



<b>Publication Year</b>	2007
<b>Acceptance in OA @INAF</b>	2024-06-24T10:26:52Z
<b>Title</b>	Proposal for LFI test dedicated to characterize New Spikes in the FFT spectrum of Scientific Data
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<b>Handle</b>	<a href="http://hdl.handle.net/20.500.12386/35222">http://hdl.handle.net/20.500.12386/35222</a>
<b>Number</b>	PL-LFI-PST-TN-080

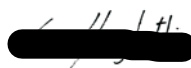
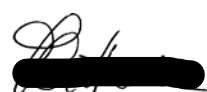
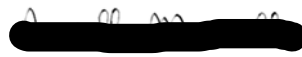


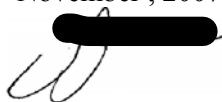


**TITLE:**                    **Proposal for LFI test dedicated to  
characterize New Spikes in the  
FFT spectrum of Scientific Data**

**DOC. TYPE:**            **TECHNICAL NOTE**

**PROJECT REF.:**        **PL-LFI-PST-TN-080**        **PAGE: I of IV, 7**

**ISSUE/REV.:**           **1.0**                                **DATE: November 2007**

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Issue/Rev. No.: 1.0  
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## CHANGE RECORD

Issue	Date	Sheet	Description of Change	Release
0.1	November 2007	All	First Draft of Document	



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## **1 ACRONYMS**

AIV	Assembly, Integration, Verification
ASW	Application Software
CCS	Central Check-out System
CDMU	Central Data Management Unit
DPU	Digital Processing Unit
IST	Integrated Satellite Test
OBC	On Board Clock
OBT	On Board Time
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
TBD	To Be Defined
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 description of a new and unexpected feature found during the warm tests at system level in the LFI FFT spectrum of the scientific data. The scope of the document is two folds

- Describe the feature so to open a dedicated NCR
- Describe a proposal of a dedicated test in order to characterize the feature



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## **3 APPLICABLE AND REFERENCE DOCUMENTS**

### **3.1 Applicable Documents**

[AD1]

### **3.2 Reference Documents**

[RD1]        “Quick Look analysis of the Warm Functional Tests”  
              PL-LFI-PST-RP-0023, Issue 2.0

[RD2]        “Data analysis and scientific performances of the LFI FM instrument”  
              PL-LFI-PST-AN-0006, Issue 1.1





## 4 Description

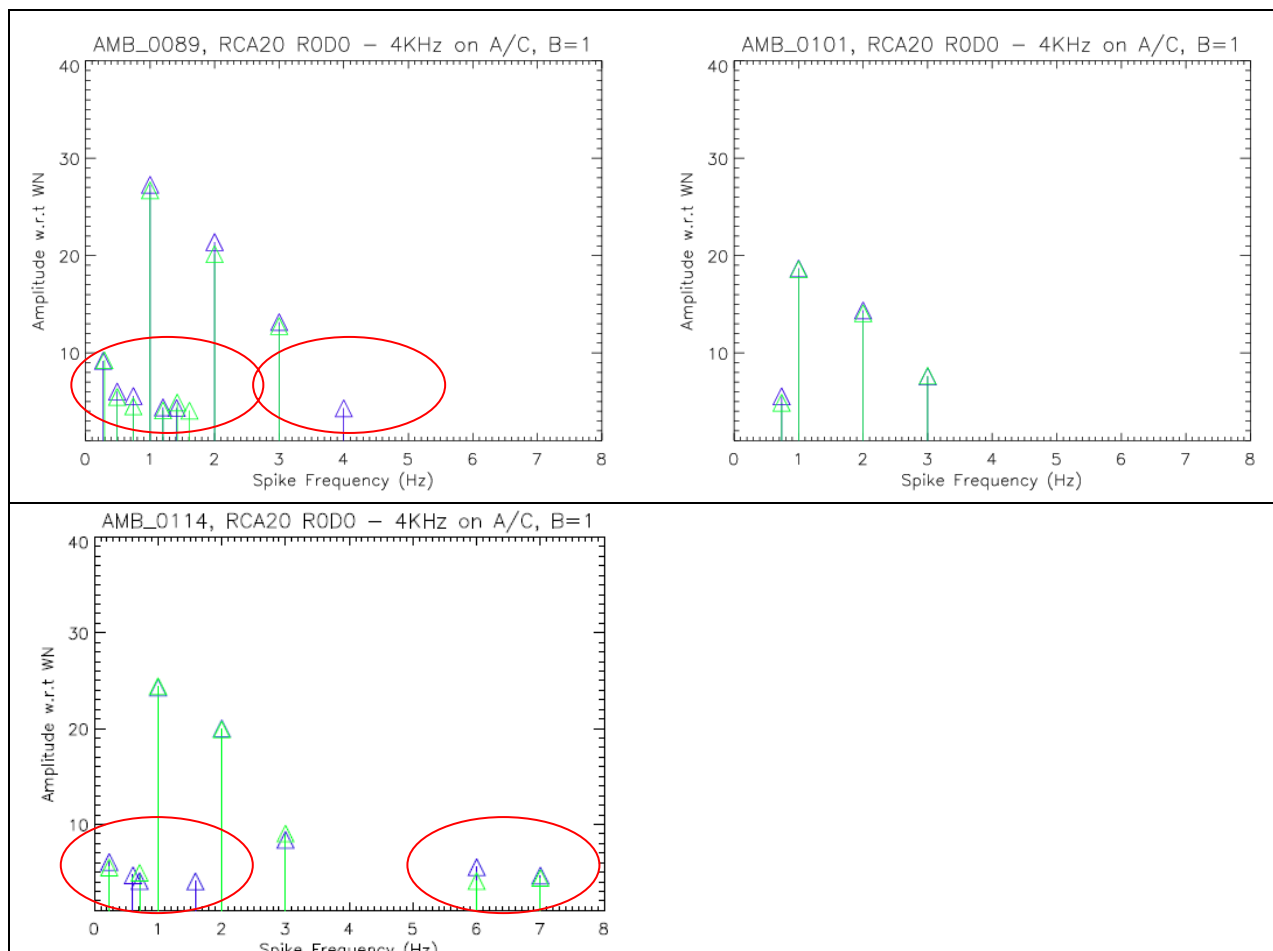
### 4.1 Data Analysis

One of the PASS/FAIL criteria for the Functional Test of LFI in warm temperature condition was that in the FFT spectrum we shouldn't find any new feature. Here below, even if only a subset of the analysis performed on the data collected during WFT, SFT, and PLM SIT is presented, it is evident that the FFT spectrum look different respect to the one collected during WFT performed in TAS-I at instrument Level. For a more detailed presentation of the data analysis results refer to [RD..] and [RD..].

The two pictures show the differences in FFT spectrum in three different examples:

- AMB\_0101 WFT test performed in TAS-I 20th October 2006 at Instrument Level
- AMB\_0089 WFT test performed in TAS-F 8th August 2007
- AMB\_0114 PLM SIT performed in TAS-F 24th October 2007

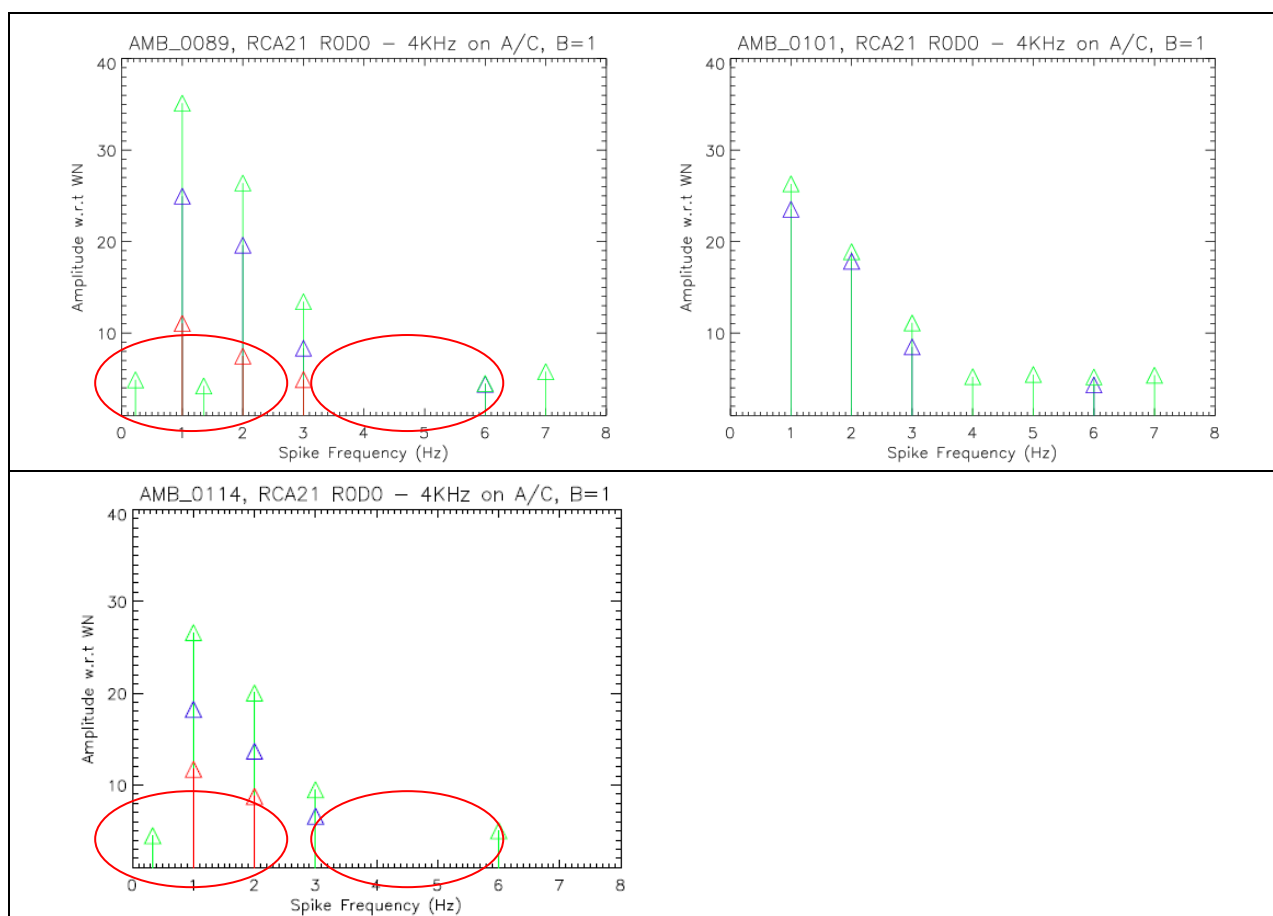
The observable is not the amplitude of each peak because the acquired time is not enough to lower the error bar of the amplitude at lower frequency, but the PASS/FAIL criteria refers to possibly new peaks at frequencies that were not observed during the FM level test campaign.





The figure above shows that during WFT at System Level Tests low frequency spikes appear in the FFT and they are basically repeated also in PLM SIT.

The 1Hz spike and its higher harmonics are well known from QM testing level campaign. After dedicated tests at QM/FM level was found that the HK sequencer of the DAE is the cause of the 1Hz spikes, once the sequencer is disabled via TC the FFT spectrum is very clean. The HK sequencer of the DAE has the function to collect every second all the HK information of the DAE sensors (temperatures, currents, voltages). In principle, even in flight, LFI could stay in nominal science production with the HK sequencer disabled but no more HK information would be available,



During the last System level tests not only the 1 Hz spike, and its harmonics, was visible but also some lower frequency spikes appeared. These spikes were totally unexpected and they were not visible in any of the WFTs performed during the QM/FM test campaign.

The figures above summarize the features but the same behaviour is still visible in the other channels and RCA and they are also visible during LFI SFT performed 19<sup>th</sup> September 2007.



## **5 Procedure Description**

### **5.1 Objectives**

During data analysis of the System Level Tests un-expected features have been found, and as explained in previous paragraph, not only the 1 Hz signal and harmonics are now visible but also unexpected low frequency spikes. The presence of these spikes is the single biggest known systematic effect in LFI and it has a dramatic effect in the Map Reconstruction. LFI IOT is asking a dedicated test to study at warm temperature the FFT of the scientific signal in different configuration to have a fully characterization of the phenomenon at system level.

The main objective could be summarized by the following points:

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

Moreover all these data will be used in LFI pipeline by LFI core team activity (LFI-Demo) to find a solid solution for a spike removal during the flight mission.

### **5.2 Description of the test**

The starting condition is LFI in DAE Set Up Mode and the procedure description to reach the DAE Set Up mode could be found in [RD..]. The test could be divided in two parts

#### **PART 1**

Before the switch on of the power groups:

1. Acquire scientific data for 1.0 hours
2. Switch off the HK sequencer
3. Acquire scientific data for 1.0 hours
4. Switch on power groups (no bias to FEMs)
5. Acquire scientific data for 1.0 hour

The overall detailed procedure from satellite in off condition is summarized in the following table



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Procedure name	Reference	Note	Time	Relative time	Absolute Time (end)
Satellite switch On			1.00.00	1.00.00	6.30 AM
Go to REBA Stand By Mode	Par 6.2.1		0.30.00	1.30.00	7.00 AM
Go to DAE Set Up Mode	Par 6.2.2		0.07.00	1.37.00	7.07 AM
		Check TQL is on and wait for IOT confirmation	0.00.00	1.37.00	7.07 AM
Go to Nominal Science	Tab 3 Pag 9	Science production in Type 1	0.20.00	1.57.00	7.27 AM
		Acquire data	1.00.00	2.57.00	8.27 AM
Disable HK DAE Sequencer	-	LC064320 with no parameters	0.02.00	2.59.00	8.29 AM
		Acquire data (*)	1.00.00	3.59.00	9.29 AM
Enable HK DAE Sequencer		LC063320 with no parameters	0.02.00	4.01.00	9.31 AM
RCA Activation	Tab 32 Pag 38	The power group are switched on.	0.02.00	4.03.00	9.33 AM
Initialization	Point 2 Tab 4 Pag 10	The zero currents condition is applied	0.08.00	4.11.00	9.41 AM
		Wait for thermalization	0.30.00	4.41.00	10.11 AM
		Acquire data in stable condition	1.00.00	5.41.00	11.11 AM

## PART 2

During the acquisition with LFI all on (assuming 4KHz switching is on),

1. Acquire scientific data for 1.0 hours for each PS Status
2. Switch off 4 KHz switching
3. Acquire scientific data for 1.0 hours
4. Switch off the HK sequencer
5. Acquire scientific data for 1.0 hours
6. Switch on 4 KHz switching
7. Acquire scientific data for 1.0 hours

Procedure name	Reference	Note	Time	Relative time	Absolute Time
Configure DAE as default	Tab 44 Pag 49	Switch on all the FEMs	0.02.00	5.43.00	11.13 AM
		Wait for thermalization	0.30.00	6.13.00	11.43 AM
		Take note of Idrain Consumption	0.05.00	6.18.00	11.48 AM
		Acquire data	1.00.00	7.18.00	12.48 PM
Change PS status on A/C		Acquire data	1.00.00	8.18.00	1.48 PM
Disable 4KZ switching on B/D			0.02.00	8.20.00	1.50 PM
Enable 4KHz switching on A/C			1.00.00	9.20.00	2.50 PM
Change PS Status on B/D			1.00.00	10.20.00	3.50 PM
Disable 4KHz Switching	Tab 44 pag 42		0.02.00	10.22.00	3.52 PM
		Acquire data	1.00.00	11.22.00	4.52 PM
Disable HK DAE Sequencer	-	LC064320 with no parameters	0.02.00	11.24.00	4.54 PM
		Acquire data (*)	1.00.00	12.24.00	5.54 PM
Enable 4KHz Switching	Tab 43 pag 41		0.02.00	12.26.00	5.56 PM
		Acquire data (*)	1.00.00	13.26.00	6.56 PM
LFI switch off	Par 6.3 and 6.4		0.20.00	13.46.00	7.16 PM
Satellite switch off			0.45.00	14.31.00	8.01 PM

## 5.3 Requirements and Time needed

If the test is performed in stand alone the time requested to the completion of the test is 14 Hours that means almost two shifts considering the Switch on and switch off of the satellite.