Title

LCU ON-BOARD SOFTWARE RELEASE NOTE

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Document Change Record

Issue	Date	Changed Sect.	Description of Change
2.2	Dec 2, 2009		New document
2.3	Jan 22, 2010		updated for patch2.3
2.4	Feb 19, 2010		updated for patch2.4
2.6	Jun 27, 2010		updated for patch2.6

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1 Scope

This document releases the LCU software patch 2.6 defined in a file specified below for upload to the LCU. It is applicable to LCU-FM and also to LCU-IM3, both unit can be in state after power cycling (hardware Reset) or operating with the already loaded patch24.

2 Applicable and Referenced Documents

2.1 Applicable documents

SRON-G/HIFI/AIV/2006-022 Procedure LCU Table Upload, issue 0.6

2.2 Referenced documents

SRC/LCU/PR/2002-018	LCU Software & Operational Modes, Commands and Housekeeping
SRC/LCU/TN/2009-0758	Technical Note on LCU SW redundant modification
SRC/LCU/TN/2000-0601	LCU On-Board Software Release Note, issue 2.2
SRC/LCU/TN/2010-0776	Technical Note on LCU SW redundant modification for partial checksum

3 Applicable System Configuration

3.1 Unit configuration

LCU Model: **FM or IM3**	**Section:** **Redundant in FM** **Prime in IM3**	**State:** **1) in STANDBY_0 mode after HW RESET** **2) in STANDBY_1 mode with patch24 already uploaded**
LOU Model: **Dummy or FM**	**Section: N.A.**	
LSU Model: **Dummy, DM or FM**	**Section: N.A.**	

When **LCU-patch26** is loaded after LCU HW reset (power cycle) LCU have to remain in STANDBY_0 mode. After loading the LCU-patch26 it is necessary to send HL_STANDBY command to LCU for transition to STANDBY_1 mode and enabling the upload the Safety Table and to keep LCU commandable.

LCU-patch26 can be also loaded when LCU remains in STANDBY_1 mode – it is the case when **LCU-patch24** has been uploaded previously.

4 Changes in the software

LCU-patch26 is applicable for LCU-FM (PROM version 2917) and LCU-IM3 (PROM version 3979) software. It contains the patch24 which was previously developed for LCUFM-redundant normal operation in flight after LCUFM-main failure in February 2010 and it contains additionally procedure to recalculate the partial checksum value of the previously defined memory area (with new implemented commands: HL_SET_PART_CHSUM and HL_CALC_PART_CHSUM) and with new implemented algorithm CRC-16. This recalculated partial checksum is given back by the housekeeping request HL_RD_PART_CHSUM.

The main feature of LCU-patch26 in comparison with patch24 is:

- new LCU partial checksum computation algorithm used in command HL_CALC_PART_CHSUM execution.

Version number after loading the LCU_patch26 is changed to:

unit	Version number
LCU-FM	296A
LCU-IM3	396A

4.1 Changes in procedures (wrt SW from PROM)

	Action	Updated procedures	Memory address
1	Erasing Clear_RAM	Clear_RAM	0x00A3 – 0x00AC
2	Erasing Clear_XRAM	Clear_XRAM	0x00AD – 0x00BC
3	Erasing Copy_PROM_RAM	Copy_ROM_to_RAM	0x00BD – 0x00D1
4	Erasing decompress lsu2 table	Decompress_lsu2_table	0x0152 – 0x0180
5	Erasing decompress green table	Decompress_green_table	0x0181 – 0x0364
6	deactivation of *standby* relay in Standby mode	Set_standby_relay	0x0BB5 – 0x0BBA 0x0BBF – 0x0BC4
7	Version number changed for x96A	hskB204	0x0EB3
8	Modification of hskB207 housekeeping request	hskB207	0x0EC7 0x0ECA
9	Temporary deactivation of *check_mode* procedure	Check_mode	0x0F24
10	Add *STANDBY_1* mode flag	komF006	0x0F39
11	Add jump to *start_part_CRC* to command table	commF00x_jump_table	0x0FAD – 0x0FAE
12	Add jump to *calc_part_CRC* to command table	commF00x_jump_table	0x0FB0 – 0x0FB1
13	Add jump to *DISSIPATIVE* mode to command table	commF00x_jump_table	0x0FB3 – 0x0FB4
14	Activation of *goto STANDBY* in all mode	komF002	0x108A – 0x108C
15	Add *STANDBY_1* mode flag	komF002	0x10B0
16	Activation of *copy safe to default* command in Standby mode	komF006	0x115A
17	Delay increased in	Frequency_switching	0x2013 – 0x2014

	LSU_FREQ_TLMY measurement in FSW		
18	Including call with reti	Start	0x208E - 0x208F
19	Clearing call to unused procedures	Start	0x2090 - 0x209F
20	Add *STANDBY_1* mode flag	Restart	0x20E2 - 0x20E4
21	Add jump to new power-down interrupt service	?power_interrupt	0x2163 - 0x2164
22	Change I4 of M3 in band 3b /Main	IV_currents_main	0x2570 - 0x2571
23	Change I4 of M3 in band 3b /Redundant	IV_currents_redundant	0x26C0 - 0x26C1
24	Add *DISSIPATIVE_mode* procedure	Patch area	0x6B2A - 0x6B41
25	Add *new power-down* interrupt procedure	Patch area	0x6B42 - 0x6B60
26	Add *start_part_CRC* procedure	Patch area	0x6B61 - 0x6B67
27	Add *calc_part_CRC* procedure	Patch area	0x6B68 - 0x6BA7
28	Add *CRCTAB* table	Patch area	0x6BA8 - 0x6DA7
29	modification of *call check_mode* in memory upload procedure	komendyF3xx	0x13D2 - 0x13D3
30	Add new procedure to break endless loop in patch area	*Patch area*	0x79EE - 0x79F6
31	Final activation of check mode procedure again	*Check_mode*	0x0F24

4.2 Changes in LCU checksum value

	LCU-FM checksum value	**LCU-IM3** checksum value
After RESET	0x8D04	0x8DED
After loading the **LCU-patch26**	0x0319	0x03A0
With **LCU-patch26** and **Safety Table 2.36** (in Nominal)	0xEECB	0xEF52

4.3 New value for LCU-CRC16 checksum value

When **LCU-patch26** is loaded the new partial LCU-CRC16 checksum value is read with housekeeping HL_RD_PART_CHSUM after the command's sequence: HL_SET_PART_CHSUM and HL_CALC_PART_CHSUM.

	LCU-FM CRC16	LCU-IM3 CRC-16
After loading the **LCU-patch26** when LCU is powered-on	0x0609	0xDE9F
With LCU-patch26 and Safety Table 2.36 (in Nominal)	0x3FA9	0xE73F

Although the old-version HL_CHECKSUM command (0xF3CC 0000) and HL_RD_CHECKSUM housekeeping request (0xB20E 0000) are still valid in LCU, they should not be use any more for continuous LCU healthy monitoring. Instead of them **the new command's sequence should be use to recalculate LCU CRC-16 checksum** :
HL_SET_PART_CHSUM with start address = 0x0000,
HL_CALC_PART_CHSUM with size = 0x79F8.

The time of recalculating CRC-16 checksum from the all memory is 1.5 seconds

Important !

In case of uploading LCU-patch26 after power cycling (when LCU is in STANDBY_0) it is necessary to send HL_STANDBY command to LCU after loading the LCU-patch26 to be able upload the Safety Table next.

4.4 CRC-16 tables for LCU-patch26 critical and safe memory area

Critical code area

int index	int crc-16	int a1S	int a1L
1	0xEB0D	0x0013	8
2	0x86CA	0x0CEC	6
3	0xC574	0x0D22	90
4	0x7C7C	0x0E58	204
5	0x5060	0x0F4F	3
6	0xEFEE	0x0F58	6
7	0x0B0B	0x0FAC	6
8	0x4F41	0x0FBB	120
9	0xB29D	0x13AF	75
10	0x2302	0x2116	23
11	0x92EE	0x21AB	126
12	0x648A	0x6B61	70
13	0xA077	0x6BA8	256

Safe code area

int index	int crc-16	int a1S	int a1L
#Code area			
1	0x9437	0x0000	19
2	0xA806	0x001B	3281
3	0x1BF3	0x0CF2	48
4	0x5694	0x0D7C	220
5	0x7D9D	0x0F24	43
6	0x72A6	0x0F52	6
7	0x5D6C	0x0F5E	78
8	0x2979	0x0FB2	9
9	0x6735	0x1033	892
10	0xEBBA	0x13FA	3356
11	0xBA98	0x212D	126
12	0x9BBD	0x2229	1385
#Patch area			
13	0xEFCF	0x6B2A	55
14	0xE1F0	0x6BA7	1
15	0x78BE	0x6DA8	3152

5 Filename / CHEKSUM Value / HASH Value

		Signature
File Identification	100627-LCU-patch26.txt	MM
Calculated LCU-FM CHECKSUM Value after uploading the Safety Tables T236 (in Nominal mode)	0xEECB	
Calculated LCU-FM partial checksum value with start address 0x0000 and size 0x79F8 with the Safety Tables T236 (in Nominal mode) uploaded	0x3FA9	
Calculated Hash Value	ed4cce3d7c424dd792d03ea9421880c1	