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Planck LFI

TITLE: **Planck-LFI CPV: Functionality Reference Point**
(P_PVP_LFI_0108_01, P_PVP_LFI_0008_01)

DOC. TYPE: **Test Report**

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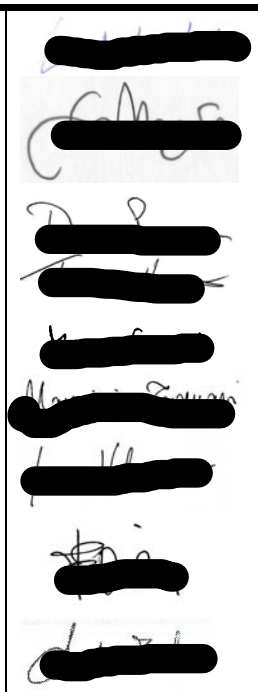
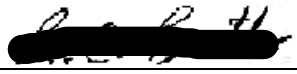
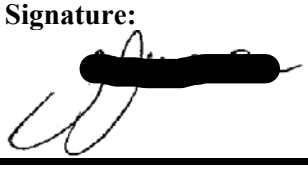
			
Agreed by	**C. BUTLER** **LFI Program Manager**	**Date:** **Signature:** 	30 November 2009
Approved by	**N. MANDOLESI** **LFI Principal Investigator**	**Date:** **Signature:** 	30 November 2009

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CHANGE RECORD

Issue	Date	Sheet	Description of Change	Release
1.0	16 October 09	All		1.0
2.0	30 November 09		Minor changes	2.0

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
CPV	Calibration Performance Verification
CSL	Centre Spatiale de Liège
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
SCS	Sorption Cooler 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 APPLICABLE AND REFERENCE DOCUMENTS

2.1 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

[AD5] Data analysis and scientific performance of the LFI FM instrument, PL-LFI-PST-AN-006 3.0

[AD6] Planck-LFI TV-TB test report: executive summary, PL-LFI-PST-RP-040 1.1

2.2 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] Data analysis and of LFI switch on and cryogenic functionality test (Ph-5-01-c of TV/TB tests) PL-LFI-PST-RP-036

[RD4] Change in bias tuning approach during the CPV phase after the CSL test campaign experience PL-LFI-PST-TN-091

[RD5] Planck-LFI CPV: Hyper Matrix Tuning, PL-LFI-PST-RP-06X

[RD7] Testing Plan of the LFI instrument during the Planck Commissioning and CPV phase PL-LFI-PST-PL-013, Issue 4.3 (04-2009)

3 Introduction

This document describes the results from the Functionality Reference Test (FRT)

The FRT is composed by two parts, devoted to different tasks:

The first part is identical to the CRYO 02 ( ) : it is devoted to check the functionality of radiometers in all the possible phase switch and 4KHz combinations, after the HYM Tuning (that was considered a possible source of stress for radiometers) and to compare with it. In particular, the LNAs drain currents will be compared, together with the noise properties as 1/f, white noise, spikes. The output voltage can be compared just roughly considering the sky signal, because the ref signal decreases due to 4K cooler cooldown: this rough comparison must take into account possible differences in the SCS temperature (driving the FPU temperature and hence the LNAs gain) and the radiometers Isolation (the signal leaking from the Reference loads and mixing with the Sky signal is proportional to the Reference Load temperature) .

The second part is identical to the same test performed in CSL (Liege , 2008) , but is performed with the LNAs bias set to the final configuration outcome from the HYM Tuning. This test, similar from the procedural point of view to the CRYO 01, is devoted to set a reference point for the future of the survey, characterizing one by one all the LNAs measuring both the scientific output and the bias (drain currents). This is operation can be repeated at any time during the survey, with a minimum effect on other channels not under test.

4 Test description

Because of their different nature and procedure, the two parts of the test are treated as independent.

4.1.1 First part (P_PVP_LFI_0008_01)

CRYO 02 bias (that is the bias table outcoming from CSL Tuning) are set. Gain and Offset bias are set in order to maximize the S/n without saturating the DAE.
Data are acquired for 30 minutes in each configuration status of the PS and 4KHz.
Changes are performed simultaneously on all the 22 radiometers.

4.1.2 Second part (P_PVP_LFI_0008_01)

Optimal bias coming from the LNAs and Phase switch bias tuning are set. This bias table is the same that will be used during the survey.
Radiometers are tested in groups, following the scheme below:

1st GROUP 18, 21
2nd GROUP 19, 22
3rd GROUP 20, 23
4th GROUP 25, 24
5th GROUP 26, 27
6th GROUP 28

ACAs are tested in turn , acting simultaneously on all the channels belonging to the same group, until each group is completed.
The basic scheme, for each group, is the following:
ACA1 and 2 are set to 0 bias condition ; 4KHz is switched off and PS polarization is set to 0.
Signal is acquired to have a 0 level reference
ACA 1 is set to nominal bias while keeping off ACA 2
ACA 1 is tested in all the useful combinations of PS and 4KHz; Moreover, PS bias are automatically lowered and increased in order to check for the phase switch functionality.
The same is repeated setting ACA2 to nominal bias and ACA 1 to 0 bias condition.
The same is repeated for the other radiometer, operating ACA 3 first and ACA 4 second.

This scheme allows to test just one channel, in the case of suspect failure or non ideal response, minimizing the disturbance (electric cross talk and data loss) on others, since just one ACA is switched off.
Channel 28 is tested alone since it foresees a special soft procedure to be switched on.
Also channel 24 mast be operated following a special procedure, but it has been harmonized with operations on RCA 25.

4.2 Output

The expected output is different for the two tests.

4.2.1 First part

For each P/S and 4KHz configuration it is expected to provide:

Bias table (drain currents) : this is the quantity under requirement. Comparison with CRYO 02 taking into account possible differences in the boundary conditions (such as for example FPU temperature).

Scientific output table (V_out) for each detector: just the SKY signal can be compared to results from CRYO 02 and taking care to account for uncertainties due to radiometers non-isolation and differences in the thermal boundary conditions such as FPU and BEU temperature.

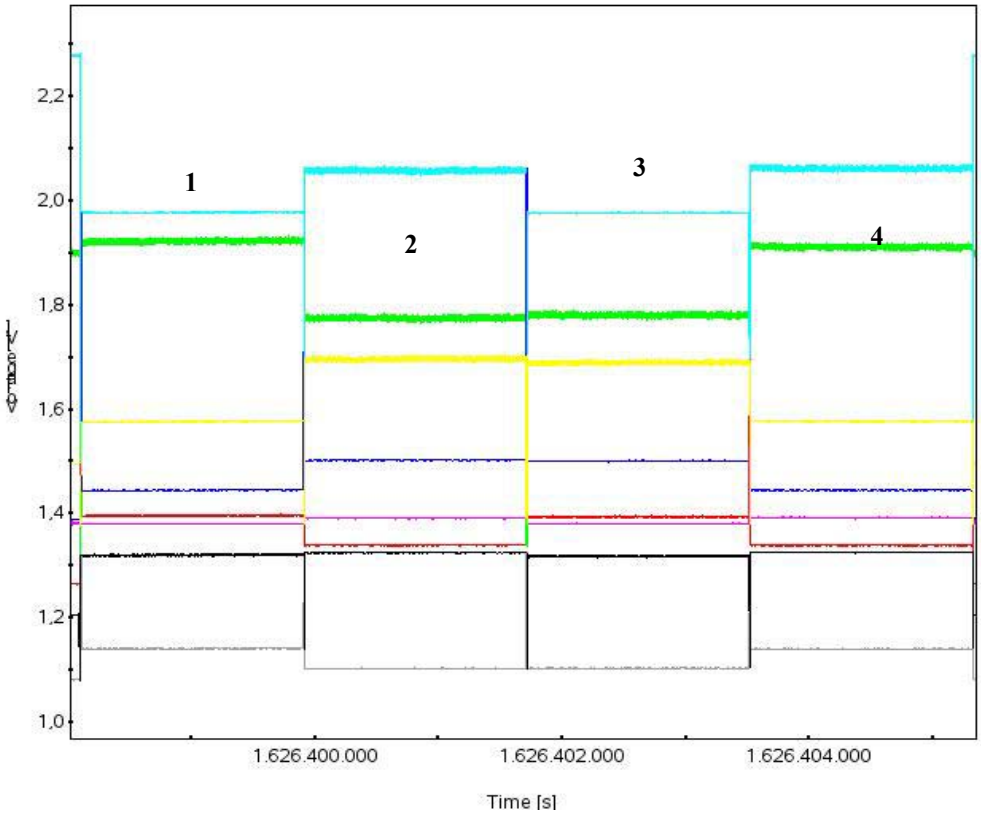

Figure 1 Example of radiometer output (here it is represented LFI-43): the four outputs (up to 8 signals when the 4KHz is enabled) are displayed. From left to right :1) P/S set to 0, 4KHz enabled on A/C;2) P/S set to 1, 4KHz enabled on A/C;3) P/S set to 0, 4KHz enabled on B/D; 4) P/S set to 1, 4KHz enabled on B/D;

4.2.2 Second part

The output of the second part is mostly qualitative in the purpose of the investigation of the radiometers functionality at the time of the test, and quantitative as reference in the case that the test will be repeated in the future . The final output will be hence:

A full investigation of the radiometers functionality in all their possible states. An example of the output for one radiometer is represented in

The file containing all the data to compare with in the case that this test will be repeated, completely or only partly, in the future.

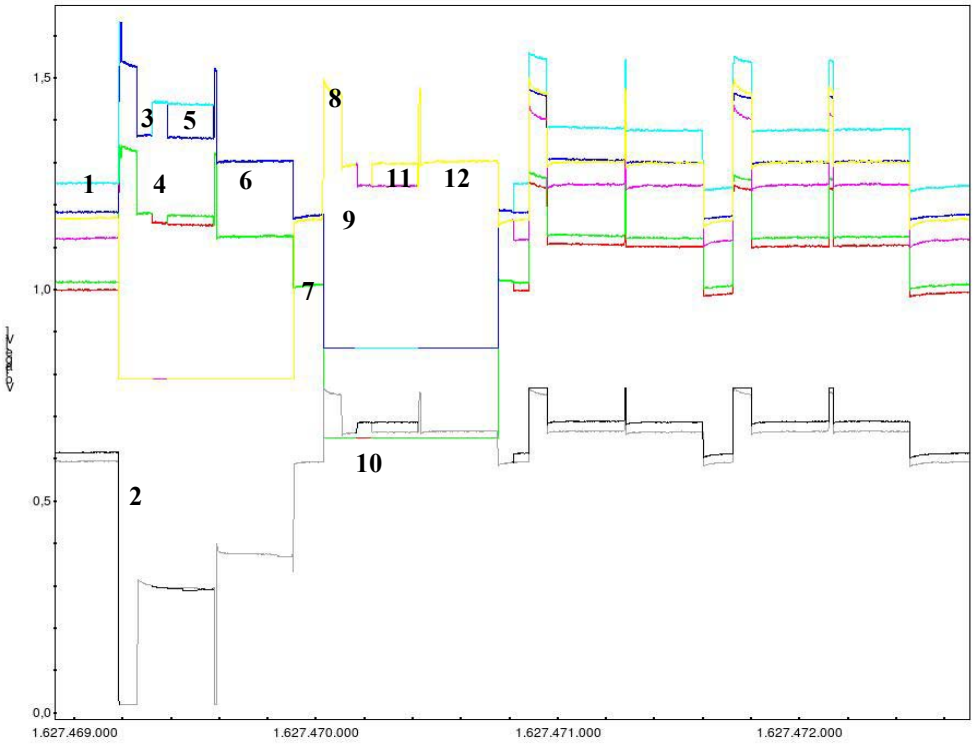

*Figure 2 Example of radiometer output (LFI-23): the four outputs (8 signals) are displayed. From left: 1) all the radiometers are biased to default, KHz on .2)ACA 1&2 biased 0, 4KHz off; 3)ACA 1 biased default (black, brown, red, green curves) ; 4)P/S changed; 5) 4KHz enabled ; I1 lowered on ACA 1; I1 restored and I2 lowered on ACA 1; I2 restored on ACA 1; 6)4KHz disabled; 7) set P/S to 0 and set 0 bias on ACA1; set default bias on ACA 2; 8**) the same procedure is repeated on ACA 2** P/S changed; 9) 4KHz enabled ; I1 lowered on ACA 2; I1 restored and I2 lowered on ACA 2; I2 restored on ACA 2; 10)4KHz disabled; 11) set P/S to 0 and set 0 bias on ACA2; 12) set default bias on ACA 1 and ACA 2.*

4.3 Analysis and output production

The analysis is performed using the LIFE code together with IDL routines running in the LIFE environment.

5 Test Execution

The first part of the test was executed twice: in fact, during the first run (OD 63, 15-16 July 09) the LFI 24 switch on procedure produced oscillations on the output of other channels. Hence a new switch on procedure was assessed and the test was re-run during OD 65 /(17-18 July 09).

The second part of the test was run successfully on OD 76 (28-29 July 09), using the final LNAs bias configuration.

TEST	START	STOP
PART 1 RUN 1	16-07-2009 01.15 UTC	16-07-2009 03.15 UTC
PART 1 RUN 2	17-07-2009 21.30 UTC	17-07-2009 23.30 UTC
PART 2	28-07-2009 09.45 UTC	28-07-2009 12.45 UTC

5.1 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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Test leader	Francesco Cuttaia
LFI IOT	Francesco Cuttaia, Marco Frailis, Samuele Galeotta, Anna Gregorio, Aniello Mennella, Luca Terenzi, Daniele Tavagnacco, Andrea Zacchei,
Industry support	

5.2 Pass - fail criteria, verification matrix

Pass/Fail criteria	Comparison with data taken before Tuning (CSL Tuned bias) within 5 % in current consumption of FEM units No unexpected features (spikes, drops, phase switch functionality ….) No unexpected event packets [RD-1] § 13.1.2.9

Constraints	Tref stable within 10 mK /h , 5K < Tref < 4K Optimum biases uploaded and checked. DAE GAIN set to 1 and DAE Offset set as for cryo 02 in the 1st part (and as for HYM tuning in the 2nd part) nominal science production TYPE 1.

5.2.1 PART 1

CPV **P_PVP_LFI_0108_01, P_PVP_LFI_0108_02**
July, 16, 17th 2009 **DoY 196, 197 OD 64, 66**
Duration **2:00:34**
Test name: **Cryogenic functional test CRYO_02**

Test objectives: This test is the same test performed on ground at cryogenic temperature during TV-TB test campaign in CSL, with exactly the same biases, and front end module at 20 K stable temperature (TSA tuned). The test has been performed once at the beginning of the CPV when not yet in final thermal conditions

Verification matrix

Check	Passed?			Recovered?	
	Yes	No	Notes	Yes	No
No unexpected events packets	Yes				
TC procedure	Yes				
Power consumption as expected	Yes				
Current consumption from FEMs as expected	Yes				
No unexpected features		no	During the PS tuning verification tests, an oscillation effect on RCA 24 created saturation effect on RCA 27 (see AR xx). The test was performed again a few days later, July the 17th-18th	yes	
Data saved and stored at DPC	Yes				

5.2.2 PART 2

CPV	**P_PVP_LFI_0008_01**
July, 28th 2009	**DoY 209 OD 76**
Duration	**2:50:48**
Test name:	**Reference functional test "flight like sequence"**
Test objectives:	The objective of the test is to perform a complete functional test of the radiometric part in stable temperature condition. The aim of this test is also to perform a functional test that mimics the one that will be done during flight and will be the reference point for any other functional test during mission. For instance if there is the need to perform a functional test on a single radiometer, there is in principle no need to switch off all the other radiometers to perform the test: all radiometers are kept on and science can be stored as usual. This is more a reference point than a functional one because at this point LFI is surely functioning as expected.

Verification matrix					
Check	Passed?			Recovered?	
	Yes	No	Notes	Yes	No
No unexpected event Packets	Yes				
TC procedure	Yes				
Every ACA is responding to Bias stimuli as expected	Yes				
Every P/S is responding to bias stimuli as expected	Yes				
Correct cryogenic biases are applied	Yes				
No unexpected features	Yes				
Real time data available	Yes				
Data saved and stored at DPC	Yes				

From now on the two test will be analysed and reported separately .

6 PART 1 (P_PVP_LFI_0108_01 and P_PVP_LFI_0108_02)

6.1 Procedure/ Test sequence and environmental conditions

6.1.1 Test procedure

The test procedure (serving also as a checklist) is summarized in APPENDIX 1 § 8.

6.1.2 Temperatures P_PVP_LFI_0108_01

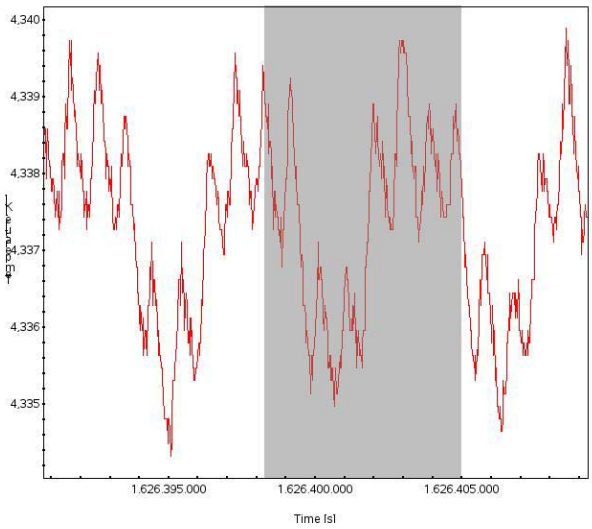


Figure 3 4K temperature stage fluctuation (sensor XXX) during part 1

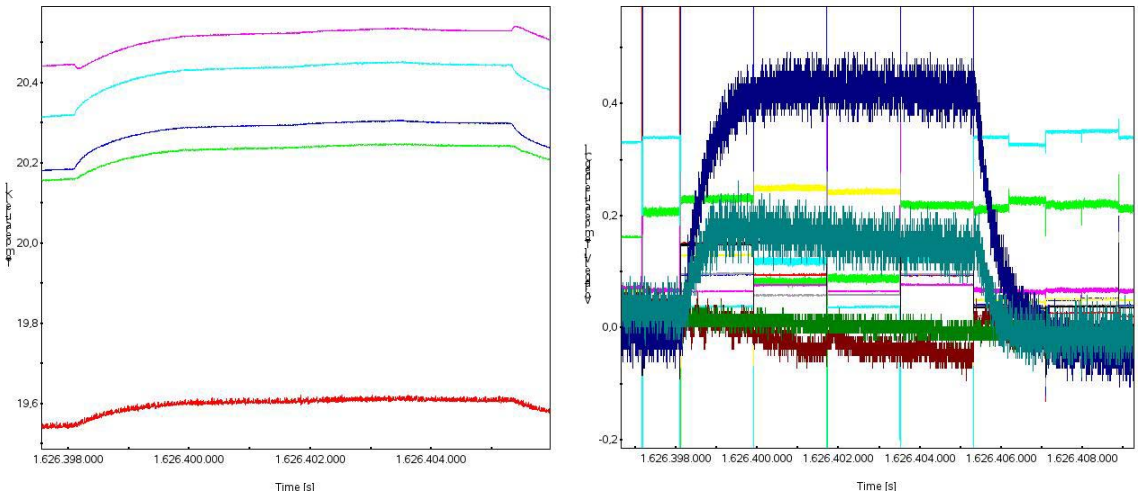


Figure 4 LFI front-end unit (left) and BEU temperature during part 1 On the left panel: green , blue, cyan, red, magenta; on the right panel: green, cyan, red, blue

6.1.3 Temperatures P_PVP_LFI_0108_02

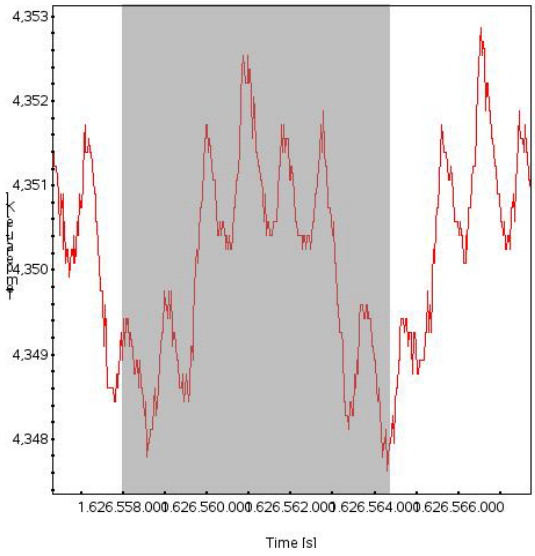


Figure 5 4K temperature stage fluctuation (sensor XXX) during part 1

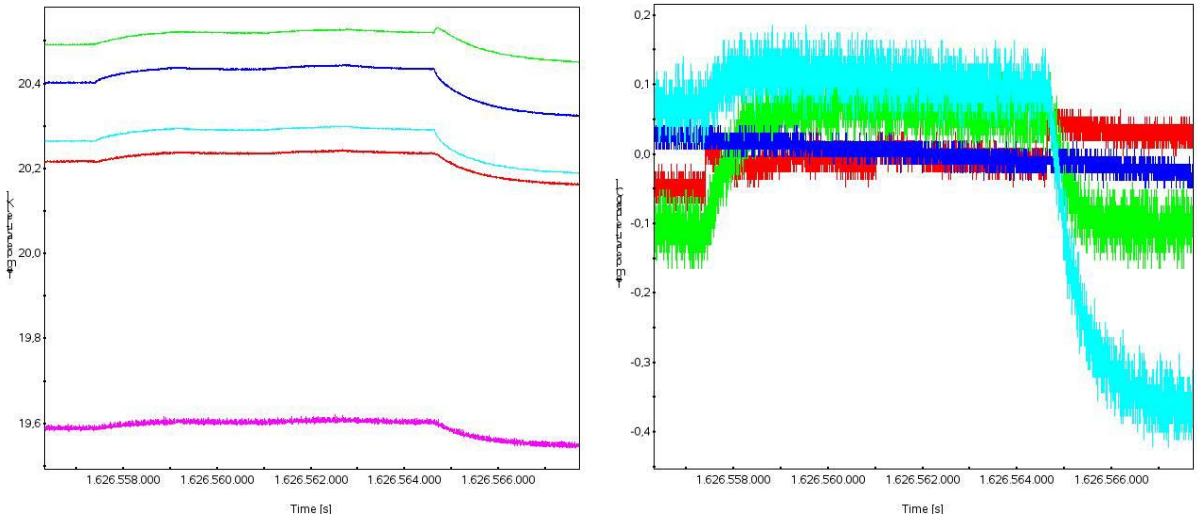


Figure 6 LFI front-end unit (left) and BEU temperature during part 1 On the left panel: green , blue, cyan, red, magenta; on the right panel: green, cyan, red, blue

	FH25	FH26	FH28	LBEM 1	LFEM 1	RBEM 1	RFEM 1
CRYO 02	TBC	TBC	TBC	TBC	TBC	TBC	TBC
P_PVP_LFI_0108_02	TBC	TBC	TBC	14.58	19.23	17.31	19.15

Table 1 TBC

6.1.4 Default bias

The same bias table was applied for the two tests. Only the gain offset setup was different.

	Vg1	Vg2	Vd	I1	I2	CH	G	O
LFI18								
S2	200	204	114	255	255	00	9	143
S1	200	196	138	255	255	01	9	132
M1	195	189	126	255	255	10	9	138
M2	198	196	125	255	255	11	9	160
LFI19								
S2	220	201	125	255	255	00	11	255
S1	215	204	120	255	255	01	4	255
M1	215	198	124	255	255	10	4	255
M2	220	196	126	255	255	11	4	255
LFI20								
S2	198	201	127	255	255	00	9	165
S1	210	211	132	255	255	01	9	160
M1	225	204	121	255	255	10	2	154
M2	231	206	127	255	255	11	2	154
LFI21								
S2	201	213	132	255	255	00	9	130
S1	196	197	136	255	255	01	9	130
M1	201	207	141	255	255	10	9	163
M2	210	187	136	255	255	11	9	130
LFI22								
S2	220	199	130	255	255	00	9	146
S1	204	184	128	255	255	01	9	100
M1	179	204	125	255	255	10	8	40
M2	178	176	130	255	255	11	9	120
LFI23								
S2	186	223	122	255	255	00	10	255
S1	197	166	118	255	255	01	10	255
M1	223	182	120	255	255	10	10	255
M2	226	195	119	255	255	11	10	255
LFI24								
M2	227	204	183	91	255	00	9	160
M1	226	204	200	152	252	01	9	134
S2	219	225	152	96	255	10	9	160
S1	219	213	157	87	234	11	9	160
LFI25								
M1	222	221	184	124	255	00	9	87
M2	224	212	185	89	255	01	9	89
S1	226	216	167	93	255	10	2	120
S2	219	220	166	121	255	11	2	120
LFI26								
M2	232	219	170	136	255	00	9	144
M1	232	221	169	118	255	01	9	132
S2	232	217	169	114	255	10	9	160
S1	228	226	172	159	255	11	9	148
LFI27								
M1	240	108	156	148	210	00	1	24
M2	245	108	157	169	214	01	0	24
S1	238	86	157	138	192	10	1	120
S2	250	126	156	148	184	11	1	140
LFI28								
M1	243	101	157	153	180	00	4	255
M2	240	112	156	169	214	01	4	255
S1	235	88	157	138	192	10	4	250
S2	245	121	158	148	184	11	10	255

Table 2 CRYO 02 bias used during P_PVP_LFI_0108_02

6.1.5 Results

RCA	CH	Id CRYO 02	Id 0108_01	Id 0108_02	D(_01_02)	D_CR02_0108_02
CH27	M1	8.16	**8.04**	**8.19**	1.85	0.37
CH27	M2	7.83	**7.66**	**7.86**	2.58	0.38
CH27	S1	8.52	**8.36**	**8.54**	2.13	0.23
CH27	S2	8.74	**8.23**	**8.77**	6.35	0.34
CH24	M2	7.2	**7.14**	**7.23**	1.25	0.42
CH24	M1	10.12	**8.51**	**10.13**	17.38	0.10
CH24	S2	14.91	**11.47**	**15**	26.67	0.60
CH24	S1	10.58	**15.16**	**10.67**	-34.77	0.85
CH21	S2	16.5	**19.51**	**16.54**	-16.48	0.24
CH21	S1	18.76	**19.05**	**19.03**	-0.11	1.43
CH21	M1	19.34	**20.47**	**19.35**	-5.63	0.05
CH21	M2	20.06	**21.94**	**20.08**	-8.85	0.10
CH22	S2	16.31	**17.7**	**16.3**	-8.24	-0.06
CH22	S1	15.98	**18.77**	**16.01**	-15.87	0.19
CH22	M1	12.88	**16.07**	**12.94**	-21.58	0.46
CH22	M2	14.95	**16.99**	**15.13**	-11.58	1.20
CH23	S2	16.17	**17.12**	**16.27**	-5.09	0.62
CH23	S1	20.36	**21.24**	**20.41**	-3.99	0.25
CH23	M1	16.59	**16.98**	**16.29**	-4.15	-1.82
CH23	M2	17.7	**17.63**	**17.78**	0.85	0.45
CH25	M1	12.28	**9.04**	**12.37**	31.11	0.73
CH25	M2	10.07	**8.03**	**10.14**	23.23	0.69
CH25	S1	11.22	**8.43**	**11.34**	29.44	1.06
CH25	S2	12.04	**8.75**	**12.15**	32.54	0.91
CH28	M1	9.62	**9.28**	**9.63**	3.70	0.10
CH28	M2	9.17	**9.54**	**9.18**	-3.85	0.11
CH28	S1	8.78	**8.82**	**8.81**	-0.11	0.34
CH28	S2	10.46	**7.28**	**10.49**	36.13	0.29
CH20	S2	20.41	**18.54**	**20.44**	9.75	0.15
CH20	S1	18.68	**18.16**	**18.76**	3.25	0.43
CH20	M1	20.93	**21.17**	**20.95**	-1.04	0.10
CH20	M2	20.63	**21.04**	**20.66**	-1.82	0.15
CH19	S2	17.65	**17.93**	**17.81**	-0.67	0.90
CH19	S1	17.14	**17.76**	**17.2**	-3.20	0.35
CH19	M1	16.72	**18.66**	**16.75**	-10.79	0.18
CH19	M2	18.63	**19.23**	**18.74**	-2.58	0.59
CH18	S2	20.64	**19.78**	**20.69**	4.50	0.24
CH18	S1	20.71	**18.41**	**20.74**	11.90	0.14
CH18	M1	13.15	**13.45**	**13.66**	1.55	3.80
CH18	M2	13.81	**14.5**	**13.89**	-4.30	0.58
CH26	M2	12.57	**10.33**	**12.64**	20.11	0.56
CH26	M1	11.27	**9.63**	**11.33**	16.22	0.53
CH26	S2	10.38	**8.12**	**10.47**	25.28	0.86
CH26	S1	13.37	**9.6**	**13.46**	33.48	0.67

Table 3 measured drain currents and comparison with CRYO 02: for completeness both the steps (P_PVP_LFI_0108_01, P_PVP_LFI_0108_02) are displayed in the table : only the second must be considered for the purpose of the test. The 6th and the 7th columns measure the drain current relative difference between the two steps and between the second and the CRYO02.

	CRYO 02				P_PVP_LFI_0108_02				
FH	Sky	RMSsky	Ref	RMSref	Sky	RMSsky	Ref	RMSref	SKY %
1800	2.003192	0.004533	3.176549	0.006798	1.972447	0.003215	2.03832	0.003294	-1.5
1801	2.616081	0.005571	4.19337	0.008571	2.580861	0.004132	2.705733	0.004318	-1.4
1810	1.037253	0.002044	1.596766	0.003111	0.987456	0.001295	1.021359	0.001345	-4.9
1811	0.907311	0.001614	1.374783	0.002444	0.867289	0.000952	0.910886	0.001027	-4.5
1900	0.907633	0.002451	1.38787	0.00381	0.872271	0.001414	0.891201	0.001442	-4.0
1901	0.969286	0.002584	1.532568	0.004137	0.93846	0.001463	0.979237	0.001531	-3.2
1910	0.682413	0.00139	1.060941	0.002117	0.675828	0.0007	0.699091	0.000754	-1.0
1911	0.841836	0.001704	1.288825	0.002439	0.829867	0.00088	0.865928	0.000889	-1.4
2000	0.925892	0.011593	1.394173	0.017742	1.209937	NO	1.209937	NO	26.6
2001	0.878671	0.011261	1.360263	0.017706	1.189144	0	1.189144	0	30.0
2010	1.417824	0.001978	2.019128	0.003344	1.349936	0.00162	1.373525	0.00167	-4.9
2011	1.395618	0.001711	2.035407	0.002997	1.33103	0.001625	1.394609	0.001697	-4.7
2100	1.017639	0.000804	1.71357	0.001251	0.992649	0.000605	1.038773	0.000617	-2.5
2101	0.963278	0.000793	1.590932	0.001186	0.933134	0.000605	0.982615	0.000634	-3.2
2110	0.690275	0.000694	1.015544	0.001024	0.648346	0.000965	0.665013	0.00097	-6.3
2111	0.655215	0.000726	0.961027	0.001054	0.620187	0.001047	0.638186	0.001087	-5.5
2200	0.406973	0.000479	0.614189	0.000771	0.786616	0.000001	0.786616	0.000001	63.6
2201	0.443449	0.00045	0.696277	0.000735	0.784785	0.000001	0.784785	0.000001	55.6
2210	0.623029	0.00175	0.9321	0.002558	0.598945	0.001178	0.599582	0.001185	-3.9
2211	0.78328	0.002191	1.161841	0.003085	0.790612	0.000001	0.790612	0.000001	0.9
2300	1.224292	0.005638	1.833115	0.008523	1.189821	0.003498	1.210719	0.003593	-2.9
2301	1.461479	0.006541	2.279799	0.010151	1.410522	0.004221	1.486748	0.004426	-3.5
2310	0.718941	0.00575	1.064406	0.009588	1.215831	0.000001	1.215831	0.000001	51.4
2311	0.370343	0.003253	0.542575	0.005268	0.879348	NO	0.879348	NO	81.5
2400	0.06106	0.000034	0.107332	0.000059	0.059621	0.000031	0.064686	0.000033	-2.4
2401	0.060666	0.000036	0.111639	0.000057	0.059836	0.000037	0.065373	0.00004	-1.4
2410	0.119841	0.00005	0.208224	0.00006	0.116776	0.000046	0.127378	0.000047	-2.6
2411	0.126961	0.000041	0.218304	0.000044	0.125097	0.000039	0.136586	0.000038	-1.5
2500	0.176116	0.000055	0.29851	0.000089	0.175385	0.000054	0.192834	0.000056	-0.4
2501	0.168471	0.000054	0.291043	0.000076	0.166716	0.00005	0.185649	0.000052	-1.0
2510	0.174915	0.000059	0.318637	0.000097	0.175773	0.000065	0.19869	0.000069	0.5
2511	0.151205	0.000053	0.270646	0.000082	0.150794	0.000048	0.168845	0.000049	-0.3
2600	0.12496	0.000042	0.221531	0.000064	0.122597	0.000042	0.141865	0.000045	-1.9
2601	0.149335	0.000036	0.256919	0.000064	0.148008	0.000051	0.173391	0.000057	-0.9
2610	0.147101	0.00005	0.27047	0.000066	0.14608	0.000047	0.164824	0.000048	-0.7
2611	0.15851	0.000044	0.278343	0.000054	0.157969	0.000037	0.177041	0.000037	-0.3
2700	1.297243	0.000387	2.641276	0.000623	1.282987	0.000378	1.473718	0.000358	-1.1
2701	1.395406	0.000409	2.832169	0.000631	1.383696	0.000396	1.592079	0.000373	-0.8
2710	1.319705	0.000355	2.582126	0.000588	1.319975	0.00034	1.513332	0.000339	0.0
2711	1.080061	0.0003	2.182367	0.000497	1.078202	0.00031	1.230901	0.000303	-0.2
2800	1.145075	0.000312	2.119504	0.000479	1.121756	0.000297	1.165611	0.000263	-2.1
2801	1.4726	0.000425	2.676637	0.000612	1.43294	0.000384	1.479293	0.00034	-2.7
2810	1.058972	0.000255	2.017067	0.000437	1.016001	0.000256	1.108733	0.000235	-4.1
2811	0.930247	0.000223	1.814534	0.000407	0.892196	0.000228	0.96524	0.000203	-4.2

Table 4 P/S 0, 4KHz A/C enabled; measured Vout and comparison with CRYO 02: the three outputs in yellow are saturating the DAE due to a Gain the high set

FH	Sky				Sky				
1800	1.993298	0.005748	3.213347	0.009119	1.960699	0.003814	2.06593	0.004035	-1.6
1801	2.642689	0.00755	4.178953	0.011867	2.609117	0.005008	2.692979	0.005143	-1.3
1810	1.043408	0.001406	1.647973	0.002235	0.997169	0.001232	1.055803	0.00132	-4.5
1811	0.920086	0.001093	1.380368	0.001633	0.884451	0.000985	0.915788	0.001024	-3.9
1900	0.903764	0.000828	1.40603	0.001302	0.86771	0.000958	0.904577	0.000999	-4.1
1901	0.972429	0.000921	1.523768	0.001475	0.938772	0.001079	0.974081	0.001113	-3.5
1910	0.683433	0.000406	1.083284	0.000661	0.674513	0.000546	0.713951	0.00057	-1.3
1911	0.847984	0.000526	1.289403	0.000781	0.83622	0.000691	0.8647	0.000722	-1.4
2000	0.944013	0.002255	1.453545	0.00357	1.209937	NO	1.209937	NO	24.7
2001	0.91629	0.002234	1.385864	0.003374	1.189144	0.000001	1.189144	0.000001	25.9
2010	1.394549	0.001339	2.048656	0.00218	1.330488	0.000969	1.397109	0.001003	-4.7
2011	1.42844	0.001447	2.007145	0.002299	1.359097	0.00094	1.375009	0.000979	-5.0
2100	1.01722	0.00081	1.729777	0.001239	0.991294	0.000934	1.050899	0.000972	-2.6
2101	0.976469	0.000726	1.584843	0.001085	0.947194	0.000891	0.980273	0.000904	-3.0
2110	0.692537	0.000715	1.027466	0.001058	0.650493	0.000592	0.675198	0.000599	-6.3
2111	0.660772	0.000747	0.957482	0.001004	0.626443	0.000589	0.637876	0.000602	-5.3
2200	0.407565	0.000536	0.629731	0.000784	0.786616	0.000001	0.786616	0.000001	63.5
2201	0.458413	0.000511	0.697196	0.000756	0.784785	0.000001	0.784785	0.000001	52.5
2210	0.632065	0.000679	0.941937	0.000927	0.608504	0.000856	0.607076	0.000844	-3.8
2211	0.797822	0.000815	1.163688	0.001102	0.790612	0.000001	0.790612	0.000001	-0.9
2300	1.050727	0.001377	1.630878	0.002193	1.040316	0.000731	1.101654	0.000775	-1.0
2301	1.287793	0.001443	1.940702	0.002179	1.26986	0.0009	1.295505	0.000899	-1.4
2310	0.733301	0.001425	1.073426	0.002253	1.215831	0.000001	1.215831	0.000001	49.5
2311	0.373302	0.000739	0.553458	0.001188	0.879348	NO	0.879348	NO	80.8
2400	0.061786	0.000034	0.108377	0.000058	0.060233	0.00003	0.065411	0.000032	-2.5
2401	0.061276	0.000037	0.113165	0.00006	0.060494	0.000034	0.066339	0.000036	-1.3
2410	0.11953	0.000049	0.207934	0.000061	0.11669	0.000047	0.12758	0.000046	-2.4
2411	0.126519	0.000043	0.219816	0.000055	0.124636	0.000035	0.137716	0.000035	-1.5
2500	0.178024	0.000061	0.30261	0.000089	0.176772	0.000056	0.196628	0.000059	-0.7
2501	0.169947	0.00006	0.29089	0.000087	0.168906	0.000053	0.186046	0.000059	-0.6
2510	0.174671	0.00006	0.318041	0.000094	0.17532	0.00006	0.198463	0.000064	0.4
2511	0.149957	0.000052	0.269716	0.000072	0.150617	0.000048	0.168364	0.000048	0.4
2600	0.125155	0.000043	0.222945	0.000062	0.122782	0.00004	0.143638	0.000044	-1.9
2601	0.151197	0.000045	0.254591	0.000072	0.149538	0.000044	0.171436	0.000048	-1.1
2610	0.148132	0.000052	0.270023	0.000068	0.147416	0.000049	0.16468	0.00005	-0.5
2611	0.158454	0.000042	0.279892	0.000056	0.158446	0.000042	0.178417	0.000043	0.0
2700	1.30126	0.000372	2.645622	0.000599	1.288177	0.000395	1.478345	0.000373	-1.0
2701	1.398314	0.000392	2.835667	0.000607	1.388095	0.000435	1.599971	0.00041	-0.7
2710	1.328512	0.000361	2.577108	0.000564	1.328207	0.000363	1.513585	0.000348	0.0
2711	1.079221	0.000296	2.179086	0.000492	1.078296	0.000304	1.234084	0.000293	-0.1
2800	1.164793	0.000326	2.120737	0.000441	1.142923	0.000291	1.162347	0.000261	-1.9
2801	1.477925	0.000425	2.696303	0.000525	1.43935	0.00036	1.496261	0.000332	-2.6
2810	1.076645	0.000287	2.026337	0.000463	1.035501	0.000273	1.114133	0.000248	-3.9
2811	0.934782	0.000244	1.834915	0.000422	0.900408	0.000239	0.982863	0.000219	-3.7

Table 5 P/S 1, 4KHz A/C enabled; measured Vout and comparison with CRYO 02: the three outputs in yellow are saturating the DAE due to a Gain the high set

FH	Sky				Sky				
1800	2.004807	0.006215	3.217059	0.009646	1.973934	0.004005	2.065771	0.004157	-1.6
1801	2.650634	0.008058	4.202519	0.01264	2.615901	0.005094	2.710543	0.005282	-1.3
1810	1.045766	0.001482	1.596131	0.002186	0.998904	0.001171	1.024466	0.001185	-4.6
1811	0.907531	0.001134	1.382429	0.001704	0.869568	0.000879	0.917177	0.00094	-4.3
1900	0.908729	0.000824	1.402574	0.001268	0.871331	0.000612	0.899933	0.000629	-4.2
1901	0.980359	0.000778	1.529828	0.001242	0.947711	0.000596	0.978202	0.000619	-3.4
1910	0.689453	0.000484	1.072243	0.000696	0.6813	0.000592	0.706891	0.000616	-1.2
1911	0.850009	0.000615	1.299815	0.000914	0.838447	0.000771	0.872687	0.000801	-1.4
2000	0.95286	0.00141	1.446043	0.002155	1.209937	NO	1.209937	NO	23.8
2001	0.911228	0.001221	1.399282	0.001847	1.189144	0.000001	1.189144	0.000001	26.5
2010	1.400981	0.001039	2.035843	0.001445	1.337265	0.001045	1.385544	0.001071	-4.7
2011	1.40721	0.000983	2.016703	0.001354	1.342513	0.000941	1.381704	0.000962	-4.7
2100	1.020495	0.000841	1.716218	0.001258	0.994497	0.00079	1.040354	0.000814	-2.6
2101	0.964205	0.000824	1.591521	0.001208	0.935101	0.000836	0.984131	0.00086	-3.1
2110	0.693761	0.00064	1.016963	0.000936	0.652584	0.000525	0.668675	0.000539	-6.1
2111	0.657218	0.000667	0.959379	0.000929	0.624602	0.000527	0.640589	0.000529	-5.1
2200	0.407774	0.000345	0.617683	0.000522	0.786616	0	0.786616	0	63.4
2201	0.445746	0.000333	0.697884	0.00052	0.784785	0.000001	0.784785	0.000001	55.1
2210	0.633764	0.000809	0.940027	0.001138	0.609705	0.000748	0.605837	0.000742	-3.9
2211	0.790004	0.001021	1.166775	0.00138	0.790612	0	0.790612	0	0.1
2300	1.057081	0.000742	1.848569	0.002869	1.044975	0.000823	1.222752	0.001349	-1.2
2301	1.472275	0.002208	1.951452	0.001188	1.42387	0.001633	1.3006	0.000967	-3.3
2310	0.734236	0.00093	1.08814	0.001409	1.215831	0.000001	1.215831	0.000001	49.4
2311	0.378444	0.000516	0.555179	0.000792	0.879348	NO	0.879348	NO	79.6
2400	0.060797	0.000034	0.10762	0.000047	0.059362	0.000031	0.064942	0.000033	-2.4
2401	0.060881	0.000036	0.111096	0.000059	0.060072	0.000033	0.065074	0.000035	-1.3
2410	0.119999	0.000052	0.20795	0.00007	0.116991	0.000048	0.127699	0.000049	-2.5
2411	0.126622	0.000041	0.21834	0.000046	0.12469	0.000037	0.136707	0.000038	-1.5
2500	0.176407	0.000059	0.303304	0.000088	0.175795	0.000057	0.197059	0.000067	-0.3
2501	0.170301	0.00005	0.291585	0.000084	0.169243	0.000053	0.186152	0.000053	-0.6
2510	0.174866	0.00006	0.318229	0.00009	0.175688	0.000058	0.198459	0.000062	0.5
2511	0.150041	0.000055	0.270356	0.000073	0.15015	0.000047	0.168686	0.000047	0.1
2600	0.124215	0.000044	0.222042	0.000066	0.122087	0.000041	0.142931	0.000045	-1.7
2601	0.150507	0.000044	0.25648	0.000063	0.149033	0.000041	0.173074	0.000046	-1.0
2610	0.14655	0.000037	0.269242	0.000068	0.145613	0.00005	0.164041	0.000049	-0.6
2611	0.157676	0.000043	0.277846	0.000058	0.157852	0.000043	0.176604	0.000041	0.1
2700	1.295618	0.000379	2.642254	0.000574	1.281674	0.000366	1.476683	0.000349	-1.1
2701	1.396811	0.000409	2.828538	0.000604	1.386768	0.000393	1.591269	0.000373	-0.7
2710	1.319843	0.000402	2.576822	0.000529	1.32005	0.000358	1.513577	0.000343	0.0
2711	1.079371	0.000339	2.181134	0.000467	1.078289	0.000301	1.231071	0.000283	-0.1
2800	2.118567	0.00046	1.164803	0.000332	1.166043	0.000268	1.143095	0.000305	-58.0
2801	2.695984	0.000516	1.472834	0.000406	1.496521	0.000345	1.433497	0.000388	-57.2
2810	2.015616	0.000383	1.076392	0.000266	1.108557	0.000251	1.035479	0.000279	-58.1
2811	1.83467	0.000377	0.930058	0.000243	0.982871	0.000209	0.892159	0.000231	-60.5

Table 6 P/S 0, 4KHz B/D enabled; measured Vout and comparison with CRYO 02: the three outputs in yellow are saturating the DAE due to a Gain the high set

FH	Sky				Sky				
1800	2.008828	0.003522	3.198187	0.005402	1.972422	0.00441	2.052211	0.004586	-1.8
1801	2.632251	0.00453	4.205354	0.006915	2.591944	0.005777	2.706385	0.005936	-1.5
1810	1.034133	0.001836	1.64585	0.002923	0.990654	0.001319	1.057912	0.001425	-4.3
1811	0.919269	0.001485	1.37061	0.002168	0.885998	0.001038	0.913524	0.001073	-3.7
1900	0.917567	0.000791	1.411979	0.001149	0.880616	0.00059	0.908095	0.000606	-4.1
1901	0.976877	0.000855	1.548529	0.001332	0.942411	0.000603	0.988476	0.000631	-3.6
1910	0.686935	0.000548	1.087964	0.000844	0.680165	0.000459	0.717827	0.000485	-1.0
1911	0.85127	0.0007	1.296114	0.001016	0.840549	0.000608	0.871332	0.000631	-1.3
2000	0.961619	0.000746	1.47001	0.001079	1.209937	NO	1.209937	NO	22.9
2001	0.926835	0.000772	1.413903	0.001177	1.189144	0.000001	1.189144	0.000001	24.8
2010	1.422717	0.001332	2.048729	0.001818	1.358092	0.001032	1.400377	0.00105	-4.6
2011	1.428687	0.001364	2.043096	0.001862	1.362316	0.000973	1.403008	0.000991	-4.8
2100	1.016268	0.000903	1.731809	0.001438	0.993346	0.000617	1.053543	0.000648	-2.3
2101	0.977526	0.0009	1.58807	0.001422	0.94958	0.000576	0.983409	0.000597	-2.9
2110	0.69182	0.000664	1.029855	0.000943	0.652115	0.000546	0.677468	0.000564	-5.9
2111	0.663091	0.00064	0.96474	0.000915	0.6294	0.000525	0.64293	0.000538	-5.2
2200	0.40798	0.000278	0.628454	0.00045	0.786616	0.000001	0.786616	0.000001	63.4
2201	0.457214	0.000303	0.697743	0.000476	0.784785	0.000001	0.784785	0.000001	52.7
2210	0.626848	0.000657	0.94168	0.000964	0.60363	0.000654	0.606721	0.000662	-3.8
2211	0.798049	0.000765	1.167912	0.001073	0.790612	0.000001	0.790612	0.000001	-0.9
2300	1.239493	0.001013	1.639913	0.001091	1.206161	0.001079	1.1064	0.000794	-2.7
2301	1.29396	0.000766	2.304371	0.002015	1.274099	0.000834	1.506159	0.001302	-1.5
2310	0.735104	0.000806	1.078567	0.001221	1.215831	0.000001	1.215831	0.000001	49.3
2311	0.375333	0.00034	0.557361	0.000622	0.879348	NO	0.879348	NO	80.3
2400	0.061304	0.000031	0.106654	0.000062	0.059771	0.000032	0.064364	0.000033	-2.5
2401	0.060388	0.000042	0.112287	0.000067	0.059525	0.000034	0.065823	0.000037	-1.4
2410	0.119556	0.000051	0.20804	0.000063	0.116727	0.000046	0.127504	0.000047	-2.4
2411	0.126965	0.000043	0.21965	0.000054	0.125176	0.000039	0.137749	0.000038	-1.4
2500	0.178207	0.000064	0.298532	0.000097	0.176976	0.000057	0.19312	0.000058	-0.7
2501	0.168616	0.000055	0.291156	0.000088	0.167048	0.000051	0.186429	0.000061	-0.9
2510	0.174836	0.000061	0.318507	0.000091	0.175651	0.000059	0.198998	0.000062	0.5
2511	0.151054	0.000045	0.269913	0.000081	0.151358	0.000045	0.168762	0.000045	0.2
2600	0.124208	0.000041	0.220773	0.000065	0.122046	0.000039	0.141395	0.000042	-1.8
2601	0.148657	0.000053	0.253837	0.000064	0.147578	0.000043	0.170951	0.000047	-0.7
2610	0.147024	0.000048	0.269364	0.000076	0.146539	0.000048	0.16412	0.000048	-0.3
2611	0.157629	0.000041	0.278771	0.000063	0.15726	0.000039	0.177553	0.000038	-0.2
2700	1.298852	0.000379	2.635765	0.000669	1.286355	0.000371	1.472424	0.00036	-1.0
2701	1.393882	0.000388	2.831252	0.000661	1.382854	0.000386	1.598551	0.000375	-0.8
2710	1.329074	0.000359	2.580271	0.000595	1.328731	0.00035	1.513946	0.000332	0.0
2711	1.08047	0.0003	2.178176	0.00047	1.078742	0.000305	1.23442	0.000289	-0.2
2800	1.164968	0.00033	2.118069	0.000476	1.143012	0.000311	1.165908	0.00028	-1.9
2801	1.472943	0.000433	2.695159	0.000586	1.433507	0.000393	1.496484	0.000348	-2.7
2810	1.076394	0.000286	2.015016	0.000458	1.035407	0.000275	1.108464	0.000253	-3.9
2811	0.929945	0.000253	1.833885	0.000423	0.892077	0.000243	0.982769	0.000229	-4.2

Table 7 P/S 1, 4KHz B/D enabled; measured Vout and comparison with CRYO 02: the three outputs in yellow are saturating the DAE due to a Gain the high set

From the above comparisons it comes out that the requirement set on drain current consistency (5%) with the CRYO 02 test is fully satisfied.We just indicated in yellow channel LFI-18 M1 that has a discrepancy higher that 2%, that was set as 'soft limit'. Instead, it is clear from Table 3 that the first step P_PVP_LFI_0108_01 produced non-sense drain currents because of the LFI 24 oscillation.

Just the Sky scientific output is worth of comparison, because of the different temperatures of the 4K reference Loads in the two tests. In the most cases the agreement is very good (less than 1%) and in all is good (less or around 5%) . On this quantity was not set any requirement. However it is useful to track it , because it is also an evidence of the good health of the phase switches and of the BEM amplifiers. Moreover, despite the environmental conditions are slightly changed between the two tests (SCS and BEU temperature) however the small change in the sky signal (decreased on all channels, as expected because of the reference load cooldown) gives at least a rough estimation of the Isolation of each radiometer.

STEP 1	[1626558005,1626559085]
STEP 2	[1626559608,1626560886]
STEP 3	[1626561231,1626562630]
STEP 4	[1626563215,1626564392]

Table 8 Time windows used for the analysis of P_PVP_LFI_0108_02

6.2 Noise properties

Fully reported in APPENDIX 2 § 9

6.3 Non nominal features

6.3.1 RCA 24 Switch on

It was wrongly believed, basing on the CSL tests experience, that the 'soft switch on' procedure for LFI 24 was required only when switching on the radiometer starting from 0 bias condition. Instead, we experienced the oscillation also in this case, that is passing from the previous bias configuration (Optimal bias) to the CRYO 02 bias just setting the new CRYO 02 bias table. The oscillation compromised the first test step P_PVP_LFI_0108_01 that hence was repeated adopting the soft switch on procedure. A dedicated investigation was carried on to characterize this effect: it is traced by NC XXX.

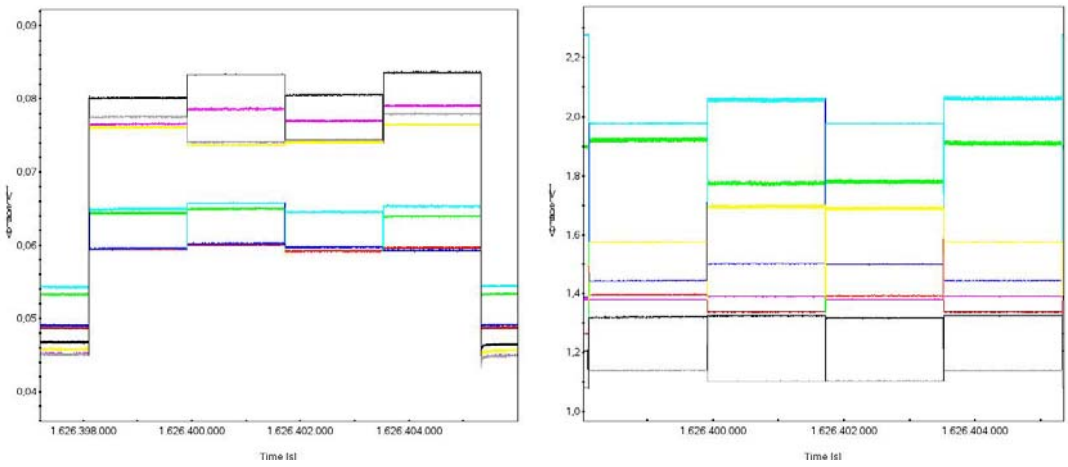


Figure 7 RCA 24 and 27: the oscillation produced saturations on other channels.

6.3.2 Instabilities

A strong drift in the Voltage output was observed in both the steps of reference test part 1 when the CRYO 02 bias table was applied . This drift , probably due to the thermal changes in the radiometers and in the BEU due to the bias change (power dissipation different in the LNAs, because of the changed drain currents, and in the BEU, because of the different power consumption at FEM tray level, documented by Figure 4 and Figure 6)

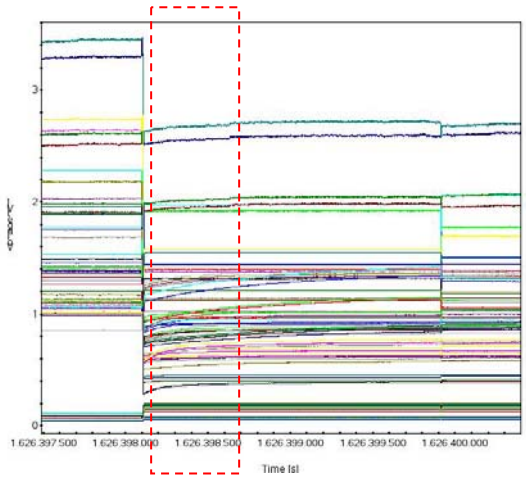


Figure 8 Vout drift during 1st step

Instabilities where observed also in the drain currents of some radiometers. In particular, drain current instabilities were observed on LFI 21 S1 and LFI 22 S2 (*Figure 9*). Similar features were already observed during CRYO 02 (*Figure 10*). The sudden drop observed during CRYO 02 on LFI 23 M2, when changing the P/S status, was instead not observed.

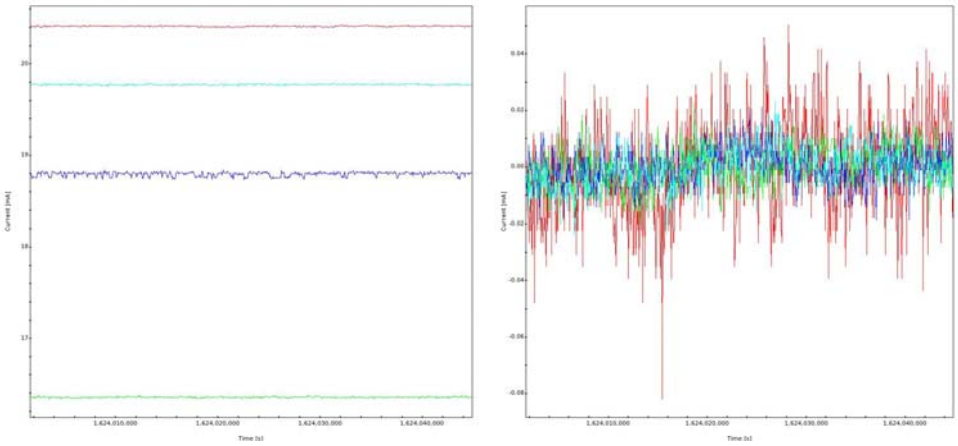
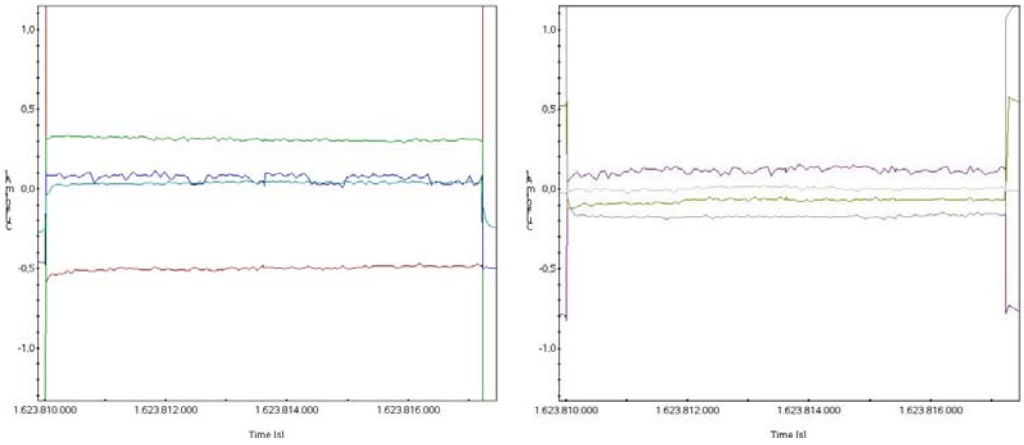


Figure 9 Instabilities on Id from LFI 21 S1 (blue, left panel) and LFI 22S2 (red, right panel)



:

Figure 10 Instabilities on Id from LFI 21 S1 (blue, left panel) and LFI 22S2 (red, right panel)during CRYO 02.

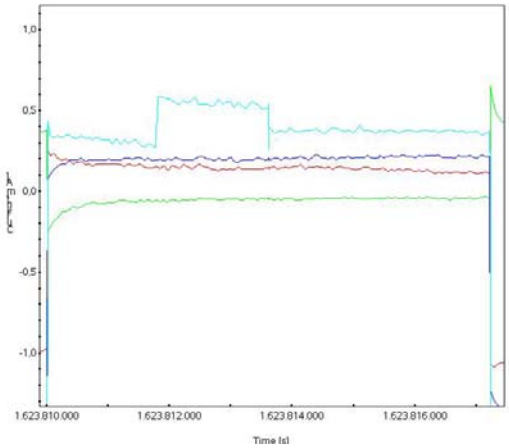


Figure 11 Instabilities on Id from LFI 23 M2 (cyan) and during CRYO 02. The instability, apparently related with the P/S status change (B/D from 0 to 1) was not observed again during the reference test.

7 PART 2

7.1 Procedure/ Test sequence, setup and environmental conditions

7.1.1 Test procedure

It is fully reported in APPENDIX 1 § 8, used also as verification matrix.

7.1.2 Bias Table

	Vg1	Vg2	Vd	I1	I2	Id
27M1	240	108	156	148	220	8.12
27M2	244	90	157	145	205	7.22
27S1	237	102	157	127	184	8.44
27S2	246	114	156	148	195	7.99
24M2	225	225	185	205	206	15
24M1	225	225	191	205	205	16.53
24S2	225	225	159	205	205	16.46
24S1	225	225	158	205	205	15.58
21S2	205	243	132	255	255	22.04
21S1	170	221	136	255	255	19.11
21M1	198	207	141	255	255	18.49
21M2	196	197	136	255	255	19.43
22S2	206	204	130	255	255	15.1
22S1	204	189	128	255	255	16.35
22M1	203	194	125	255	255	14.07
22M2	178	176	130	255	255	14.88
23S2	190	208	122	255	255	14.79
23S1	181	211	118	255	255	20.57
23M1	207	192	120	255	255	14.71
23M2	210	195	119	255	255	14.2
25M1	225	225	185	205	205	14.37
25M2	225	225	187	205	205	14.87
25S1	225	225	169	205	205	14.81
25S2	225	225	167	205	205	14.67
28M1	243	101	157	130	160	9.63
28M2	240	112	156	127	228	9.19
28S1	240	84	157	127	222	9.11
28S2	245	121	158	103	165	10.49
20S2	188	201	127	255	255	18.62
20S1	199	221	132	255	255	18.82
20M1	209	219	121	255	255	20.63
20M2	215	221	127	255	255	20.63
19S2	204	216	125	255	255	17.02
19S1	215	209	120	255	255	17.9
19M1	213	206	124	255	255	18.19
19M2	211	208	126	255	255	19.92
18S2	216	182	114	255	255	18.45
18S1	155	215	138	255	255	15.92
18M1	195	189	126	255	255	13.11
18M2	198	201	125	255	255	14.43
26M2	225	225	178	205	205	14.72
26M1	225	225	176	205	205	12.85
26S1	225	225	176	205	205	13.4
26S2	225	225	178	205	205	13.72

Table 9 default bias table set before P_PVP_LFI_0008_01

7.1.3 Temperatures

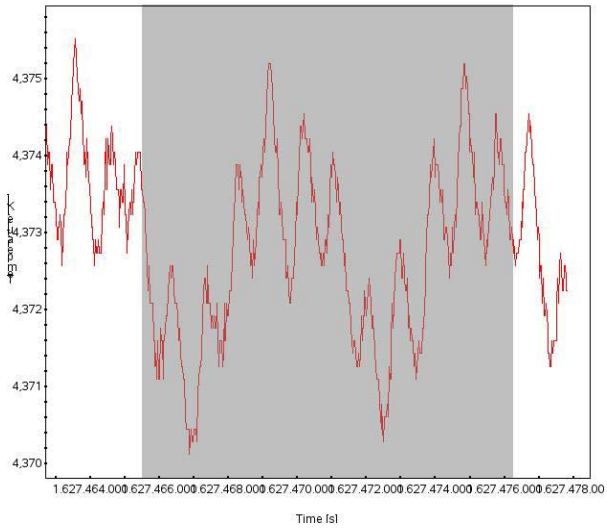


Figure 12 4K temperature during part 2

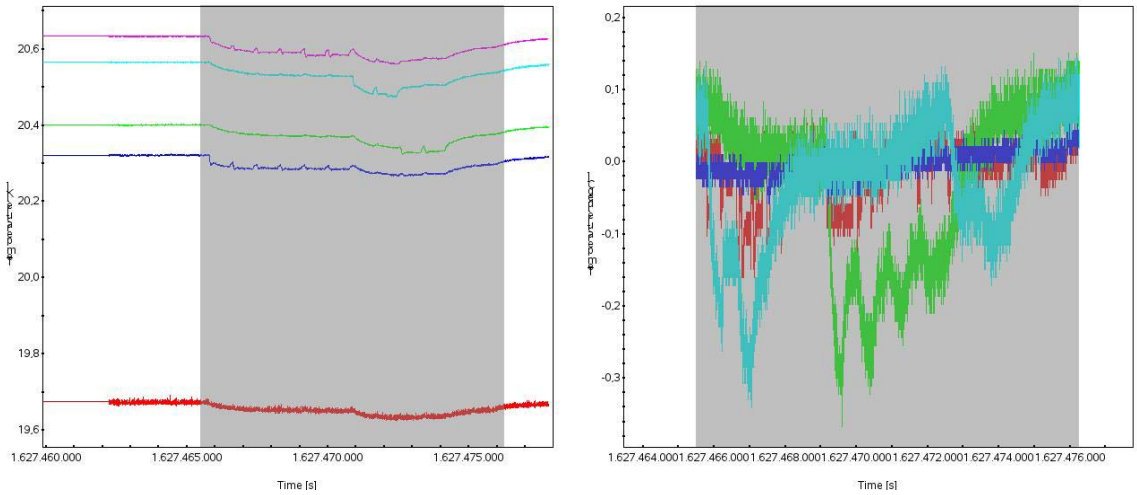


Figure 13 LFI front-end unit (left) and BEU temperature during part 1 On the left panel: green , blue, cyan, red, magenta; on the right panel: green, cyan, red, blue

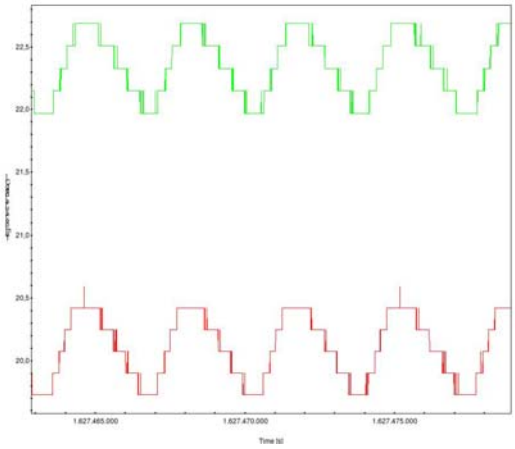


Figure 14 SPU DPU temperatures during the reference test part 2

7.2 Results and Conclusions

In some cases, due to the bias table applied for the GAIN and offset , when the one ACA is switched off to test the coupled one, on the coupled radiometer of the same RCA a power increasing is registered (as expected due to the larger power available for that radiometer consequently to the common bias return in the harness) : this caused saturation in those channels having voltage output close to the DAE limit (because of the DAE gain and offset bias table applied) . However, this is not an indication of a problem in the radiometers but of the wrong choice in the DAE gain offset table applied.

Due to the problem found on RCA 23 (inducing instabilities on other channels when the P/S is biased 1) in the days immediately before the Reference test, it was operated without changing the status of the P/S . The procedure was further simplified keeping the 4KHz disabled when the RCA 23 was under test.

7.3 Results and Conclusions

The data analysis suggested that all the units behave as expected, at least from a qualitative point of view. In fact, this test was executed for the first time under this bias setup and hence can not have a numerical counterpart in the previous tests. However, all the radiometers seem to respond as expected to the bias stimulus :

the signal increasing / decreasing is observed when switching on / off one ACA , meaning that the LNAs respond properly;

the signal separation is observed when changing the P/S status or at least when the I1 or I2 currents powering the phase switches are lowered /increased: it means that the phase switch respond as expected. All results are documented in APPENDIX XXX.

Data instead were stored and flagged (time windows) for any uses in the future.

7.4 Recommendation

For the future, in the case the test will be repeated in flight, it is important to evaluate the possibility to modify the Gain-offset bias table in order to avoid saturation.

8 TEST PROCEDURES

8.1 PART 1

Step	Description	START REF.	DURATION	Time	RCA
8	CRYO-2 (UM section 13.1.2.5)	0:00:00			
8.1	Disable A/C 4kHz	0:00:00	0:00:02		All
8.2	Disable B/D 4kHz	0:00:02	0:00:02		All
8.3	Set A/C P/S Status (0)	0:00:04	0:00:02		All
8.4	Set B/D P/S Status (0)	0:00:06	0:00:02		All
8.5	Set Cryo values on all RCAs (CSL values)	0:00:08	0:00:06		All
8.6	Enable A/C 4kHz	0:00:14	0:00:02		All
8.7	Acquire Data	0:00:16	0:30:00		
8.8	Set B/D P/S Status (1)	0:30:16	0:00:02		All
8.9	Acquire Data	0:30:18	0:30:00		
8.10	Disable A/C 4kHz	1:00:18	0:00:02		All
8.11	Set A/C P/S Status (0)	1:00:20	0:00:02		All
8.12	Set B/D P/S Status (0)	1:00:22	0:00:02		All
8.13	Enable B/D 4kHz	1:00:24	0:00:02		All
8.14	Acquire Data	1:00:26	0:30:00		
8.15	Set A/C P/S Status (1)	1:30:26	0:00:02		All
8.16	Acquire Data	1:30:28	0:30:00		
8.17	Apply Default DAE Configuration as current configuration	2:00:28	0:00:02		
	end of the test	2:00:30	0:00:00		

8.2 PART 2

Step	Description	START REF.	DURATION	Time	RCA
14	Reference Test (UM § 13.1.2.9)	0:00:00			
14.1	RCA 18 and 21	0:00:00			18,21
14.1.1	Set zero bias on ACA1 and ACA2 of RCA 18 and 21	0:00:00	0:00:06		18,21-1,2
14.1.2	Disable B/D 4kHz on RCA 18 and 21	0:00:06	0:00:02		18,21
14.1.3	Disable A/C 4kHz on RCA 18 and 21	0:00:08	0:00:02		18,21
14.1.4	Set A/C P/S Status (0) on RCA 18 and 21	0:00:10	0:00:02		18,21
14.1.5	Set B/D P/S Status (0) on RCA 18 and 21	0:00:12	0:00:02		18,21
14.1.6	WAIT 1 minute	0:00:14	0:01:00		
14.1.7	Set Cryo bias on ACA1 of RCA 18, 21	0:01:14	0:00:06		18,21-1
14.1.8	WAIT 1 minute	0:01:20	0:01:00		
14.1.9	Set A/C P/S Status (1) on RCA 18 and 21	0:02:20	0:00:02		18,21
14.1.10	WAIT 1 minute	0:02:22	0:01:00		
14.1.11	Enable 4kHz (A/C) RCA 18 and 21	0:03:22	0:00:02		18,21
14.1.12	WAIT 1 minute	0:03:24	0:01:00		
14.1.13	Set Iswitch1 low value on ACA1 RCA 18, 21	0:04:24	0:00:02		18,21-1
14.1.14	WAIT 1 minute	0:04:26	0:01:00		
14.1.15	Set Iswitch1 nominal value on ACA1 RCA 18, 21	0:05:26	0:00:02		18,21-1
14.1.16	Set Iswitch2 low value on ACA1 RCA 18, 21	0:05:28	0:00:02		18,21-1
14.1.17	WAIT 1 minute	0:05:30	0:01:00		
14.1.18	Set Iswitch2 nominal value on ACA1 RCA 18, 21	0:06:30	0:00:02		18,21-1
14.1.19	Disable 4kHz (A/C) RCA 18, 21	0:06:32	0:00:02		18,21
14.1.20	Set A/C P/S Status (0) on RCA 18 and 21	0:06:34	0:00:02		18,21
14.1.21	Set zero bias on ACA1 of RCA 18, 21	0:06:36	0:00:06		18,21-1
14.1.22	Set Cryo bias on ACA2 of RCA 18, 21	0:06:42	0:00:06		18,21-2
14.1.23	WAIT 1 minute	0:06:48	0:01:00		
14.1.24	Set B/D P/S Status (1) on RCA 18 and 21	0:07:48	0:00:02		18,21
14.1.25	WAIT 1 minute	0:07:50	0:01:00		
14.1.26	Enable 4kHz (B/D) RCA 18 and 21	0:08:50	0:00:02		18,21
14.1.27	WAIT 1 minute	0:08:52	0:01:00		
14.1.28	Set Iswitch1 low value on ACA2 RCA 18, 21	0:09:52	0:00:02		18,21-2
14.1.29	WAIT 1 minute	0:09:54	0:01:00		
14.1.30	Set Iswitch1 nominal value on ACA2 RCA 18, 21	0:10:54	0:00:02		18,21-2
14.1.31	Set Iswitch2 low value on ACA2 RCA 18, 21	0:10:56	0:00:02		18,21-2
14.1.32	WAIT 1 minute	0:10:58	0:01:00		
14.1.33	Set Iswitch2 nominal value on ACA2 RCA 18, 21	0:11:58	0:00:02		18,21-2
14.1.34	Set Cryo bias on ACA1 of RCA 18, 21	0:12:00	0:00:06		18,21-1
14.1.35	WAIT 1 minute	0:12:06	0:01:00		
	Note: ACA1 and 2 of RCA 18 and 21 now set with Cryo values	0:13:06	0:01:00		18,21
14.1.36	Set zero bias on ACA3 and ACA4 of RCA 18 and 21	0:14:06	0:00:06		18,21-3,4
14.1.37	Disable B/D 4kHz on RCA 18 and 21	0:14:12	0:00:02		18,21
14.1.38	Disable A/C 4kHz on RCA 18 and 21	0:14:14	0:00:02		18,21
14.1.39	Set A/C P/S Status (0) on RCA 18 and 21	0:14:16	0:00:02		18,21
14.1.40	Set B/D P/S Status (0) on RCA 18 and 21	0:14:18	0:00:02		18,21
14.1.41	WAIT 1 minute	0:14:20	0:01:00		
14.1.42	Set Cryo bias on ACA3 of RCA 18, 21	0:15:20	0:00:06		18,21-3
14.1.43	WAIT 1 minute	0:15:26	0:01:00		
14.1.44	Set A/C P/S Status (1) on RCA 18 and 21	0:16:26	0:00:02		18,21
14.1.45	WAIT 1 minute	0:16:28	0:01:00		
14.1.46	Enable 4kHz (A/C) RCA 18 and 21	0:17:28	0:00:02		18,21
14.1.47	WAIT 1 minute	0:17:30	0:01:00		
14.1.48	Set Iswitch1 low value on ACA3 RCA 18, 21	0:18:30	0:00:02		18,21-3
14.1.49	WAIT 1 minute	0:18:32	0:01:00		
14.1.50	Set Iswitch1 nominal value on ACA3 RCA 18, 21	0:19:32	0:00:02		18,21-3
14.1.51	Set Iswitch2 low value on ACA3 RCA 18, 21	0:19:34	0:00:02		18,21-3
14.1.52	WAIT 1 minute	0:19:36	0:01:00		
14.1.53	Set Iswitch2 nominal value on ACA3 RCA 18, 21	0:20:36	0:00:02		18,21-3
14.1.54	Disable 4kHz (A/C) RCA 18, 21	0:20:38	0:00:02		18,21
14.1.55	Set A/C P/S Status (0) on RCA 18 and 21	0:20:40	0:00:02		18,21
14.1.56	Set zero bias on ACA3 of RCA 18, 21	0:20:42	0:00:06		18,21-3
14.1.57	Set Cryo bias on ACA4 of RCA 18, 21	0:20:48	0:00:06		18,21-4
14.1.58	WAIT 1 minute	0:20:54	0:01:00		
14.1.59	Set B/D P/S Status (1) on RCA 18 and 21	0:21:54	0:00:02		18,21
14.1.60	WAIT 1 minute	0:21:56	0:01:00		
14.1.61	Enable 4kHz (B/D) RCA 18 and 21	0:22:56	0:00:02		18,21
14.1.62	WAIT 1 minute	0:22:58	0:01:00		
14.1.63	Set Iswitch1 low value on ACA2 RCA 18, 21	0:23:58	0:00:02		18,21-4
14.1.64	WAIT 1 minute	0:24:00	0:01:00		
14.1.65	Set Iswitch1 nominal value on ACA4 RCA 18, 21	0:25:00	0:00:02		18,21-4
14.1.66	Set Iswitch2 low value on ACA4 RCA 18, 21	0:25:02	0:00:02		18,21-4
14.1.67	WAIT 1 minute	0:25:04	0:01:00		
14.1.68	Set Iswitch2 nominal value on ACA4 RCA 18, 21	0:26:04	0:00:02		18,21-4
14.1.69	Set Cryo bias on ACA3 of RCA 18, 21	0:26:06	0:00:06		18,21-3
14.1.70	WAIT 1 minute	0:26:12	0:01:00		
	Note: All ACAs of RCA 18 and 21 now set with Cryo values	0:27:12	0:01:00		18,21

14.2	RCA 19 and 22	0:28:12	0:00:00		19,22
14.2.1	Set zero bias on ACA1 and ACA2 of RCA 19 and 22	0:28:12	0:00:06		19,22-1,2
14.2.2	Disable B/D 4kHz on RCA 19 and 22	0:28:18	0:00:02		19,22
14.2.3	Disable A/C 4kHz on RCA 19 and 22	0:28:20	0:00:02		19,22
14.2.4	Set A/C P/S Status (0) on RCA 19 and 22	0:28:22	0:00:02		19,22
14.2.5	Set B/D P/S Status (0) on RCA 19 and 22	0:28:24	0:00:02		19,22
14.2.6	WAIT 1 minute	0:28:26	0:01:00		
14.2.7	Set Cryo bias on ACA1 of RCA 19, 22	0:29:26	0:00:06		19,22-1
14.2.8	WAIT 1 minute	0:29:32	0:01:00		
14.2.9	Set A/C P/S Status (1) on RCA 19 and 22	0:30:32	0:00:02		19,22
14.2.10	WAIT 1 minute	0:30:34	0:01:00		
14.2.11	Enable 4kHz (A/C) RCA 19 and 22	0:31:34	0:00:02		19,22
14.2.12	WAIT 1 minute	0:31:36	0:01:00		
14.2.13	Set Iswitch1 low value on ACA1 RCA 19, 22	0:32:36	0:00:02		19,22-1
14.2.14	WAIT 1 minute	0:32:38	0:01:00		
14.2.15	Set Iswitch1 nominal value on ACA1 RCA 19, 22	0:33:38	0:00:02		19,22-1
14.2.16	Set Iswitch2 low value on ACA1 RCA 19, 22	0:33:40	0:00:02		19,22-1
14.2.17	WAIT 1 minute	0:33:42	0:01:00		
14.2.18	Set Iswitch2 nominal value on ACA1 RCA 19, 22	0:34:42	0:00:02		19,22-1
14.2.19	Disable 4kHz (A/C) RCA 19, 22	0:34:44	0:00:02		19,22
14.2.20	Set A/C P/S Status (0) on RCA 19 and 22	0:34:46	0:00:02		19,22
14.2.21	Set zero bias on ACA1 of RCA 19, 22	0:34:48	0:00:06		19,22-1
14.2.22	Set Cryo bias on ACA2 of RCA 19, 22	0:34:54	0:00:06		19,22-2
14.2.23	WAIT 1 minute	0:35:00	0:01:00		
14.2.24	Set B/D P/S Status (1) on RCA 19 and 22	0:36:00	0:00:02		19,22
14.2.25	WAIT 1 minute	0:36:02	0:01:00		
14.2.26	Enable 4kHz (B/D) RCA 19 and 22	0:37:02	0:00:02		19,22
14.2.27	WAIT 1 minute	0:37:04	0:01:00		
14.2.28	Set Iswitch1 low value on ACA2 RCA 19, 22	0:38:04	0:00:02		19,22-2
14.2.29	WAIT 1 minute	0:38:06	0:01:00		
14.2.30	Set Iswitch1 nominal value on ACA2 RCA 19, 22	0:39:06	0:00:02		19,22-2
14.2.31	Set Iswitch2 low value on ACA2 RCA 19, 22	0:39:08	0:00:02		19,22-2
14.2.32	WAIT 1 minute	0:39:10	0:01:00		
14.2.33	Set Iswitch2 nominal value on ACA2 RCA 19, 22	0:40:10	0:00:02		19,22-2
14.2.34	Set Cryo bias on ACA1 of RCA 19, 22	0:40:12	0:00:06		19,22-1
14.2.35	WAIT 1 minute	0:40:18	0:01:00		
	Note: ACA1 and 2 of RCA 19 and 22 now set with Cryo values	0:41:18	0:01:00		19,22
14.2.36	Set zero bias on ACA3 and ACA4 of RCA 19 and 22	0:42:18	0:00:06		19,22-3,4
14.2.37	Disable B/D 4kHz on RCA 19 and 22	0:42:24	0:00:02		19,22
14.2.38	Disable A/C 4kHz on RCA 19 and 22	0:42:26	0:00:02		19,22
14.2.39	Set A/C P/S Status (0) on RCA 19 and 22	0:42:28	0:00:02		19,22
14.2.40	Set B/D P/S Status (0) on RCA 19 and 22	0:42:30	0:00:02		19,22
14.2.41	WAIT 1 minute	0:42:32	0:01:00		
14.2.42	Set Cryo bias on ACA3 of RCA 19, 22	0:43:32	0:00:06		19,22-3
14.2.43	WAIT 1 minute	0:43:38	0:01:00		
14.2.44	Set A/C P/S Status (1) on RCA 19 and 22	0:44:38	0:00:02		19,22
14.2.45	WAIT 1 minute	0:44:40	0:01:00		
14.2.46	Enable 4kHz (A/C) RCA 19 and 22	0:45:40	0:00:02		19,22
14.2.47	WAIT 1 minute	0:45:42	0:01:00		
14.2.48	Set Iswitch1 low value on ACA3 RCA 19, 22	0:46:42	0:00:02		19,22-3
14.2.49	WAIT 1 minute	0:46:44	0:01:00		
14.2.50	Set Iswitch1 nominal value on ACA3 RCA 19, 22	0:47:44	0:00:02		19,22-3
14.2.51	Set Iswitch2 low value on ACA3 RCA 19, 22	0:47:46	0:00:02		19,22-3
14.2.52	WAIT 1 minute	0:47:48	0:01:00		
14.2.53	Set Iswitch2 nominal value on ACA3 RCA 19, 22	0:48:48	0:00:02		19,22-3
14.2.54	Disable 4kHz (A/C) RCA 19, 22	0:48:50	0:00:02		19,22
14.2.55	Set A/C P/S Status (0) on RCA 19 and 22	0:48:52	0:00:02		19,22
14.2.56	Set zero bias on ACA3 of RCA 19, 22	0:48:54	0:00:06		19,22-3
14.2.57	Set Cryo bias on ACA4 of RCA 19, 22	0:49:00	0:00:06		19,22-4
14.2.58	WAIT 1 minute	0:49:06	0:01:00		
14.2.59	Set B/D P/S Status (1) on RCA 19 and 22	0:50:06	0:00:02		19,22
14.2.60	WAIT 1 minute	0:50:08	0:01:00		
14.2.61	Enable 4kHz (B/D) RCA 19 and 22	0:51:08	0:00:02		19,22
14.2.62	WAIT 1 minute	0:51:10	0:01:00		
14.2.63	Set Iswitch1 low value on ACA4 RCA 19, 22	0:52:10	0:00:02		19,22-4
14.2.64	WAIT 1 minute	0:52:12	0:01:00		
14.2.65	Set Iswitch1 nominal value on ACA4 RCA 19, 22	0:53:12	0:00:02		19,22-4
14.2.66	Set Iswitch2 low value on ACA4 RCA 19, 22	0:53:14	0:00:02		19,22-4
14.2.67	WAIT 1 minute	0:53:16	0:01:00		
14.2.68	Set Iswitch2 nominal value on ACA4 RCA 19, 22	0:54:16	0:00:02		19,22-4
14.2.69	Set Cryo bias on ACA3 of RCA 19, 22	0:54:18	0:00:06		19,22-3
14.2.70	WAIT 1 minute	0:54:24	0:01:00		
	Note: All ACAs of RCA 19 and 22 now set with Cryo values	0:55:24	0:01:00		19,22

14.3	RCA 20 and 23	0:56:24	0:00:00		20,23
14.3.1	Set zero bias on ACA1 and ACA2 of RCA 20 and 23	0:56:24	0:00:06		20,23-1,2
14.3.2	Disable B/D 4kHz on RCA 20 and 23	0:56:30	0:00:02		20,23
14.3.3	Disable A/C 4kHz on RCA 20 and 23	0:56:32	0:00:02		20,23
14.3.4	Set A/C P/S Status (0) on RCA 20 and 23	0:56:34	0:00:02		20,23
14.3.5	Set B/D P/S Status (0) on RCA 20 and 23	0:56:36	0:00:02		20,23
14.3.6	WAIT 1 minute	0:56:38	0:01:00		
14.3.7	Set Cryo bias on ACA1 of RCA 20, 23	0:57:38	0:00:06		20,23-1
14.3.8	WAIT 1 minute	0:57:44	0:01:00		
14.3.9	Set A/C P/S Status (1) on RCA 20 and 23	0:58:44	0:00:02		20,23
14.3.10	WAIT 1 minute	0:58:46	0:01:00		
14.3.11	Enable 4kHz (A/C) RCA 20 and 23	0:59:46	0:00:02		20,23
14.3.12	WAIT 1 minute	0:59:48	0:01:00		
14.3.13	Set Iswitch1 low value on ACA1 RCA 20, 23	1:00:48	0:00:02		20,23-1
14.3.14	WAIT 1 minute	1:00:50	0:01:00		
14.3.15	Set Iswitch1 nominal value on ACA1 RCA 20, 23	1:01:50	0:00:02		20,23-1
14.3.16	Set Iswitch2 low value on ACA1 RCA 20, 23	1:01:52	0:00:02		20,23-1
14.3.17	WAIT 1 minute	1:01:54	0:01:00		
14.3.18	Set Iswitch2 nominal value on ACA1 RCA 20, 23	1:02:54	0:00:02		20,23-1
14.3.19	Disable 4kHz (A/C) RCA 20, 23	1:02:56	0:00:02		20,23
14.3.20	Set A/C P/S Status (0) on RCA 20 and 23	1:02:58	0:00:02		20,23
14.3.21	Set zero bias on ACA1 of RCA 20, 23	1:03:00	0:00:06		20,23-1
14.3.22	Set Cryo bias on ACA2 of RCA 20, 23	1:03:06	0:00:06		20,23-2
14.3.23	WAIT 1 minute	1:03:12	0:01:00		
14.3.24	Set B/D P/S Status (1) on RCA 20 ~~and 23~~	1:04:12	0:00:02		20,23
14.3.25	WAIT 1 minute	1:04:14	0:01:00		
14.3.26	Enable 4kHz (B/D) RCA 20 ~~and 23~~	1:05:14	0:00:02		20,23
14.3.27	WAIT 1 minute	1:05:16	0:01:00		
14.3.28	Set Iswitch1 low value on ACA2 RCA 20, 23	1:06:16	0:00:02		20,23-2
14.3.29	WAIT 1 minute	1:06:18	0:01:00		
14.3.30	Set Iswitch1 nominal value on ACA2 RCA 20, 23	1:07:18	0:00:02		20,23-2
14.3.31	Set Iswitch2 low value on ACA2 RCA 20, 23	1:07:20	0:00:02		20,23-2
14.3.32	WAIT 1 minute	1:07:22	0:01:00		
14.3.33	Set Iswitch2 nominal value on ACA2 RCA 20, 23	1:08:22	0:00:02		20,23-2
14.3.34	Set Cryo bias on ACA1 of RCA 20, 23	1:08:24	0:00:06		20,23-1
14.3.35	WAIT 1 minute	1:08:30	0:01:00		
	Note: ACA1 and 2 of RCA 20 and 23 now set with Cryo values	1:09:30	0:01:00		20,23
14.3.36	Set zero bias on ACA3 and ACA4 of RCA 20 and 23	1:10:30	0:00:06		20,23-3,4
14.3.37	Disable B/D 4kHz on RCA 20 and 23	1:10:36	0:00:02		20,23
14.3.38	Disable A/C 4kHz on RCA 20 and 23	1:10:38	0:00:02		20,23
14.3.39	Set A/C P/S Status (0) on RCA 20 and 23	1:10:40	0:00:02		20,23
14.3.40	Set B/D P/S Status (0) on RCA 20 and 23	1:10:42	0:00:02		20,23
14.3.41	WAIT 1 minute	1:10:44	0:01:00		
14.3.42	Set Cryo bias on ACA3 of RCA 20, 23	1:11:44	0:00:06		20,23-3
14.3.43	WAIT 1 minute	1:11:50	0:01:00		
14.3.44	Set A/C P/S Status (1) on RCA 20 and 23	1:12:50	0:00:02		20,23
14.3.45	WAIT 1 minute	1:12:52	0:01:00		
14.3.46	Enable 4kHz (A/C) RCA 20 and 23	1:13:52	0:00:02		20,23
14.3.47	WAIT 1 minute	1:13:54	0:01:00		
14.3.48	Set Iswitch1 low value on ACA3 RCA 20, 23	1:14:54	0:00:02		20,23-3
14.3.49	WAIT 1 minute	1:14:56	0:01:00		
14.3.50	Set Iswitch1 nominal value on ACA3 RCA 20, 23	1:15:56	0:00:02		20,23-3
14.3.51	Set Iswitch2 low value on ACA3 RCA 20, 23	1:15:58	0:00:02		20,23-3
14.3.52	WAIT 1 minute	1:16:00	0:01:00		
14.3.53	Set Iswitch2 nominal value on ACA3 RCA 20, 23	1:17:00	0:00:02		20,23-3
14.3.54	Disable 4kHz (A/C) RCA 20, 23	1:17:02	0:00:02		20,23
14.3.55	Set A/C P/S Status (0) on RCA 20 and 23	1:17:04	0:00:02		20,23
14.3.56	Set zero bias on ACA3 of RCA 20, 23	1:17:06	0:00:06		20,23-3
14.3.57	Set Cryo bias on ACA4 of RCA 20, 23	1:17:12	0:00:06		20,23-4
14.3.58	WAIT 1 minute	1:17:18	0:01:00		
14.3.59	Set B/D P/S Status (1) on RCA 20 ~~and 23~~	1:18:18	0:00:02		20,23
14.3.60	WAIT 1 minute	1:18:20	0:01:00		
14.3.61	Enable 4kHz (B/D) RCA 20 ~~and 23~~	1:19:20	0:00:02		20,23
14.3.62	WAIT 1 minute	1:19:22	0:01:00		
14.3.63	Set Iswitch1 low value on ACA4 RCA 20, 23	1:20:22	0:00:02		20,23-4
14.3.64	WAIT 1 minute	1:20:24	0:01:00		
14.3.65	Set Iswitch1 nominal value on ACA4 RCA 20, 23	1:21:24	0:00:02		20,23-4
14.3.66	Set Iswitch2 low value on ACA4 RCA 20, 23	1:21:26	0:00:02		20,23-4
14.3.67	WAIT 1 minute	1:21:28	0:01:00		
14.3.68	Set Iswitch2 nominal value on ACA4 RCA 20, 23	1:22:28	0:00:02		20,23-4
14.3.69	Set Cryo bias on ACA3 of RCA 20, 23	1:22:30	0:00:06		20,23-3
14.3.70	WAIT 1 minute	1:22:36	0:01:00		
	Note: All ACAs of RCA 20 and 23 now set with Cryo values	1:23:36	0:01:00		20,23

14.4	RCA 25 and 24	1:24:36	0:00:00		24,25
14.4.1	Set zero bias on ACA1 and ACA2 of RCA 25 and 24	1:24:36	0:00:06		24,25-1,2
14.4.2	Disable B/D 4kHz on RCA 25 and 24	1:24:42	0:00:02		24,25
14.4.3	Disable A/C 4kHz on RCA 25 and 24	1:24:44	0:00:02		24,25
14.4.4	Set A/C P/S Status (0) on RCA 25 and 24	1:24:46	0:00:02		24,25
14.4.5	Set B/D P/S Status (0) on RCA 25 and 24	1:24:48	0:00:02		24,25
14.4.6	WAIT 1 minute	1:24:50	0:01:00		
14.4.7	Set Cryo bias on ACA1 of RCA 25, 24	1:25:50	0:00:06		24,25-1
14.4.8	WAIT 1 minute	1:25:56	0:01:00		
14.4.9	Set A/C P/S Status (1) on RCA 25 and 24	1:26:56	0:00:02		24,25
14.4.10	WAIT 1 minute	1:26:58	0:01:00		
14.4.11	Enable 4kHz (A/C) RCA 25 and 24	1:27:58	0:00:02		24,25
14.4.12	WAIT 1 minute	1:28:00	0:01:00		
14.4.13	Set Iswitch1 low value on ACA1 RCA 25, 24	1:29:00	0:00:02		24,25-1
14.4.14	WAIT 1 minute	1:29:02	0:01:00		
14.4.15	Set Iswitch1 nominal value on ACA1 RCA 25, 24	1:30:02	0:00:02		24,25-1
14.4.16	Set Iswitch2 low value on ACA1 RCA 25, 24	1:30:04	0:00:02		24,25-1
14.4.17	WAIT 1 minute	1:30:06	0:01:00		
14.4.18	Set Iswitch2 nominal value on ACA1 RCA 25, 24	1:31:06	0:00:02		24,25-1
14.4.19	Disable 4kHz (A/C) RCA 25, 24	1:31:08	0:00:02		24,25
14.4.20	Set A/C P/S Status (0) on RCA 25 and 24	1:31:10	0:00:02		24,25
14.4.21	Set zero bias on ACA1 of RCA 25, 24	1:31:12	0:00:06		24,25-1
14.4.22	Set Cryo bias on ACA2 of RCA 25, 24	1:31:18	0:00:06		24,25-2
14.4.23	WAIT 1 minute	1:31:24	0:01:00		
14.4.24	Set B/D P/S Status (1) on RCA 25 and 24	1:32:24	0:00:02		24,25
14.4.25	WAIT 1 minute	1:32:26	0:01:00		
14.4.26	Enable 4kHz (B/D) RCA 25 and 24	1:33:26	0:00:02		24,25
14.4.27	WAIT 1 minute	1:33:28	0:01:00		
14.4.28	Set Iswitch1 low value on ACA2 RCA 25, 24	1:34:28	0:00:02		24,25-2
14.4.29	WAIT 1 minute	1:34:30	0:01:00		
14.4.30	Set Iswitch1 nominal value on ACA2 RCA 25, 24	1:35:30	0:00:02		24,25-2
14.4.31	Set Iswitch2 low value on ACA2 RCA 25, 24	1:35:32	0:00:02		24,25-2
14.4.32	WAIT 1 minute	1:35:34	0:01:00		
14.4.33	Set Iswitch2 nominal value on ACA2 RCA 25, 24	1:36:34	0:00:02		24,25-2
14.4.34	Set Cryo bias on ACA1 of RCA 25, 24	1:36:36	0:00:06		24,25-1
14.4.35	WAIT 1 minute	1:36:42	0:01:00		
	Note: ACA1 and 2 of RCA 25 and 24 now set with Cryo values	1:37:42	0:01:00		24,25
14.4.36	Set zero bias on ACA3 and ACA4 of RCA 25 and 24	1:38:42	0:00:06		24,25-3,4
14.4.37	Disable B/D 4kHz on RCA 25 and 24	1:38:48	0:00:02		24,25
14.4.38	Disable A/C 4kHz on RCA 25 and 24	1:38:50	0:00:02		24,25
14.4.39	Set A/C P/S Status (0) on RCA 25 and 24	1:38:52	0:00:02		24,25
14.4.40	Set B/D P/S Status (0) on RCA 25 and 24	1:38:54	0:00:02		24,25
14.4.41	WAIT 1 minute	1:38:56	0:01:00		
14.4.42	Set Cryo bias on ACA3 of RCA 25, 24	1:39:56	0:00:06		24,25-3
14.4.43	WAIT 1 minute	1:40:02	0:01:00		
14.4.44	Set A/C P/S Status (1) on RCA 25 and 24	1:41:02	0:00:02		24,25
14.4.45	WAIT 1 minute	1:41:04	0:01:00		
14.4.46	Enable 4kHz (A/C) RCA 25 and 24	1:42:04	0:00:02		24,25
14.4.47	WAIT 1 minute	1:42:06	0:01:00		
14.4.48	Set Iswitch1 low value on ACA3 RCA 25, 24	1:43:06	0:00:02		24,25-3
14.4.49	WAIT 1 minute	1:43:08	0:01:00		
14.4.50	Set Iswitch1 nominal value on ACA3 RCA 25, 24	1:44:08	0:00:02		24,25-3
14.4.51	Set Iswitch2 low value on ACA3 RCA 25, 24	1:44:10	0:00:02		24,25-3
14.4.52	WAIT 1 minute	1:44:12	0:01:00		
14.4.53	Set Iswitch2 nominal value on ACA3 RCA 25, 24	1:45:12	0:00:02		24,25-3
14.4.54	Disable 4kHz (A/C) RCA 25, 24	1:45:14	0:00:02		24,25
14.4.55	Set A/C P/S Status (0) on RCA 25 and 24	1:45:16	0:00:02		24,25
14.4.56	Set zero bias on ACA3 of RCA 25, 24	1:45:18	0:00:06		24,25-3
	Set Cryo values on ACA4 RCA 24 (Special ordering)	1:45:24	0:00:00		24-4
14.4.57	Set Vg2 on ACA4 of RCA 24	1:45:24	0:00:02		24-4
14.4.58	Set Vdrain on ACA4 of RCA 24	1:45:26	0:00:02		24-4
14.4.59	Set Vg1 on ACA4 of RCA 24	1:45:28	0:00:02		24-4
14.4.60	Set Iswitch1 on ACA4 of RCA 24	1:45:30	0:00:02		24-4
14.4.61	Set Iswitch2 on ACA4 of RCA 24	1:45:32	0:00:02		24-4
14.4.62	Set Cryo bias on ACA4 of RCA 25	1:45:34	0:00:06		25-4
14.4.63	WAIT 1 minute	1:45:40	0:01:00		
14.4.64	Set B/D P/S Status (1) on RCA 25 and 24	1:46:40	0:00:02		24,25
14.4.65	WAIT 1 minute	1:46:42	0:01:00		
14.4.66	Enable 4kHz (B/D) RCA 25 and 24	1:47:42	0:00:02		24,25
14.4.67	WAIT 1 minute	1:47:44	0:01:00		
14.4.68	Set Iswitch1 low value on ACA4 RCA 25, 24	1:48:44	0:00:02		24,25-4
14.4.69	WAIT 1 minute	1:48:46	0:01:00		
14.4.70	Set Iswitch1 nominal value on ACA4 RCA 25, 24	1:49:46	0:00:02		24,25-4
14.4.71	Set Iswitch2 low value on ACA4 RCA 25, 24	1:49:48	0:00:02		24,25-4
14.4.72	WAIT 1 minute	1:49:50	0:01:00		
14.4.73	Set Iswitch2 nominal value on ACA4 RCA 25, 24	1:50:50	0:00:02		24,25-4
14.4.74	Set Cryo bias on ACA3 of RCA 25, 24	1:50:52	0:00:06		24,25-3
14.4.75	WAIT 1 minute	1:50:58	0:01:00		
	Note: All ACAs of RCA 25 and 24 now set with Cryo values	1:51:58	0:01:00		24,25

14.5	RCA 26 and 27	1:52:58	0:00:00		26,27
14.5.1	Set zero bias on ACA1 and ACA2 of RCA 26 and 27	1:52:58	0:00:06		26,27-1,2
14.5.2	Disable B/D 4kHz on RCA 26 and 27	1:53:04	0:00:02		26,27
14.5.3	Disable A/C 4kHz on RCA 26 and 27	1:53:06	0:00:02		26,27
14.5.4	Set A/C P/S Status (0) on RCA 26 and 27	1:53:08	0:00:02		26,27
14.5.5	Set B/D P/S Status (0) on RCA 26 and 27	1:53:10	0:00:02		26,27
14.5.6	WAIT 1 minute	1:53:12	0:01:00		
14.5.7	Set Cryo bias on ACA1 of RCA 26, 27	1:54:12	0:00:06		26,27-1
14.5.8	WAIT 1 minute	1:54:18	0:01:00		
14.5.9	Set A/C P/S Status (1) on RCA 26 and 27	1:55:18	0:00:02		26,27
14.5.10	WAIT 1 minute	1:55:20	0:01:00		
14.5.11	Enable 4kHz (A/C) RCA 26 and 27	1:56:20	0:00:02		26,27
14.5.12	WAIT 1 minute	1:56:22	0:01:00		
14.5.13	Set Iswitch1 low value on ACA1 RCA 26, 27	1:57:22	0:00:02		26,27-1
14.5.14	WAIT 1 minute	1:57:24	0:01:00		
14.5.15	Set Iswitch1 nominal value on ACA1 RCA 26, 27	1:58:24	0:00:02		26,27-1
14.5.16	Set Iswitch2 low value on ACA1 RCA 26, 27	1:58:26	0:00:02		26,27-1
14.5.17	WAIT 1 minute	1:58:28	0:01:00		
14.5.18	Set Iswitch2 nominal value on ACA1 RCA 26, 27	1:59:28	0:00:02		26,27-1
14.5.19	Disable 4kHz (A/C) RCA 26, 27	1:59:30	0:00:02		26,27
14.5.20	Set A/C P/S Status (0) on RCA 26 and 27	1:59:32	0:00:02		26,27
14.5.21	Set zero bias on ACA1 of RCA 26, 27	1:59:34	0:00:06		26,27-1
14.5.22	Set Cryo bias on ACA2 of RCA 26, 27	1:59:40	0:00:06		26,27-2
14.5.23	WAIT 1 minute	1:59:46	0:01:00		
14.5.24	Set B/D P/S Status (1) on RCA 26 and 27	2:00:46	0:00:02		26,27
14.5.25	WAIT 1 minute	2:00:48	0:01:00		
14.5.26	Enable 4kHz (B/D) RCA 26 and 27	2:01:48	0:00:02		26,27
14.5.27	WAIT 1 minute	2:01:50	0:01:00		
14.5.28	Set Iswitch1 low value on ACA2 RCA 26, 27	2:02:50	0:00:02		26,27-2
14.5.29	WAIT 1 minute	2:02:52	0:01:00		
14.5.30	Set Iswitch1 nominal value on ACA2 RCA 26, 27	2:03:52	0:00:02		26,27-2
14.5.31	Set Iswitch2 low value on ACA2 RCA 26, 27	2:03:54	0:00:02		26,27-2
14.5.32	WAIT 1 minute	2:03:56	0:01:00		
14.5.33	Set Iswitch2 nominal value on ACA2 RCA 26, 27	2:04:56	0:00:02		26,27-2
14.5.34	Set Cryo bias on ACA1 of RCA 26, 27	2:04:58	0:00:06		26,27-1
14.5.35	WAIT 1 minute	2:05:04	0:01:00		
	Note: ACA1 and 2 of RCA 26 and 27 now set with Cryo values	2:06:04	0:01:00		26,27
14.5.36	Set zero bias on ACA3 and ACA4 of RCA 26 and 27	2:07:04	0:00:06		26,27-3,4
14.5.37	Disable B/D 4kHz on RCA 26 and 27	2:07:10	0:00:02		26,27
14.5.38	Disable A/C 4kHz on RCA 26 and 27	2:07:12	0:00:02		26,27
14.5.39	Set A/C P/S Status (0) on RCA 26 and 27	2:07:14	0:00:02		26,27
14.5.40	Set B/D P/S Status (0) on RCA 26 and 27	2:07:16	0:00:02		26,27
14.5.41	WAIT 1 minute	2:07:18	0:01:00		
14.5.42	Set Cryo bias on ACA3 of RCA 26, 27	2:08:18	0:00:06		26,27-3
14.5.43	WAIT 1 minute	2:08:24	0:01:00		
14.5.44	Set A/C P/S Status (1) on RCA 26 and 27	2:09:24	0:00:02		26,27
14.5.45	WAIT 1 minute	2:09:26	0:01:00		
14.5.46	Enable 4kHz (A/C) RCA 26 and 27	2:10:26	0:00:02		26,27
14.5.47	WAIT 1 minute	2:10:28	0:01:00		
14.5.48	Set Iswitch1 low value on ACA3 RCA 26, 27	2:11:28	0:00:02		26,27-3
14.5.49	WAIT 1 minute	2:11:30	0:01:00		
14.5.50	Set Iswitch1 nominal value on ACA3 RCA 26, 27	2:12:30	0:00:02		26,27-3
14.5.51	Set Iswitch2 low value on ACA3 RCA 26, 27	2:12:32	0:00:02		26,27-3
14.5.52	WAIT 1 minute	2:12:34	0:01:00		
14.5.53	Set Iswitch2 nominal value on ACA3 RCA 26, 27	2:13:34	0:00:02		26,27-3
14.5.54	Disable 4kHz (A/C) RCA 26, 27	2:13:36	0:00:02		26,27
14.5.55	Set A/C P/S Status (0) on RCA 26 and 27	2:13:38	0:00:02		26,27
14.5.5	Set zero bias on ACA3 of RCA 26, 27	2:13:40	0:00:06		26,27-3
14.5.57	Set Cryo bias on ACA4 of RCA 26, 27	2:13:46	0:00:06		26,27-4
14.5.58	WAIT 1 minute	2:13:52	0:01:00		
14.5.59	Set B/D P/S Status (1) on RCA 26 and 27	2:14:52	0:00:02		26,27
14.5.60	WAIT 1 minute	2:14:54	0:01:00		
14.5.61	Enable 4kHz (B/D) RCA 26 and 27	2:15:54	0:00:02		26,27
14.5.62	WAIT 1 minute	2:15:56	0:01:00		
14.5.63	Set Iswitch1 low value on ACA4 RCA 26, 27	2:16:56	0:00:02		26,27-4
14.5.64	WAIT 1 minute	2:16:58	0:01:00		
14.5.65	Set Iswitch1 nominal value on ACA4 RCA 26, 27	2:17:58	0:00:02		26,27-4
14.5.66	Set Iswitch2 low value on ACA4 RCA 26, 27	2:18:00	0:00:02		26,27-4
14.5.67	WAIT 1 minute	2:18:02	0:01:00		
14.5.68	Set Iswitch2 nominal value on ACA4 RCA 26, 27	2:19:02	0:00:02		26,27-4
14.5.69	Set Cryo bias on ACA3 of RCA 26, 27	2:19:04	0:00:06		26,27-3
14.5.70	WAIT 1 minute	2:19:10	0:01:00		
	Note: All ACAs of RCA 26 and 27 now set with Cryo values	2:20:10	0:01:00		26,27

14.6	RCA 28	2:21:10	0:00:00		28
14.6.1	Set zero bias on ACA1 and ACA2 of RCA 28	2:21:10	0:00:06		28-1,2
14.6.2	Disable B/D 4kHz on RCA 28	2:21:16	0:00:02		28
14.6.3	Disable A/C 4kHz on RCA 28	2:21:18	0:00:02		28
14.6.4	Set A/C P/S Status (0) on RCA 28	2:21:20	0:00:02		28
14.6.5	Set B/D P/S Status (0) on RCA 28	2:21:22	0:00:02		28
14.6.6	WAIT 1 minute	2:21:24	0:01:00		
14.6.7	Power on ACA1 and ACA2 with Soft Sw-On proc	2:22:24	0:00:06		28-1,2
	Power on ACA1 and ACA2 with Soft Sw-On proc	2:22:30	0:00:06		28-1,2
	Power on ACA1 and ACA2 with Soft Sw-On proc	2:22:36	0:00:06		28-1,2
	Power on ACA1 and ACA2 with Soft Sw-On proc	2:22:42	0:00:06		28-1,2
14.6.8	Set Cryo bias on ACA2 of RCA 28	2:22:48	0:00:06		28-2
14.6.9	WAIT 1 minute	2:22:54	0:01:00		
14.6.10	Set A/C P/S Status (1) on RCA 28	2:23:54	0:00:02		28
14.6.11	WAIT 1 minute	2:23:56	0:01:00		
14.6.12	Enable 4kHz (A/C) RCA 28	2:24:56	0:00:02		28
14.6.13	WAIT 1 minute	2:24:58	0:01:00		
14.6.14	Set Iswitch1 low value on ACA1 RCA 28	2:25:58	0:00:02		28-1
14.6.15	WAIT 1 minute	2:26:00	0:01:00		
14.6.16	Set Iswitch1 nominal value on ACA1 RCA 28	2:27:00	0:00:02		28-1
14.6.17	Set Iswitch2 low value on ACA1 RCA 28	2:27:02	0:00:02		28-1
14.6.18	WAIT 1 minute	2:27:04	0:01:00		
14.6.19	Set Iswitch2 nominal value on ACA1 RCA 28	2:28:04	0:00:02		28-1
14.6.20	Disable 4kHz (A/C) RCA 28	2:28:06	0:00:02		28
14.6.21	Set A/C P/S Status (0) on RCA 28	2:28:08	0:00:02		28
14.6.22	Set zero bias on ACA1 of RCA 28	2:28:10	0:00:06		28-1
14.6.23	Power on ACA1 and ACA2 with Soft Sw-On proc	2:28:16	0:00:06		28-1,2
	Power on ACA1 and ACA2 with Soft Sw-On proc	2:28:22	0:00:06		28-1,2
	Power on ACA1 and ACA2 with Soft Sw-On proc	2:28:28	0:00:06		28-1,2
	Power on ACA1 and ACA2 with Soft Sw-On proc	2:28:34	0:00:06		28-1,2
14.6.24	Set Cryo bias on ACA1 of RCA 28	2:28:40	0:00:06		28-1
14.6.25	WAIT 1 minute	2:28:46	0:01:00		
14.6.26	Set B/D P/S Status (1) on RCA 28	2:29:46	0:00:02		28
14.6.27	WAIT 1 minute	2:29:48	0:01:00		
14.6.28	Enable 4kHz (B/D) RCA 28	2:30:48	0:00:02		28
14.6.29	WAIT 1 minute	2:30:50	0:01:00		
14.6.30	Set Iswitch1 low value on ACA2 RCA 28	2:31:50	0:00:02		28-2
14.6.31	WAIT 1 minute	2:31:52	0:01:00		
14.6.32	Set Iswitch1 nominal value on ACA2 RCA 28	2:32:52	0:00:02		28-2
14.6.33	Set Iswitch2 low value on ACA2 RCA 28	2:32:54	0:00:02		28-2
14.6.34	WAIT 1 minute	2:32:56	0:01:00		
14.6.35	Set Iswitch2 nominal value on ACA2 RCA 28	2:33:56	0:00:02		28-2
14.6.36	Set zero bias on ACA2 of RCA 28	2:33:58	0:00:06		28-2
14.6.37	Power on ACA1 and ACA2 with Soft Sw-On proc	2:34:04	0:00:06		28-1,2
	Power on ACA1 and ACA2 with Soft Sw-On proc	2:34:10	0:00:06		28-1,2
	Power on ACA1 and ACA2 with Soft Sw-On proc	2:34:16	0:00:06		28-1,2
	Power on ACA1 and ACA2 with Soft Sw-On proc	2:34:22	0:00:06		28-1,2
14.6.38	WAIT 1 minute	2:34:28	0:01:00		
	Note: ACA1 and 2 of RCA 28 now set with Cryo values	2:35:28	0:01:00		28
14.6.39	Set zero bias on ACA3 and ACA4 of RCA 28	2:36:28	0:00:06		28-3,4
14.6.40	Disable B/D 4kHz on RCA 28	2:36:34	0:00:02		28
14.6.41	Disable A/C 4kHz on RCA 28	2:36:36	0:00:02		28
14.6.42	Set A/C P/S Status (0) on RCA 28	2:36:38	0:00:02		28
14.6.43	Set B/D P/S Status (0) on RCA 28	2:36:40	0:00:02		28
14.6.44	WAIT 1 minute	2:36:42	0:01:00		
14.6.45	Set Cryo bias on ACA3 of RCA 28	2:37:42	0:00:06		28-3
14.6.46	WAIT 1 minute	2:37:48	0:01:00		
14.6.47	Set A/C P/S Status (1) on RCA 28	2:38:48	0:00:02		28
14.6.48	WAIT 1 minute	2:38:50	0:01:00		
14.6.49	Enable 4kHz (A/C) RCA 28	2:39:50	0:00:02		28
14.6.50	WAIT 1 minute	2:39:52	0:01:00		
14.6.51	Set Iswitch1 low value on ACA3 RCA 28	2:40:52	0:00:02		28-3
14.6.52	WAIT 1 minute	2:40:54	0:01:00		
14.6.53	Set Iswitch1 nominal value on ACA3 RCA 28	2:41:54	0:00:02		28-3
14.6.54	Set Iswitch2 low value on ACA3 RCA 28	2:41:56	0:00:02		28-3
14.6.55	WAIT 1 minute	2:41:58	0:01:00		
14.6.56	Set Iswitch2 nominal value on ACA3 RCA 28	2:42:58	0:00:02		28-3
14.6.57	Disable 4kHz (A/C) RCA 28	2:43:00	0:00:02		28
14.6.58	Set A/C P/S Status (0) on RCA 28	2:43:02	0:00:02		28
14.6.59	Set zero bias on ACA3 of RCA 28	2:43:04	0:00:06		28-3
14.6.60	Set Cryo bias on ACA4 of RCA 28	2:43:10	0:00:06		28-4
14.6.61	WAIT 1 minute	2:43:16	0:01:00		
14.6.62	Set B/D P/S Status (1) on RCA 28	2:44:16	0:00:02		28
14.6.63	WAIT 1 minute	2:44:18	0:01:00		
14.6.64	Enable 4kHz (B/D) RCA 28	2:45:18	0:00:02		28
14.6.65	WAIT 1 minute	2:45:20	0:01:00		
14.6.66	Set Iswitch1 low value on ACA4 RCA 28	2:46:20	0:00:02		28-4
14.6.67	WAIT 1 minute	2:46:22	0:01:00		
14.6.68	Set Iswitch1 nominal value on ACA4 RCA 28	2:47:22	0:00:02		28-4
14.6.69	Set Iswitch2 low value on ACA4 RCA 28	2:47:24	0:00:02		28-4
14.6.70	WAIT 1 minute	2:47:26	0:01:00		
14.6.71	Set Iswitch2 nominal value on ACA4 RCA 28	2:48:26	0:00:02		28-4
14.6.72	Set Cryo bias on ACA3 of RCA 28	2:48:28	0:00:06		28-3
14.6.7	WAIT 1 minute	2:48:34	0:01:00		
	Note: All ACAs of RCA 28 now set with Cryo values	2:49:34	0:01:00		28
		2:50:34	0:00:00		
14.7	Apply DEFAULT Configuration	2:50:34	0:00:00		all
14.7.1	Apply Default DAE Configuration as current configuration	2:50:34	0:00:02		all
	end of the test	2:50:36	0:00:00		

9 APPENDIX 2 : PART 1

9.1 1/f , WN

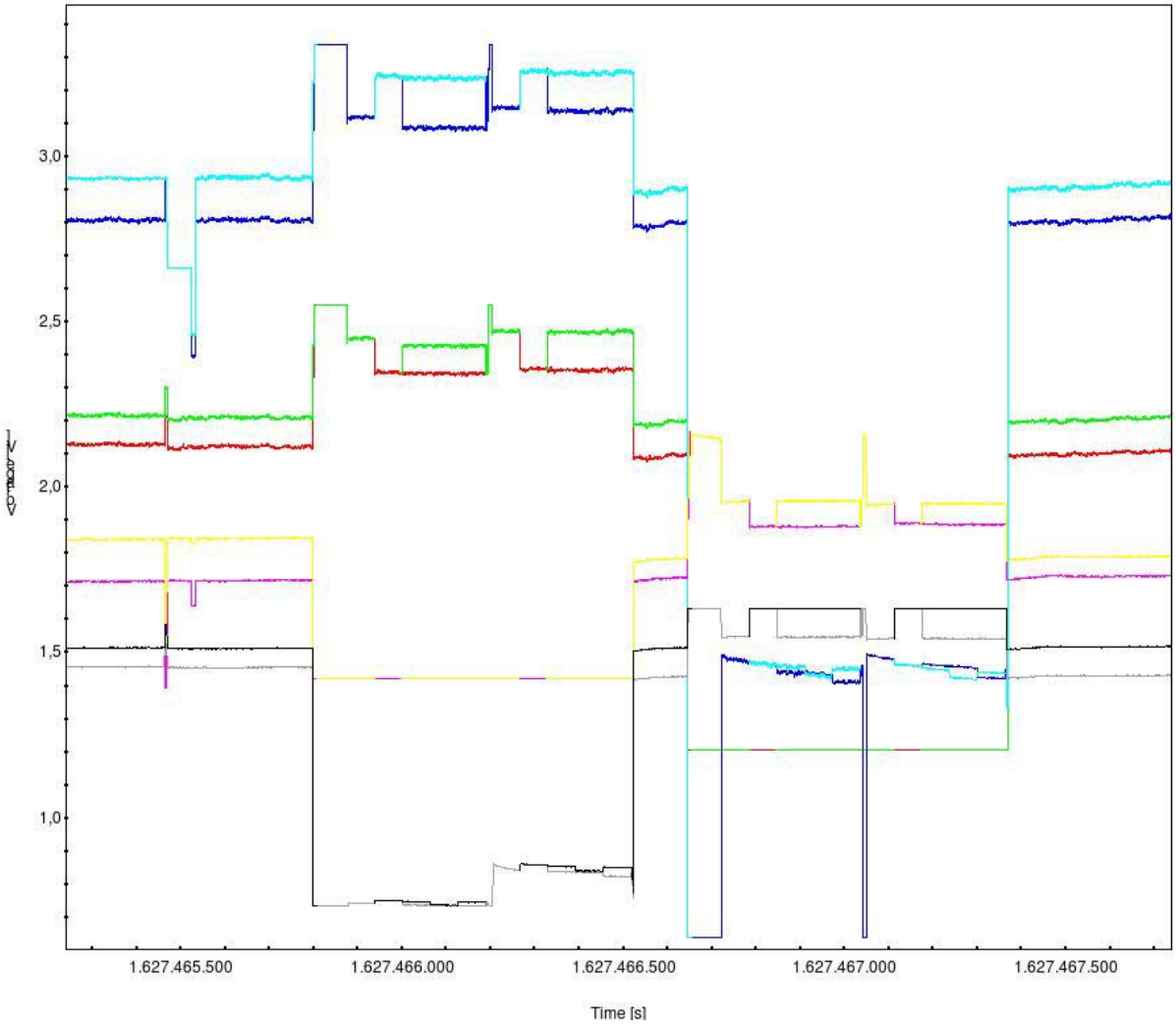
TBI

9.2 spikes

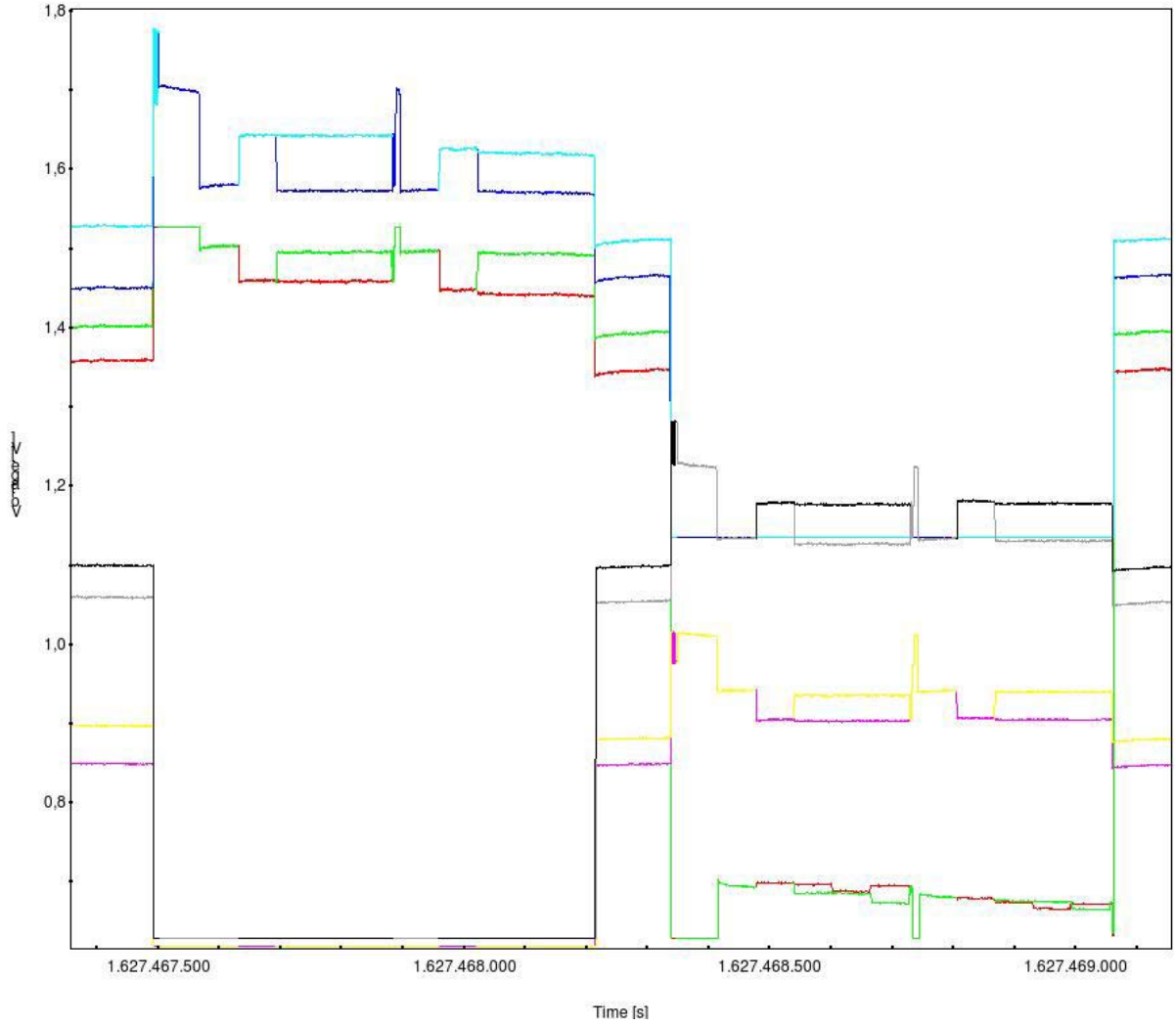
TBI

10 Appendix 3 – PART 2: Signal output

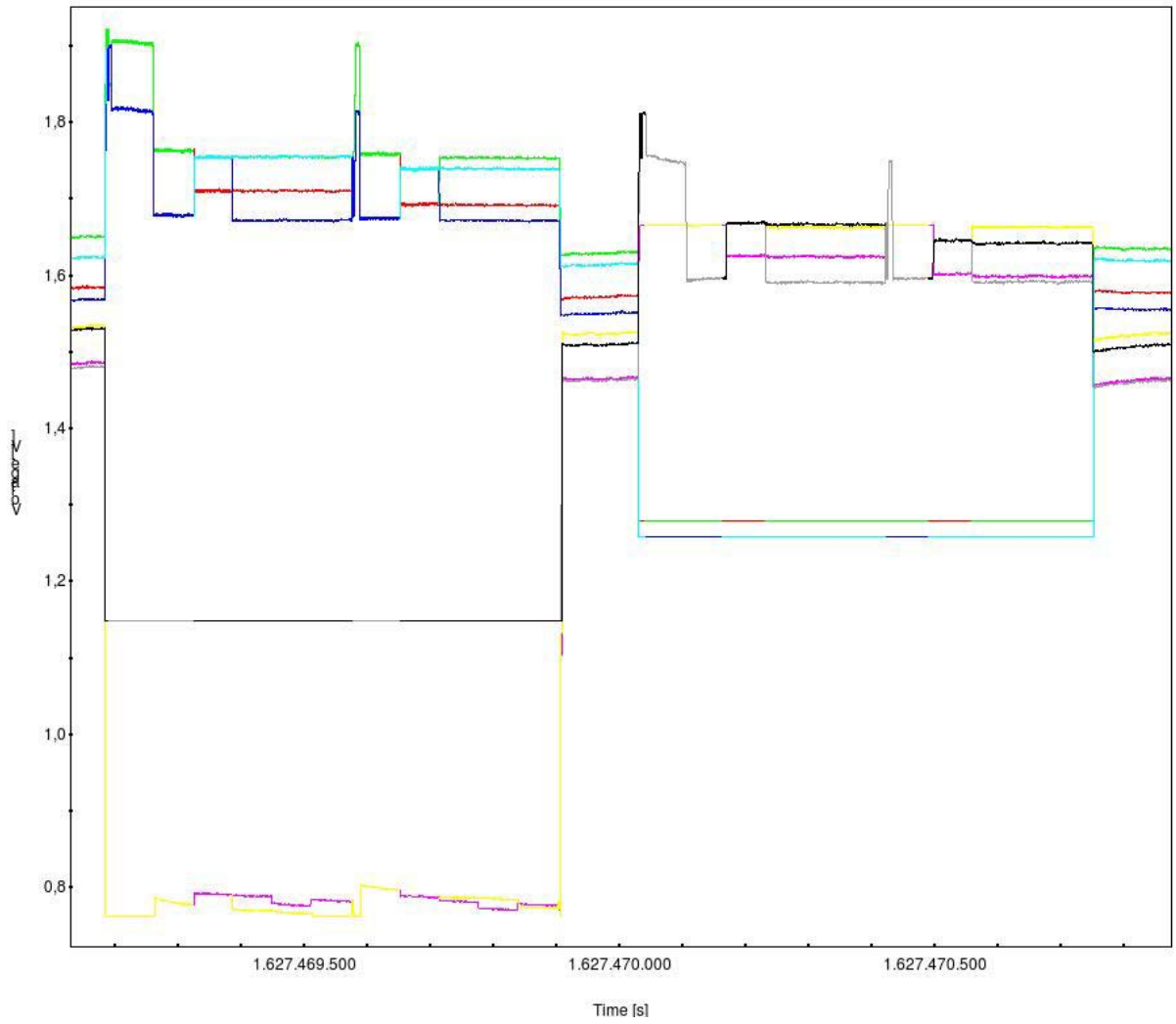
RCA 18



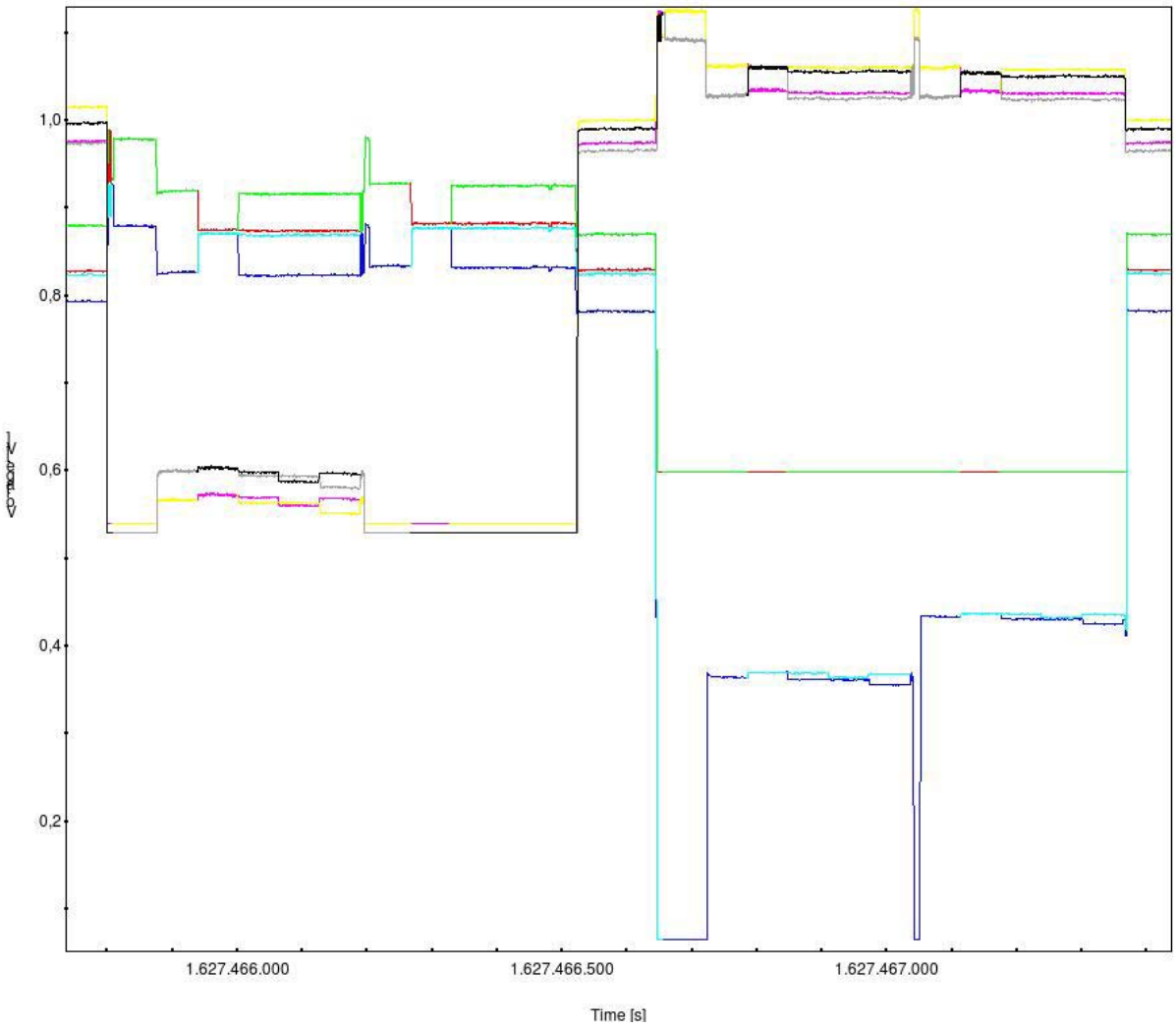
RCA 19


1,8
1,6
1,4
1,2
1,0
0,8
1.627.467.500
1.627.468.000
1.627.468.500
1.627.469.000
Time [s]

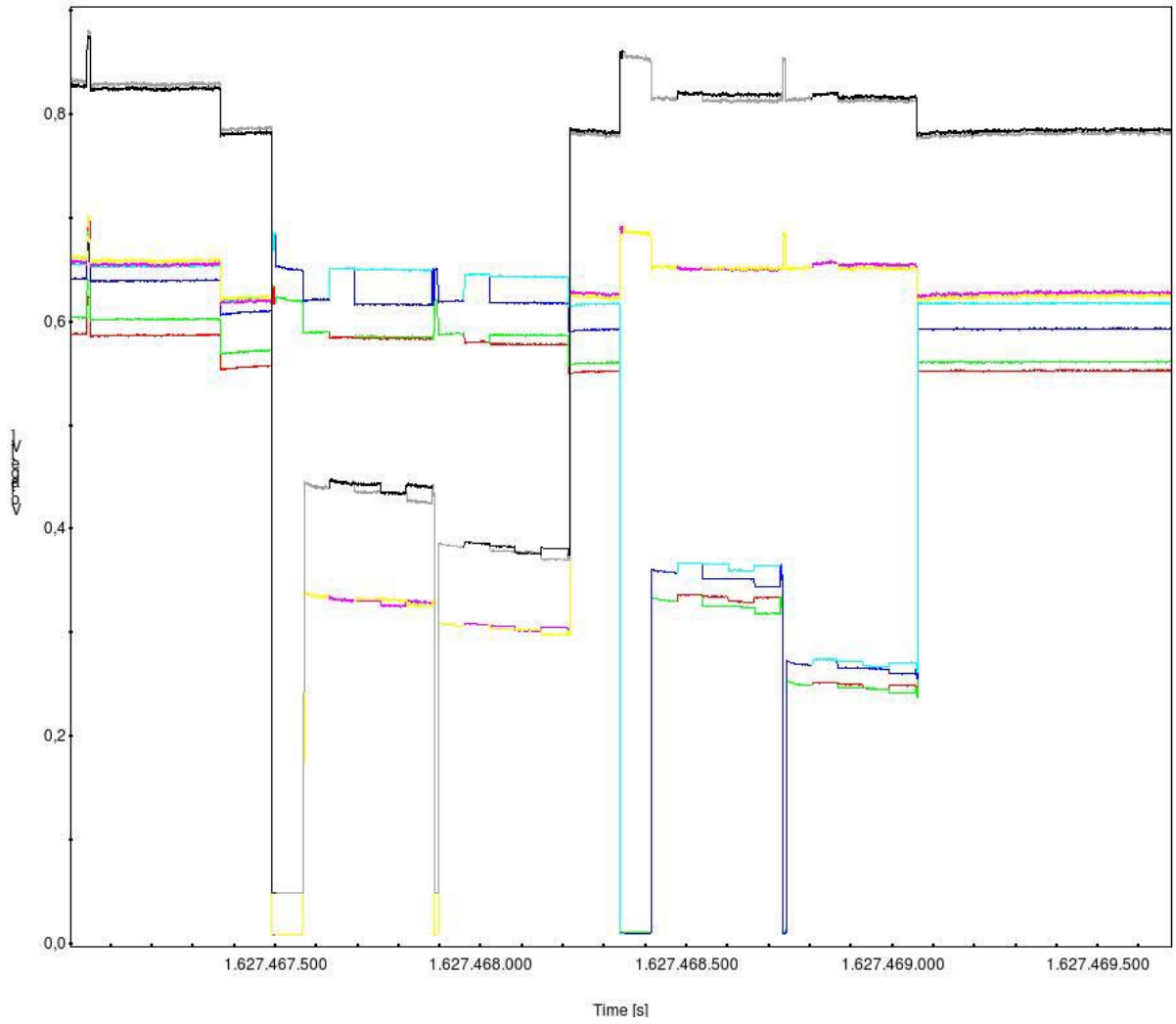
RCA 20



RCA 21



RCA 22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0,6
0,4
0,2
0,0
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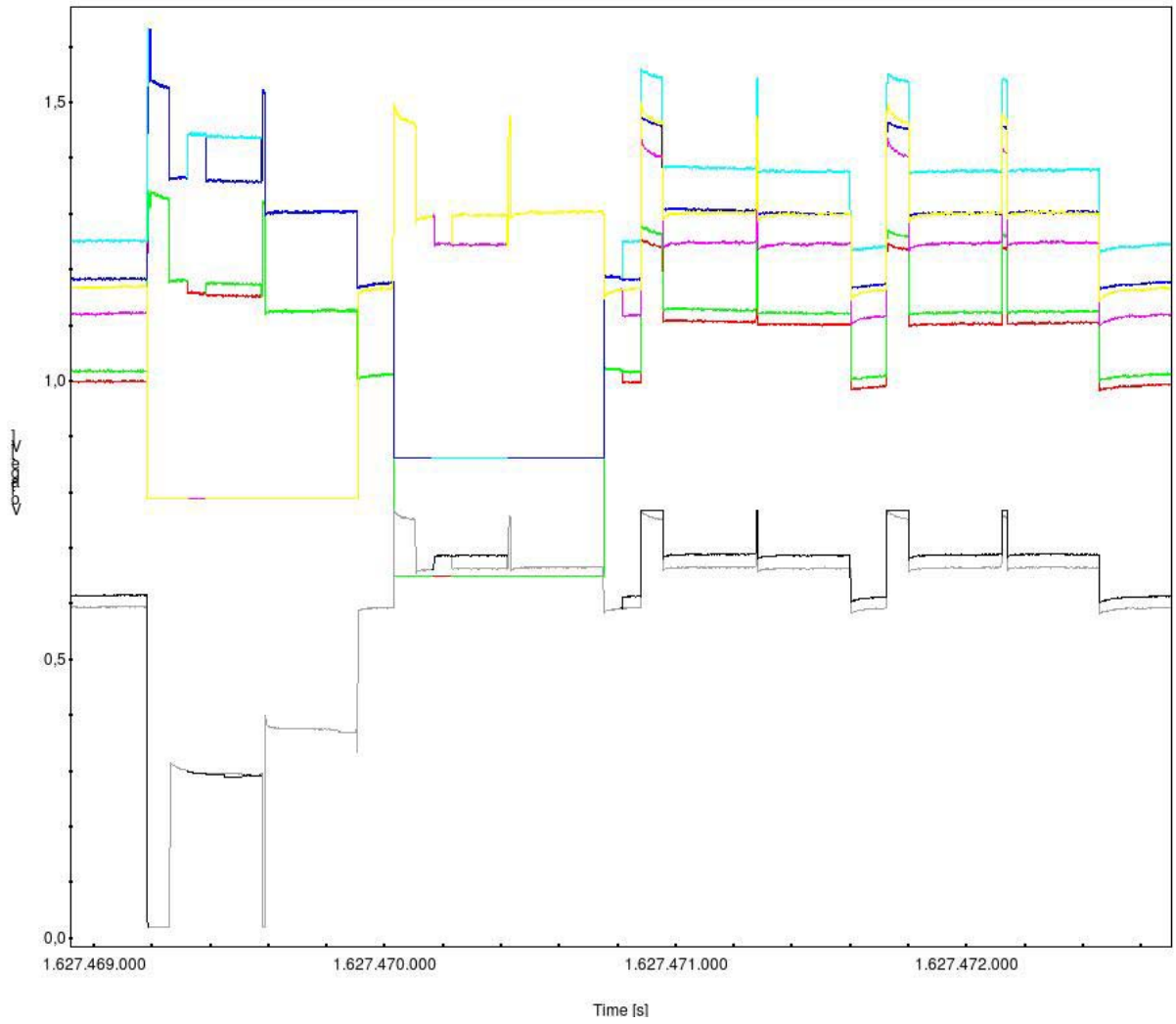
1.627.468.000
1.627.468.500
1.627.469.000
1.627.469.500
Time [s]

RCA 23


1,5
1,0
0,5
0,0
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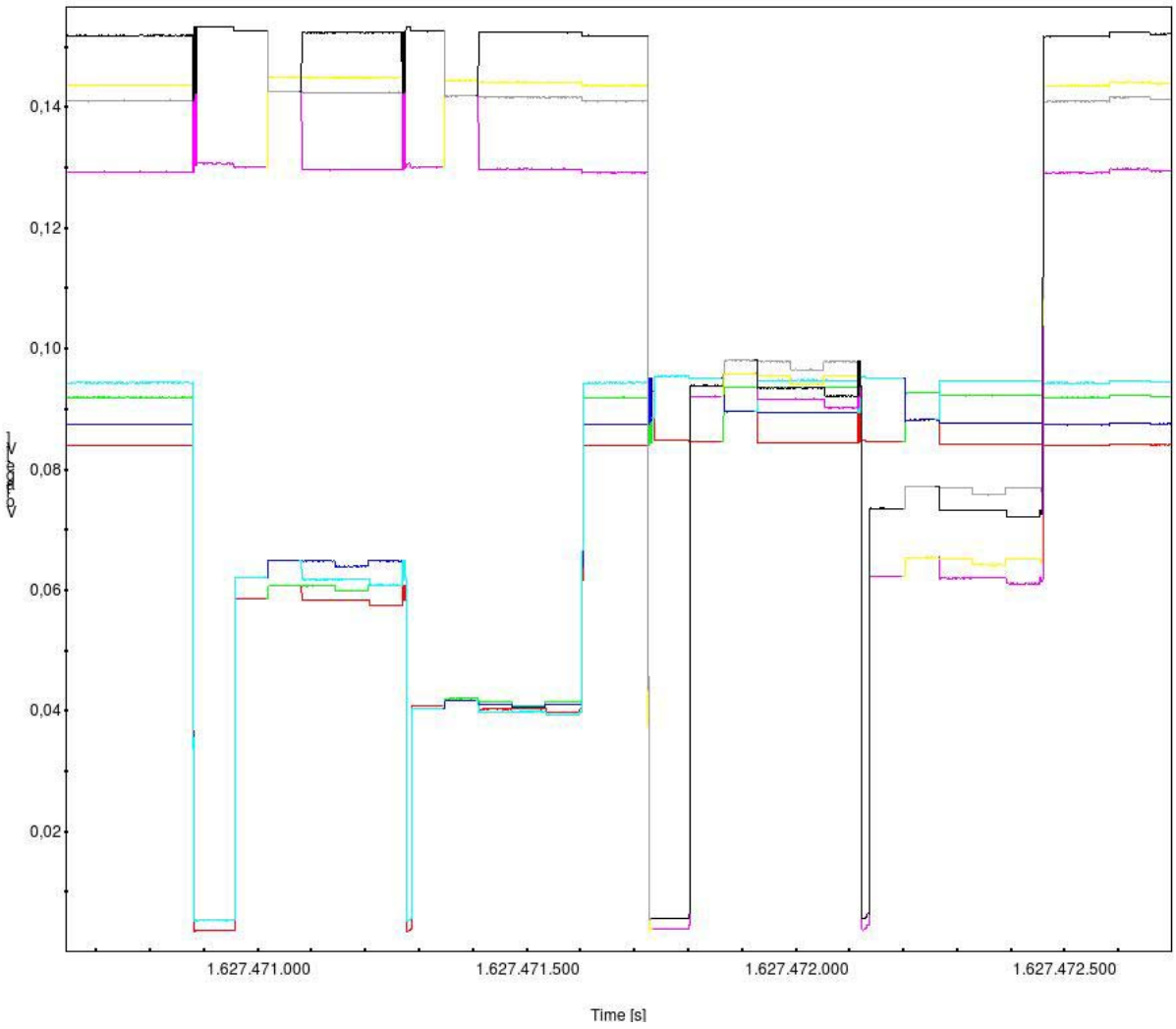
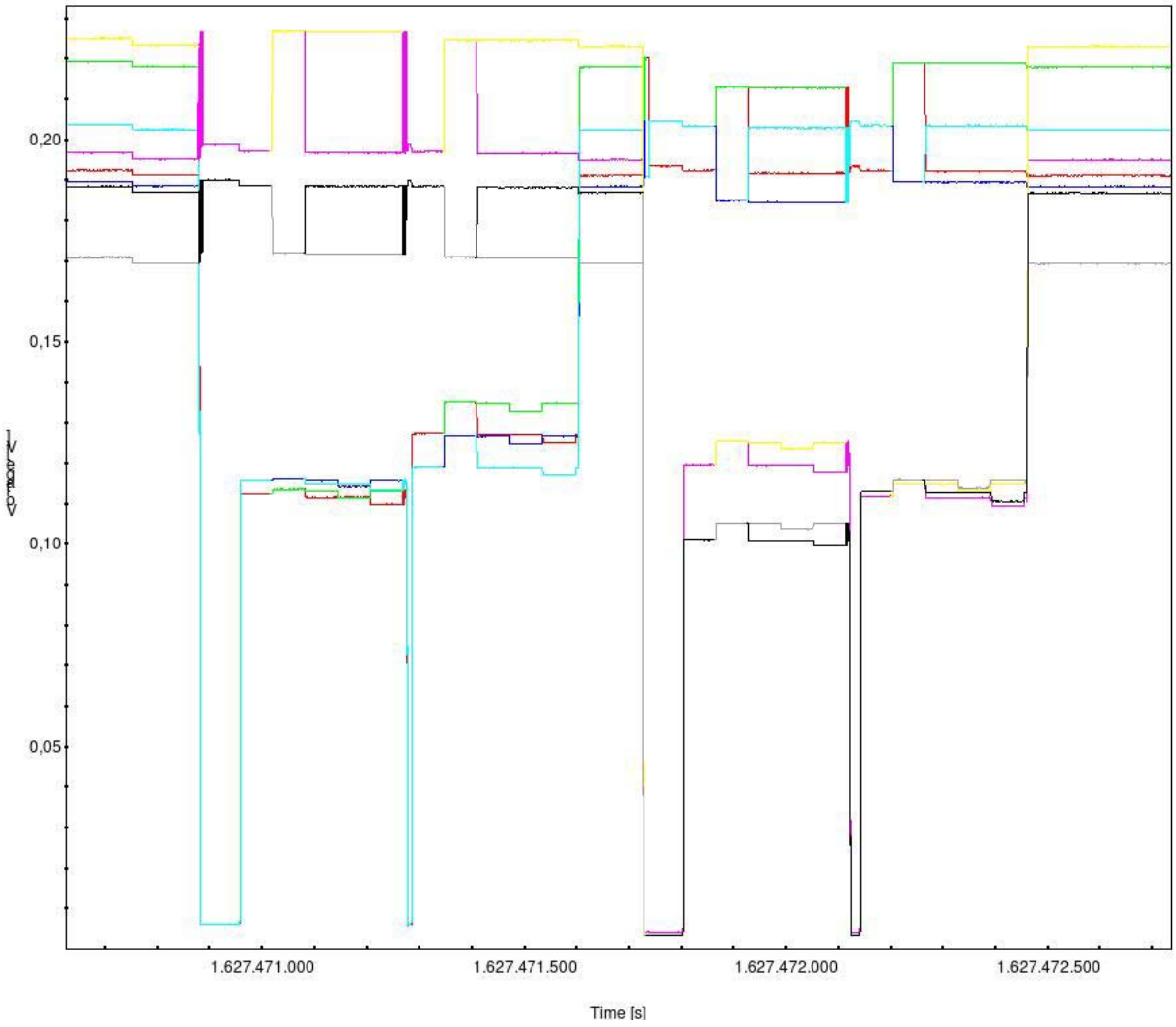
1.627.470.000
1.627.471.000
1.627.472.000
Time [s]

RCA 24


0,14
0,12
0,10
0,08
0,06
0,04
0,02
1.627.471.000
1.627.471.500
1.627.472.000
1.627.472.500
Time [s]

RCA 25


0,20
0,15
0,10
0,05
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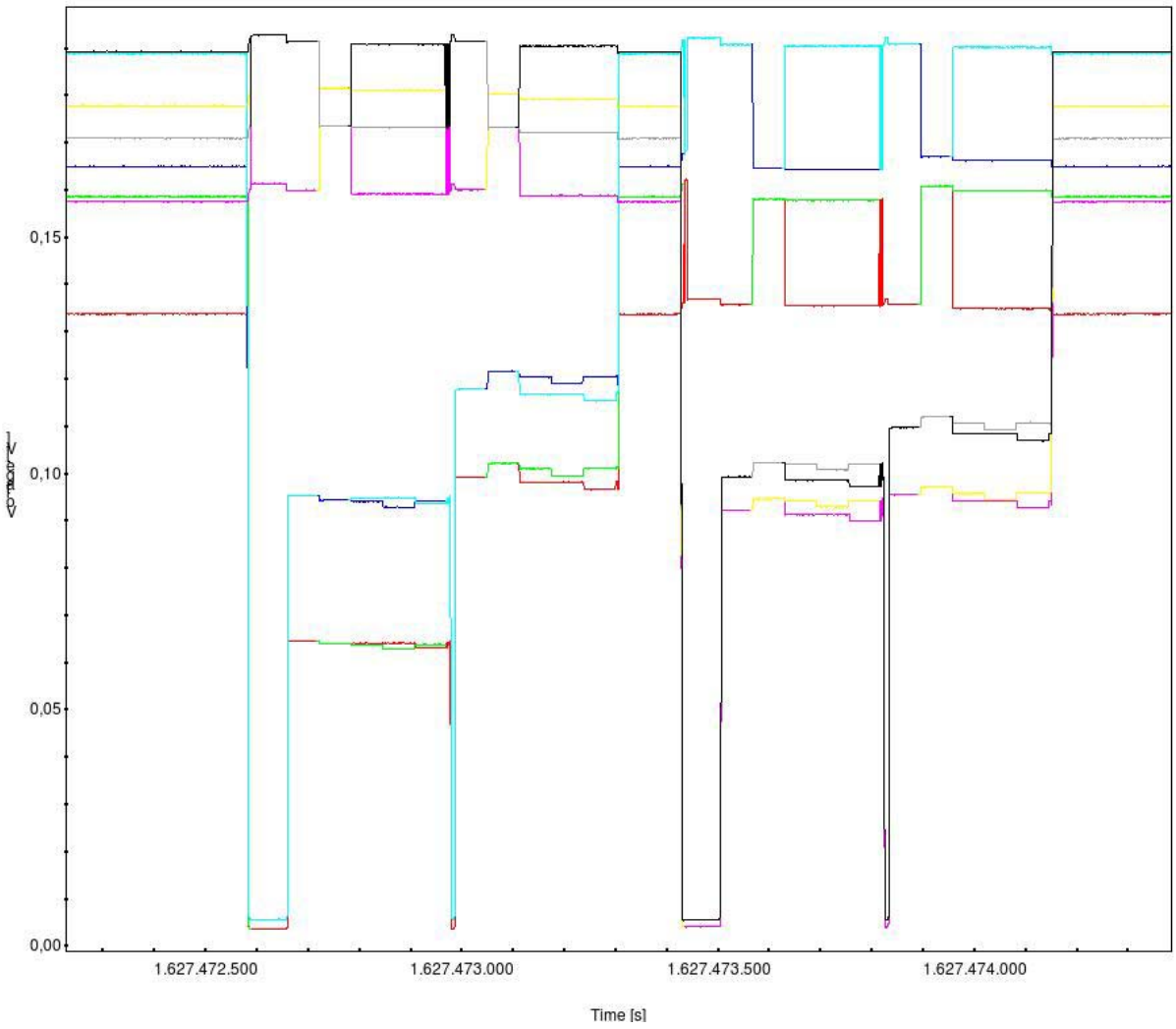
1.627.471.500
1.627.472.000
1.627.472.500
Time [s]

RCA 26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0,10
0,05
0,00
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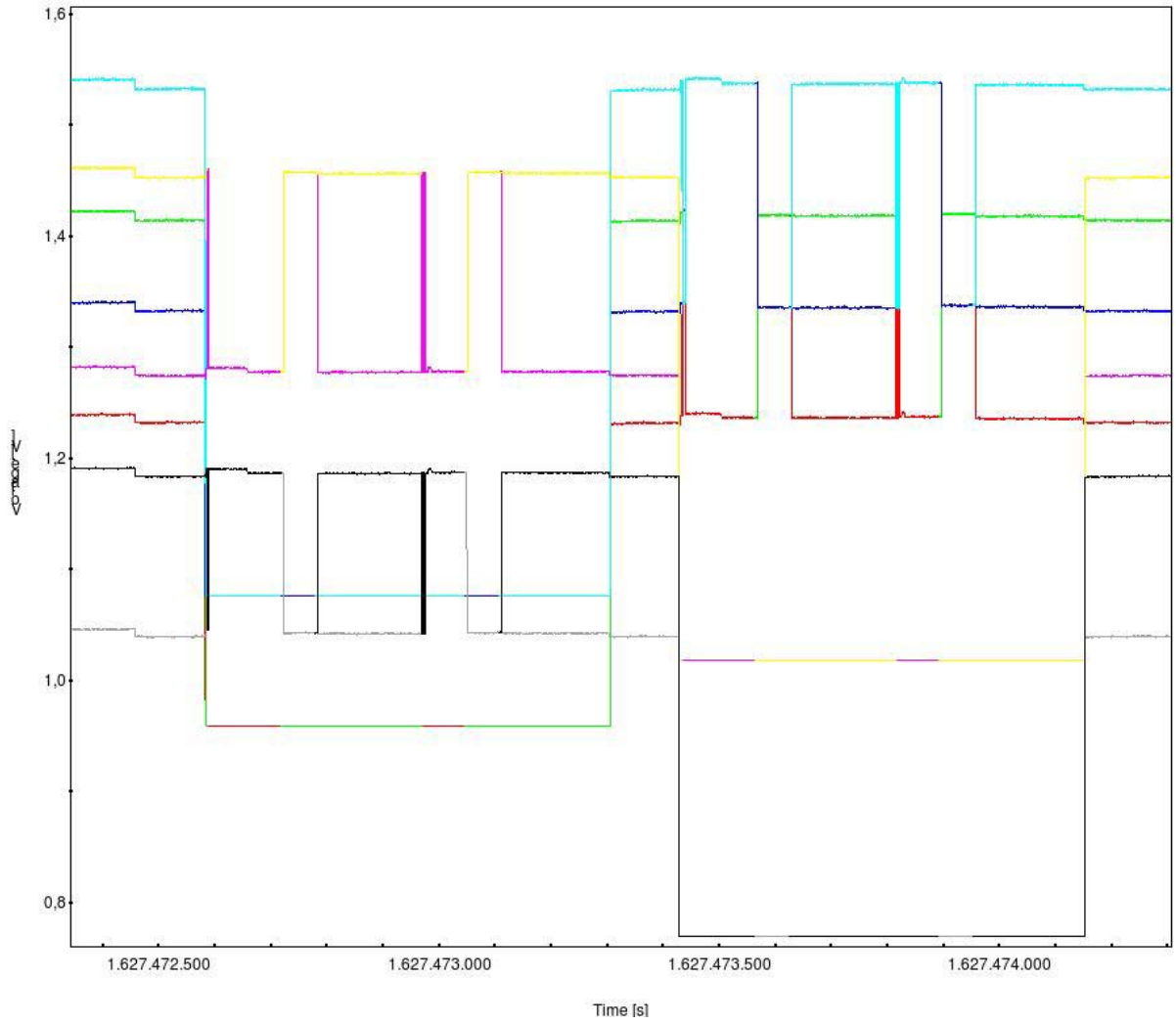
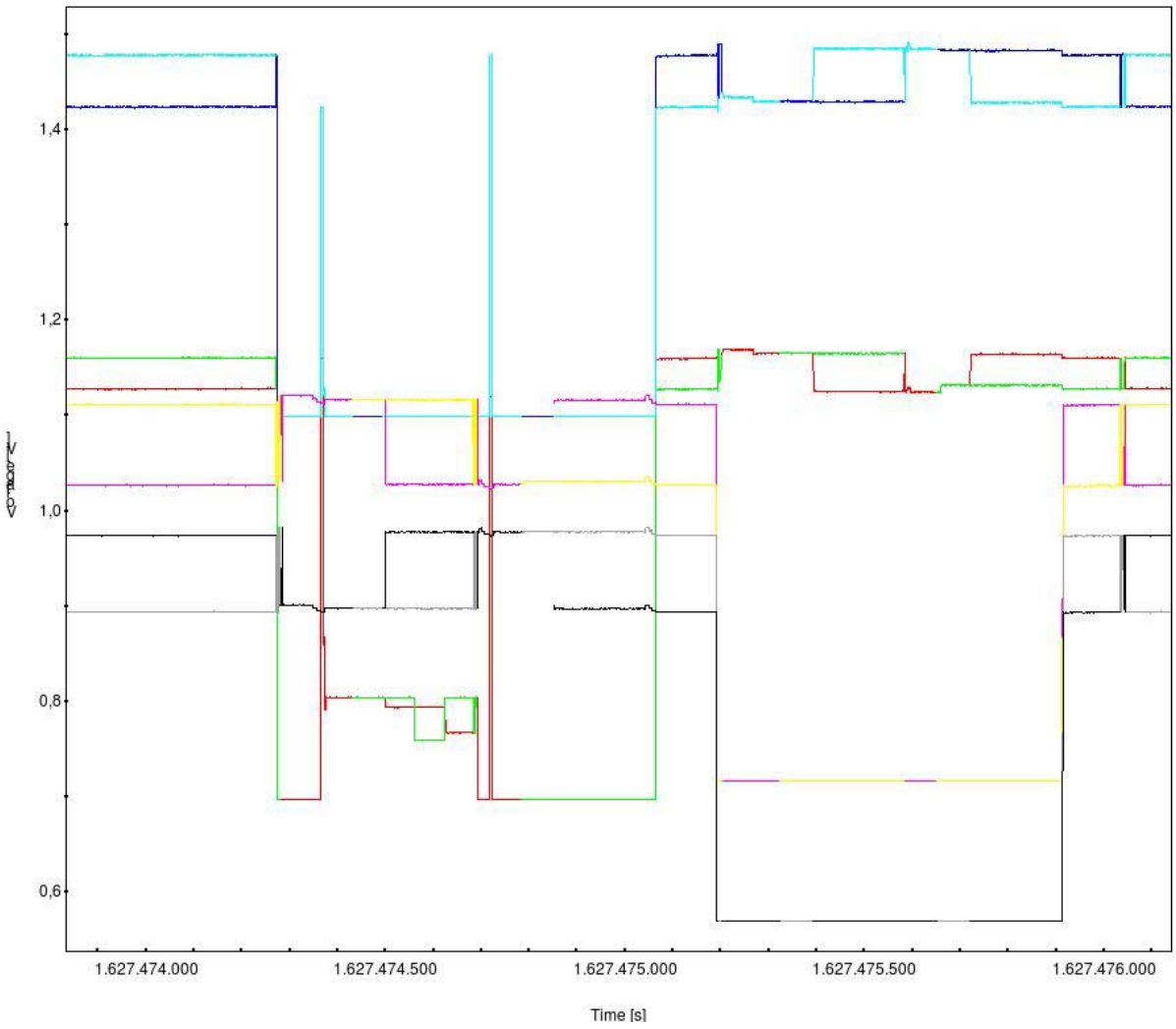
1.627.473.000
1.627.473.500
1.627.474.000
Time [s]

RCA 27


1,6
1,4
1,2
1,0
0,8
1.627.472.500
1.627.473.000
1.627.473.500
1.627.474.000
Time [s]

RCA 28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1,2
1,0
0,8
0,6
1.627.474.000
1.627.474.500
1.627.475.000
1.627.475.500
1.627.476.000
Time [s]