

CONCERT

Project Reference RO-OCN-TN-3868

Title Concert operation LTS

Author A. Herique, W.Kofman, P. Puget, S. Zine,
Y. Rogez

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Page 1 / 12

CONCERT Operations Report

Long-Term Science



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Page 2 / 12

CHANGE RECORDS

ISSUE	DATE	EVOLUTION	AUTHOR
1.0	07/09/15		Y. Rogez
1.1	13/07/17	Corrected the date of LS14	Y. Rogez



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Page 3 / 12

Table of Contents

1	INTRODUCTION.....	5
2	LANDER SEARCH IN BEACON MODE	6
2.1	Main actions	6
2.2	General analysis	8
2.2.1	Performances (OCN only)	8
2.2.2	Temperature	9
2.2.3	Telemetry and data integrity	9
2.2.4	OCXO	9
2.3	Detailed operational analysis	10
2.3.1	For all LS# except LS2	10
2.3.1.1	Timing analysis	10
2.3.1.2	Clock synchronization accuracy	10
2.3.1.3	Data integrity	10
2.3.2	For LS2 – 09/07/2015 15:00:00	10
2.3.2.1	Timing analysis	10
2.3.2.2	Clock synchronization accuracy	10
2.3.2.3	Data integrity	10
2.3.2.4	Highlights and comments	11
3	CONCLUSIONS	12



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Revision - Date V1.1 – 13/07/2016

Page 4 / 12

List of figures

Figure 1 : Lander PSS current feed during LS2	11
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List of tables

Table 1 : CONCERT operations summary for LTS	7
Table 2 : Performances overview – part 1	8
Table 3 : Performances overview – part 2	8
Table 4 : Temperatures for all tests	9



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Revision - Date V1.1 – 13/07/2016

Page 5 / 12

1 Introduction

This document is the technical report of CONCERT operations for the Long-Term Science phase (LTS). The LTS phase begins the 15/11/2015 (end of First Science Sequence) to the end of Philae life time.

Until now, only “lander search” operations have been performed during LTS, as Philae remains almost unreachable. The purpose of turning CONCERT instrument ON during these lander search operations is to do ranging measurements in visibility (as done at the end of FSS, [RD2]). Another interest in doing such operation is to double the chances of detect an RF signal between Rosetta and Philae in case of an erratic status of the communication link.

It includes:

- MTP 018 (7 beacon sequences)
- MTP 019 (4 beacon sequences)
- MTP 020 (3 beacon sequences)
- Later MTP (no CONCERT operation)

Notes

Scale references are arbitrary for power in dB in this document figures.

Applicable documents

[AD 1]

Reference documents

[RD 1] RO-OCN-TN-3864 - Consert Save Mode.docx

[RD 2] RO-OCN-TN-3866 Consert SDL+FSS operation report V1.1.docx

[RD 3] LIOR_CONCERT-BEACON mode LTS V1.doc



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Revision - Date V1.1 – 13/07/2016

Page 6 / 12

2 Lander search in BEACON mode

2.1 Main actions

In LTS period from MTP 9 (Nov 2014) to MTP 24 (Jan. 2016), operations were performed to search Philae. The objective of such operations is to establish a stable link between Rosetta and Philae, and to localize it in order to start science operations on Philae's instruments.

In this context, the CONSERT instrument has two objectives:

1. Provide a secondary RF link channel between Philae and Rosetta. The primary one being done by the communication RF S/S.
2. Perform ranging measurements between the orbiter and the lander, as done at the end of FSS (cf. [RD 2]).

In all cases, OCN and LCN were operated together with beacon sequence ([RD 3]). During such sequence, no tuning is needed and only a few part of the signal are expected to be retrieved: the synchronization between OCN and LCN only happen periodically every few minutes. This is the same functioning as used at the end of the FSS.

As the communications between Philae and Rosetta were very difficult, we have used a specific commanding process. The commanding sequence on-board Philae at the end of FSS was still available on Philae's CDMS in LTS. So, only a triggering on the AMST was needed to launch the CONSERT BEACON sequence. The number of sounding parameter still in the AMST loaded onboard Philae was very overestimated (10000 soundings), so the end of operation was commanded by the switch OFF command (or lander power OFF). To improve the chances for the commands to be uplinked from Rosetta to Philae with these unstable RF links, the trigger command for CONSERT AMST was sent a lot of times during the RF link slot. The first CONSERT-ON trigger command received by the CDMS launch the corresponding AMST and ignore any later trigger.



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Revision - Date V1.1 – 13/07/2016

Page 7 / 12

Below is the table of all attempts made to find Philae:

Date	Time (UTC)	Duration	MTP	Operation description
05/07/2015	11:50:00	05:26:00	18	LS1 - Lander search / ranging (BEACON)
09/07/2015	15:00:00	05:26:00	18	LS2 - Lander search / ranging (BEACON)
12/07/2015	04:00:00	05:26:00	18	LS3 - Lander search / ranging (BEACON)
13/07/2015	18:15:00	05:26:00	18	LS4 - Lander search / ranging (BEACON)
14/07/2015	06:30:00	05:26:00	18	LS5 - Lander search / ranging (BEACON)
14/07/2015	18:45:00	05:26:00	18	LS6 - Lander search / ranging (BEACON)
24/07/2015	14:15:00	05:26:00	18	LS7 - Lander search / ranging (BEACON)
12/08/2015	07:30:00	05:26:00	19	LS8 - Lander search / ranging (BEACON)
12/08/2015	17:45:00	05:26:00	19	LS9 - Lander search / ranging (BEACON)
17/08/2015	08:30:00	05:26:00	19	LS10 - Lander search / ranging (BEACON)
17/08/2015	20:45:00	05:26:00	19	LS11 - Lander search / ranging (BEACON)
12/09/2015	21:00:00	05:26:00	20	LS12 - Lander search / ranging (BEACON)
18/09/2015	00:30:00	05:26:00	20	LS13 - Lander search / ranging (BEACON)
20/12/2015	23:00:00	05:26:00	24	LS14 - Lander search / ranging (BEACON)
09/01/2016	14:00:00	05:26:00	24	LS15 - Lander search / ranging (BEACON)
12/01/2016	01:30:00	05:26:00	24	LS16 - Lander search / ranging (BEACON)

Table 1 : CONCERT operations summary for LTS



CONCERT

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Revision - Date V1.1 – 13/07/2016

Page 8 / 12

2.2 General analysis

Upon all the lander search operations where CONCERT was commanded to be operated, only the LS2 on 09/07/2015 returned LCN telemetry data. OCN operated nominally for all operations.

2.2.1 Performances (OCN only)

	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8
Ping-pong S/P position (°)	-0.3/0.3	-0.1/0.1	21/-21 to -0.4/0.4	-1.1/1.1 to -0.5/0.5	0.1/-0.1 to -0.1/0.1	0 to -20.2/20.2 to 0	0 to 12.2/-12.2	-0.1/0.1 to -0.3/0.3
Ping-pong OCN signal								
Peak level (dB)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GCW	0	0	0	0	0	0	0	0
Current (mA)	95	95	95	95	95	95	95	95
OCXO	130	128	130	128	130	130	130	128
Peak Position	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Temperature Range	10.6/15	12.5/16	14.1/17.3	10.7/15.1	9.7/14.5	9.7/14.5	10.6/15.6	11.1/15.7
Ping-pong LCN signal								
Peak level (dB)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GCW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Current (mA)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OCXO	N/A	131	N/A	N/A	N/A	N/A	N/A	N/A
Temperature Range	N/A	19.7	N/A	N/A	N/A	N/A	N/A	N/A

Table 2 : Performances overview – part 1

	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16
Ping-pong S/P position (°)	-0.3/0.3 to -0.4/0.4	-1.8/1.8 to -4/4	2/-2 to -0.8/0.8	22.9/-22.9	-1/1 to 1/-1	0/0 to 11.6/-11.6	0.6/-0.6 to 0.5/-0.5	-2/2 to 2/-2
Ping-pong OCN signal								
Peak level (dB)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GCW	0	0	0	0	0	0	0	0
Current (mA)	95	95	95	95	95	95	95	95
OCXO	130	130	130	130	130	130	130	130
Peak Position	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Temperature Range	11.1/16.1	11.1/15.6	10.6/15.6	21.5/25.5	12.6/16.2	13.1/17.3	11.6/17.3	10.6/17.3
Ping-pong LCN signal								
Peak level (dB)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GCW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Current (mA)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OCXO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Temperature Range	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3 : Performances overview – part 2



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Revision - Date V1.1 – 13/07/2016

Page 9 / 12

2.2.2 Temperature

		Ocxo Start	Ocxo end	Digi Start	Digi End	Ebox Start	Ebox end
LS1	OCN	15.3	26.2	11.7	21.8	10.6	15
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS2	OCN	17	26.2	13.6	21.8	12.5	16
	LCN	24.8	N/A	20.3	N/A	19.7	N/A
LS3	OCN	20.3	26.2	17	23.3	14.1	16.7
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS4	OCN	15.3	26.2	11.7	21.8	10.7	15.1
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS5	OCN	13.6	24.8	11.7	20.3	9.7	14.5
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS6	OCN	13.6	24.8	9.8	21.8	9.7	14.5
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS7	OCN	15.3	26.2	11.7	21.8	10.6	15.6
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS8	OCN	15.3	26.2	13.6	21.8	11.1	15.7
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS9	OCN	17	26.2	11.7	21.8	11.1	16.1
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS10	OCN	17	26.2	13.6	23.3	11.1	15.6
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS11	OCN	15.3	26.2	11.7	21.8	10.6	15.6
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS12	OCN	26.2	33	23.3	29	21.5	22
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS13	OCN	17	26.2	13.6	23.3	12.6	16.2
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS14	OCN	18.7	26.2	15.3	23.3	13.1	15.6
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS15	OCN	18.7	27.6	13.6	23.3	11.6	17.3
	LCN	N/A	N/A	N/A	N/A	N/A	N/A
LS16	OCN	15.3	27.6	11.7	24.8	10.6	17.3
	LCN	N/A	N/A	N/A	N/A	N/A	N/A

Table 4 : Temperatures for all tests

2.2.3 Telemetry and data integrity

Data integrity is OK on OCN side.

No telemetry and data coming from Philae, except for the LS2 operation (cf. 2.3.2).

2.2.4 OCXO

N/A as no tuning operation have been performed on these operations (BEACON mode).



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Revision - Date V1.1 – 13/07/2016

Page 10 / 12

2.3 Detailed operational analysis

2.3.1 For all LS# except LS2

OCN operated from the nominal start time to the nominal end time and acquired 7815 soundings, as expected.

No signal has been detected from LCN.

No CONCERT science TM (APID1804) retrieved from LCN.

No HK coming from Philae.

2.3.1.1 Timing analysis

Timings are OK on OCN.

2.3.1.2 Clock synchronization accuracy

N/A : no tuning has been performed as the operation uses the stroboscopic mode (no tuning).

2.3.1.3 Data integrity

On OCN side, no corrupted data has been found.

On LCN side, no data retrieved

2.3.2 For LS2 – 09/07/2015 15:00:00

OCN operated from the nominal start time to the nominal end time and acquired 7815 soundings, as expected.

No signal has been detected from LCN.

26 CONCERT science TM (APID1804) have been received on ground. By regard to the nominal TM emitted by LCN during its starting phase, 8 TM are missing at the beginning. They exiting ones correspond to the nominal TM emitted by LCN until the tuning phase during 6 minutes.

All these TM are misdated with negative date stamps by regard to the lander time reference (-20428 day, -15 hours, -4 minutes). Which corresponds to 27/01/1947, roughly.

2.3.2.1 Timing analysis

Timings are OK on OCN.

2.3.2.2 Clock synchronization accuracy

N/A : no tuning has been performed as the operation uses the stroboscopic mode (no tuning).

2.3.2.3 Data integrity

On OCN side, no corrupted data has been found.



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Revision - Date V1.1 – 13/07/2016

Page 11 / 12

On LCN side, the few TM packets received were not corrupted but were misdated (negative dates were decommutated).

2.3.2.4 Highlights and comments

Considering the data retrieved on ground, it appears that CONCERT started at the expected time, with proper MT. But it stopped unexpectedly at the beginning of the tuning phase.

It has been verified by Philae commanding team (LCC) that the “blind commanding” mode was correct: no residual commanding could have stop CONCERT, as deeply tested on the GRM.

The current feed from the lander platform have been analyzed and shows no evident problem on this side. Figure 1 shows the evolution of the PSS current and bus voltage feeding to LCN during the relevant period of time.

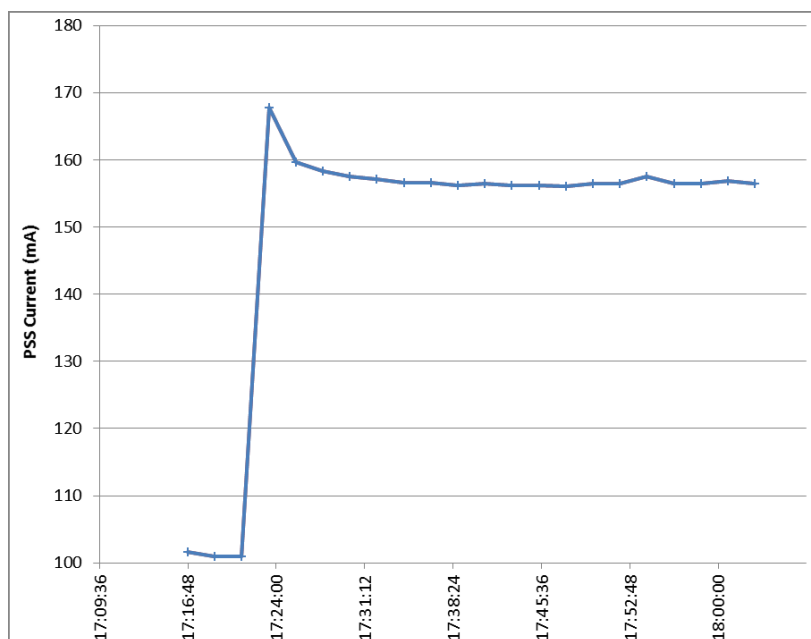


Figure 1 : Lander PSS current feed during LS2



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Revision - Date V1.1 – 13/07/2016

Page 12 / 12

3 Conclusions

OCN worked nominally.

LCN did not produced any science data during LTS. The lander search campaign operations aided with CONSERT instrument didn't allowed to localize Philae.

For a single operation (LS2) on 09 July 2015 15:00:00, LCN has started but unexpectedly stopped sending TM at the beginning of the tuning phase. The reasons of this behavior of LCN are not clear and there is no more clues to investigate further this issue.

LS16 on 12/01/2016 is the last operation of the CONSERT instrument.

– END OF DOCUMENT –