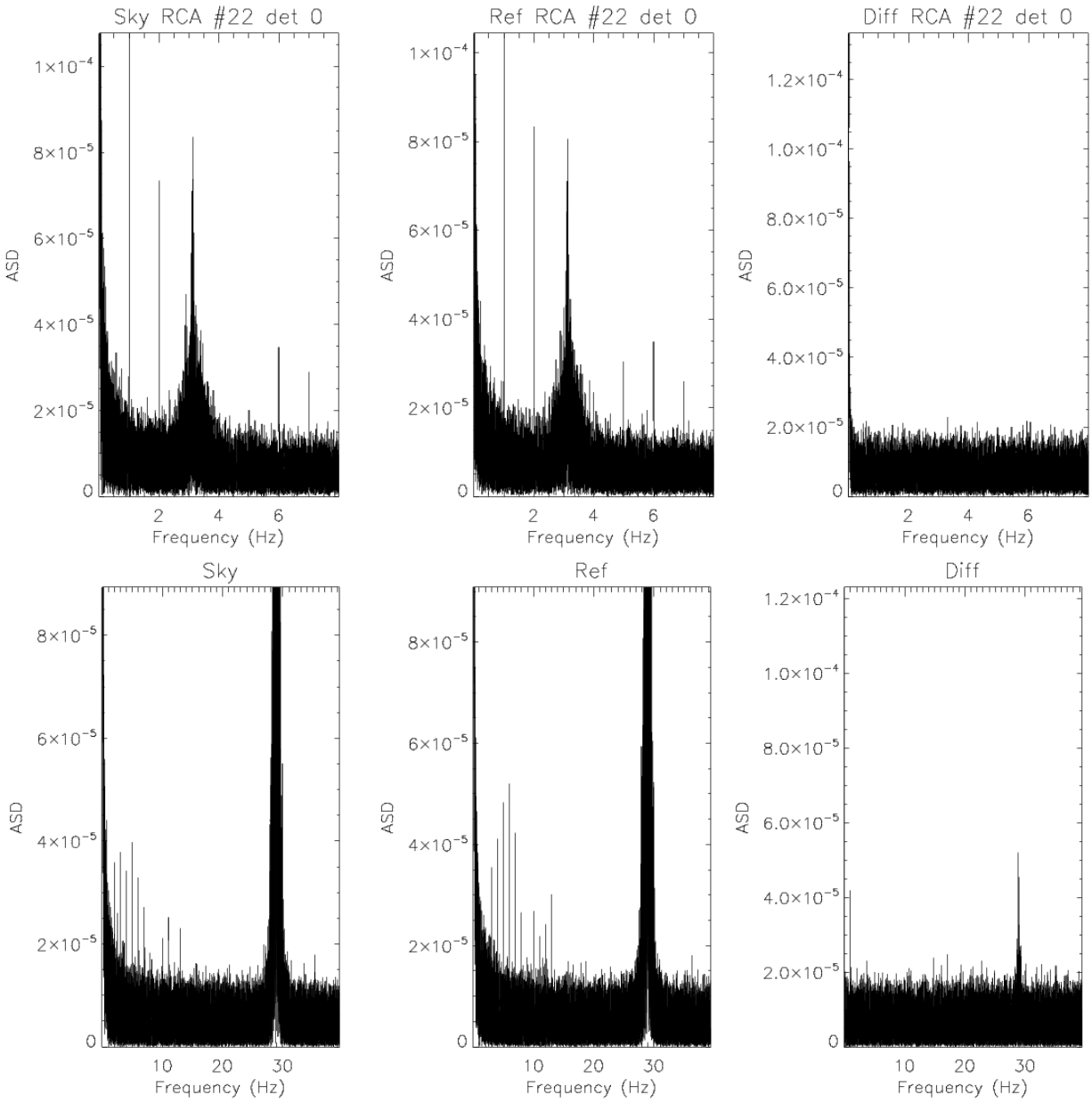


Fig. 4 – The output of LFI22 R1D0 and R1D1 show a disturbance that is not correlated with the HK sequencer status and does not show the "monochromatic" character of all the other spikes. Here we show the output of R0D0 acquired during this test (top panel) with reduced sampling frequency (16 Hz) and AVR1 mode and during REBA tuning tests with nominal sampling frequency (76.8 Hz) and COM5 mode

5 TC History

TC Code	Description	Execution Time					
LC 8320	RM_START	2008	37	7	12	21	AMB_130
LC 3320	CL_START	2008	37	7	9	4	
LC 10320	CALIBRATION	2008	37	6	45	47	
LC 65320	DCSCSSTA	2008	37	6	6	59	
LC 7320	SC_START	2008	37	6	6	58	
LC 65320	DCSCSSTA	2008	37	5	42	22	
LC 7320	SC_START	2008	37	5	42	22	
LC 76320	SetSciProc	2008	37	5	41	7	
LC 150320	Enable TM	2008	37	5	38	1	
LC 150320	Enable TM	2008	37	5	33	9	
LC 71320	SetREBASci	2008	37	5	33	4	
LC 71320	SetREBASci	2008	37	5	32	58	
LC 71320	SetREBASci	2008	37	5	32	53	
LC 71320	SetREBASci	2008	37	5	32	48	
LC 150320	Enable TM	2008	37	5	26	52	
LC 75320	Naverage	2008	37	5	26	51	
LC 18320	SC_STOP_	2008	37	5	23	50	
LC 66320	DCSCCSTO	2008	37	5	23	50	AMB_0128
LC 63320	DCHKSSTA	2008	37	5	23	47	
LC 150320	Enable TM	2008	37	4	14	10	
LC 128320	SetConfigRCA	2008	37	4	14	9	
LC 150320	Enable TM	2008	37	4	10	40	
LC 128320	SetConfigRCA	2008	37	4	10	39	
LC 64320	DCHKSSTO	2008	37	3	1	25	AMB_0127
LC 150320	Enable TM	2008	37	1	54	44	AMB_0126
LC 128320	SetConfigRCA	2008	37	1	54	43	
LC 150320	Enable TM	2008	37	0	47	24	AMB_0125
LC 128320	SetConfigRCA	2008	37	0	47	24	
LC 150320	Enable TM	2008	37	0	46	48	
LC 128320	SetConfigRCA	2008	37	0	46	46	
LC 150320	Enable TM	2008	37	0	46	29	
LC 128320	SetConfigRCA	2008	37	0	46	28	
LC 150320	Enable TM	2008	37	0	45	43	
LC 128320	SetConfigRCA	2008	37	0	45	43	
LC 150320	Enable TM	2008	37	0	42	2	
LC 128320	SetConfigRCA	2008	37	0	42	1	
LC 150320	Enable TM	2008	37	0	39	14	
LC 128320	SetConfigRCA	2008	37	0	39	13	
LC 150320	Enable TM	2008	36	23	36	26	AMB_0124
LC 128320	SetConfigRCA	2008	36	23	36	24	
LC 150320	Enable TM	2008	36	23	35	57	
LC 128320	SetConfigRCA	2008	36	23	35	56	
LC 150320	Enable TM	2008	36	22	24	8	AMB_0122
LC 128320	SetConfigRCA	2008	36	22	24	8	

4. Tab. TC History of the first slot of the test (5th and 6th February 2008). The TC failure is enlighten in red

TC Code		Description	Execution Time					
LC	8320	RM_START	2008	38	4	50	45	
LC	3320	CL_START	2008	38	4	48	34	
LC	10320	CALIBRATION	2008	38	4	32	44	
LC	65320	DCSCSSTA	2008	38	3	56	52	
LC	7320	SC_START	2008	38	3	56	52	
LC	76320	SetSciProc	2008	38	3	56	29	
LC	150320	Enable TM	2008	38	3	55	31	
LC	150320	Enable TM	2008	38	3	54	11	
LC	71320	SetREBASci	2008	38	3	54	5	
LC	71320	SetREBASci	2008	38	3	54	0	AMB_0140
LC	71320	SetREBASci	2008	38	3	53	55	
LC	71320	SetREBASci	2008	38	3	53	49	
LC	150320	Enable TM	2008	38	3	53	31	
LC	75320	Naverage	2008	38	3	53	29	
LC	18320	SC_STOP_	2008	38	3	51	11	
LC	66320	DCSCCSTO	2008	38	3	51	11	
LC	150320	Enable TM	2008	38	3	48	20	
LC	59320	DCDEFCON	2008	38	3	48	19	
LC	132320	SciDCDCSetup	2008	38	3	47	48	
LC	63320	DCHKSSTA	2008	38	2	45	18	
LC	132320	SciDCDCSetup	2008	38	1	15	56	AMB_0139
LC	64320	DCHKSSTO	2008	38	0	14	3	AMB_0138
LC	150320	Enable TM	2008	37	22	57	1	
LC	121320	SetConfCh	2008	37	22	56	57	
LC	150320	Enable TM	2008	37	22	56	48	
LC	121320	SetConfCh	2008	37	22	56	45	
LC	150320	Enable TM	2008	37	22	56	36	
LC	121320	SetConfCh	2008	37	22	56	33	
LC	150320	Enable TM	2008	37	22	56	3	
LC	121320	SetConfCh	2008	37	22	56	0	
LC	150320	Enable TM	2008	37	22	55	51	AMB_0137
LC	121320	SetConfCh	2008	37	22	55	48	
LC	150320	Enable TM	2008	37	22	55	33	
LC	128320	SetConfigRCA	2008	37	22	55	33	
LC	150320	Enable TM	2008	37	22	55	16	
LC	128320	SetConfigRCA	2008	37	22	55	16	
LC	150320	Enable TM	2008	37	22	55	6	
LC	128320	SetConfigRCA	2008	37	22	55	5	
LC	150320	Enable TM	2008	37	22	54	36	
LC	128320	SetConfigRCA	2008	37	22	54	35	
LC	65320	DCSCSSTA	2008	37	22	51	1	
LC	7320	SC_START	2008	37	22	51	0	
LC	76320	SetSciProc	2008	37	22	50	43	
LC	150320	Enable TM	2008	37	22	50	32	
LC	75320	Naverage	2008	37	22	50	32	
LC	18320	SC_STOP_	2008	37	22	49	22	AMB_0135
LC	18320	SC_STOP_	2008	37	22	42	52	
LC	66320	DCSCCSTO	2008	37	22	42	52	
LC	21320	CAL_STOP_	2008	37	22	42	37	
LC	19320	RM_STOP_	2008	37	22	42	21	
LC	15320	CL_STOP_	2008	37	22	42	9	

5. Tab. History file of the second slot of the tests. The TC failures are enlighten in red.