EADS astrium

Test Report

Herschel

Title: **SPIRE LPU Electrical Integration Report for FCU Interfaces P/J-43 and P/J-44**

CI-No: 125 200

Prepared by:	A. Koppe	Date: 25.10.07
Checked by:	S. Idler	25-10.07
Product Assurance:	S. Stritter	26.10.07
Configuration Control:	W. Wietbrock	12.11.07
Project Management:	Dr. W. Fricke	12/11/2007

Distribution: See Distribution List (last page)

Issue	Date	Sheet	Description of Change	Release
1	25.10.2007	All	First issue	

Table of Content

1 Scope

1.1 Objective

This report describes the electrical verification of the SPIRE LPU interfaces on connectors P/J 43 and P/J 44 following the successful completion of the SVM power interfaces verification on connectors P/J41 and P/J42 which was a prerequisite to the execution of the as-run procedure.

2 Test Report Summary

2.1 Operations

Execution of step-by-step procedure after successful verification of prime/redundant power interfaces and prime/redundant high level commands.

2.2 Test Procedure

SPIRE-RAL-PRC-002972, issue 0.4

2.3 Procedure Variations

No.	Step	Description
1	4	...mate to **LPU** J43
2	5	...mate to **LPU** J44
3	7	... of **LPU** J43
4	11	... contacts 4 and **8** of **LPU** J43 (4 positive wrt **8**)
5	12	Reading of S/C TM is not possible due to database and CDMS S/W version incompatibility
6	14	... of **LPU** J43
7	16	... contacts 4 and **8** of **LPU** J43 (4 positive wrt **8**)
8	20	... contacts 1-9 of **LPU** J43
9	23	Reading of S/C TM is not possible due to database and CDMS S/W version incompatibility
10	24	... contacts 7-8 of **LPU** J44
11	26	... contacts 4 and **8** of **LPU** J44 (4 positive wrt **8**)
12	28	... from **LPU** J43
13	29	... from **LPU** J44
14	35	Mate 3**7**-way BOB
15	40	PINs 26, 27, 28, 29, 30 carry 28 V which is correct
16	41	PINs 26, 27, 28, 29, 30 carry 28 V which is correct
17	51	92 is the hot contact
18	49	Different script used to power on DPU & DRCU Prime
19	55	92 is the hot contact
20	57	Reading of S/C TM is not possible due to database and CDMS S/W

No.	Step	Description
		version incompatibility
21	60	Different script used to power off DRCU & DPU Prime
22	63	Different script used to power on DPU & DRCU Redundant
23	73	Different script used to power off DRCU & DPU Redundant

2.4 Non Conformances

None

2.5 Conclusion

The SPIRE LPU has been successfully integrated on the FCU (see MoM SCI-PT/49405). All scope measurements have bee attached to the as-run procedure. The results have been evaluated by the supplier (RAL) with the following conclusion:

The test was carried out according to the specification except where noted.
The polarity of the signal was measured at the output to the launch latch when the latch command was sent via the FCU.
The polarity of the signal was measured at the output to the launch latch when the LPU was activated via the HL command.

These polarities were the same.
This indicated that the LPU is working as expected and will provide extra latching force for launch as designed.
The command used to latch the SMEC latch was 0x90430001.
The command used to latch the SMEC latch during all ground testing at instrument level (ILT) was 0x90430001.
This confirms that the correct latch command was used.

The test was successful.

Annex 1 AS RUN PROCEDURE

SPIRE

SUBJECT: **SPIRE LPU ELECTRICAL INTEGRATION PROCEDURE**

PREPARED BY: **Douglas Griffin**

DOCUMENT No: **SPIRE-RAL-PRC-002972**

ISSUE: **0.4 REDLINE** **Date:** **17-10-07**

CHECKED BY: **Dominique Pouliquen** **Date:** .....

APPROVED BY: **Eric Sawyer** **Date:** .....

AS RUN PROCEDURE
18.10.2007

Last printed: 12:15:51 17/10/2007

Change Record

ISSUE	DATE	
0.1	17-10-07	Initial release -
0.2	15-10-07	Inserted some TBD values
		Added I/F check of P29/P30
0.3	16-10-07	Corrected pin allocations for 128-way Launch latch contacts (92 and 93)
		Added verifications that relays open as well as close
		Updated LCL and HL nomenclature to match the ASED denominations
		Removed steps which measure the polarity of the FCU Latch command current
0.4	17-10-07	Re-added steps which measure the polarity of the FCU Latch Command current
		Included SFT procedure cross referenced procedures for commanding SPIRE (also added RD 3)
		Removed references to the final mating of SIH-SS-11 and SIH-SS-13 as these steps can only be completed once the SPIRE SVM panel is closed !

Table of Contents

1. APPLICABLE/REFERENCE DOCUMENTS

Number	TITLE	Document Number	Issue
AD 1	LPU: Interface Control Document	LAM.PJT.SPI.DCI.070719_01	1.1
AD 2	Making SPIRE ESD Safe	SPIRE-RAL-NOT-002028	2
AD 3	LPU Mechanical Integration	TBW	

Number	TITLE	Document Number	Issue
RD1	Cryo Harness Interconnection Diagram SPIRE (PFM)	2547-121430-030-01-0B	B
RD2	SPIRE HARNESS DEFINITION DOCUMENT		
RD3	SPIRE FM SHORT FUNCTIONAL TEST PROCEDURES	SPIRE-RAL-PRC-2494	2.4

2. SCOPE AND INTRODUCTION

This document establishes the detailed procedure to be followed for the integration of the SPIRE LPU.

3. PERSONNEL

SPIRE Engineer
EADS Engineer
EADS PA

Spacecraft Power and Commands:

LCL #25: Prime LPU LCL
LCL #26: Red. LPU LCL

HL #5: Prime Latch hold command
HL #6: Prime Latch release command
HL #21: Red. Latch hold command
HL #22: Red. Latch release command

4. DETAILED PROCEDURE

4.1 Prerequisites

1. The black anodising has been removed from the designated area on the FCU in preparation for integration of the LPU
2. The SVM panel has been opened
3. The LPU has been delivered and has completed incoming inspection
4. The modifications to SIH-SS-11 and SIH-SS-13 (FCU P29/30) have been completed
5. All SIH-SS are mated to the DRCU (with the exception of LPU P43/44)
6. The electrical interfaces to the spacecraft (P41 and P42) carrying prime/redundant 28V power and the prime/redundant high level commands have been verified according to AD 1.

4.2 End State

The LPU has been integrated to the FCU
SPIRE is ready for the SVM panel to be closed for re-mating of the cryoharness

4.3 Test Equipment

One 128-Way Break-out Box
Two 9-Way DSub Break-out Boxes
Test leads for Break out Box
Three 10Ω ±5%, ½ W Resistance Bridge for Break-out Boxes
DVM
Isolated input Digital Storage oscilloscope

4.4 Notes

1. SPIRE is ESD sensitive. Handling of these units is to be carried out by personnel suitably trained and equipped. Prior to carrying out the mating operations detailed below, the Pxx and Jxx connectors are to put in an ionized air stream for > 30 sec to discharge the harness.

4.5 Detailed Procedure

No:	Activity	Remarks/Results	Sign off
	Spacecraft Interface Verification		
1	~~Provisional mechanical integration of LPU according to AD 3~~	Completed	
2	~~Mate FCU P41 to FCU J41 (prime spacecraft I/F)~~	Completed	
3	~~Mate FCU P42 to FCU J42 (redundant spacecraft I/F)~~	Completed	
	Initial Functional and State Test LPU		
4	Prepare a 9-Way BOB as per §6 and mate to ~~FCU~~ J43		✓
5	Prepare a 9-Way BOB as per §6 and mate to ~~FCU~~ LPU J44		✓
6	Send prime high-level command (HL #6) (make sure that it is isolated to start with)	DCT01170 (HLC6)	✓
7	Verify that the resistance between contacts 7 and 8 of ~~FCU~~ LPU J43 is less than 1 Ohm	Checks that the current for the MCU latch/un-latch commands passes through the LPU OK	350mΩ
8	Power on prime LPU LCL (LCL#25) LPU	ZC102999 (LCL#25 CLOSE)	✓
9	Verify with a DVM that no power appears on contacts 1-9 of ~~FCU~~ J43 and J44		✓
10	Send prime high-level command (HL #5) LPU	DCT01170 (HLC5)	✓
11	Measure the voltage drop across contacts 4 and 8 of ~~FCU~~ J43 (4 positive wrt 8) and calculate current (Pass criteria 153mA<X<185mA)	-1.655 V I = -165.5 mA	✓
12	Record the current being drawn by the prime LPU LCL (LCL #25) in the spacecraft TM	not possible due to data bus, IDMS S/W	–
13	Verify that contacts 1, 3, 5, 6, 7, 8 and 9 of J43 and J44 are unpowered LPU		✓
14	Verify that the resistance between contacts 7 and 8 of ~~FCU~~ J43 is greater than 5 MOhm	J43 > 50 MΩ ~~J44 > 50 MΩ~~	✓
15	Send prime high-level command (HL #6)	DCT01170 (HLC6)	✓

No:	Activity	Remarks/Results	Sign off
16	Measure the voltage drop across contacts 4 and 8 of ~~FCU~~ LPU J43 (4 positive wrt 8) and calculate current (Pass criteria X = 0mA)	0 V	✓
17	Un-power prime LPU LCL (LCL #25)	ZC142999 (LCL#25 OPEN)	✓
18	Send redundant high-level command (HL #22) (make sure that it is isolated to start with)	DCT01170 (HLC22)	✓
19	Power on redundant LPU LCL (LCL #26)	ZCA02999 (LCL#26 CLOSE)	✓
20	Verify with a DVM that no power appears on contacts 1-9 of ~~FCU~~ LPU J43 and J44		✓
21	Send redundant high-level command (HL #21)	DCT01170 (HLC21)	✓
22	Measure the voltage drop across contacts 4 and 8 of ~~FCU~~ LPU J44 (4 positive wrt 8) and calculate current (Pass criteria 153<X<185)	V = -1.621 I = -162 mA	✓
23	Record the current being drawn by the redundant LPU LCL (LCL # 26)in the spacecraft TM	not possible, see step 12	—
24	Verify that the resistance between contacts 7 and 8 of ~~FCU~~ LPU J44 is greater than 5 MOhm	> 30 MΩ	✓
25	Send redundant high-level command (HL #22)	DCT01170 (HLC22)	✓
26	Measure the voltage drop across contacts 4 and 8 of ~~FCU~~ LPU J44 (4 positive wrt 8) and calculate current (Pass criteria X = 0mA)	0 V	✓
27	Unpower Redundant LPU LCL (LCL #26)	ZCA42999 (LCL#26 OPEN)	✓
28	Remove 9-way BOB from ~~FCU~~ LPU J43		✓
29	Remove 9-way BOB from ~~FCU~~ LPU J44		✓
30	Mate LPU P43 to J43 (Final mating)		✓
31	Mate LPU P44 to J44 (Final mating)		✓
32	Demate FCU P29		✓
33	Demate FCU P30		✓
34	Mate 37-Way BOB to FCU P29		✓
35	Mate 37-Way BOB to FCU P30		✓
36	Power on Prime LPU LCL (LCL #25)	ZC102999 (LCL#25 CLOSE)	✓
37	Power on Red. LPU LCL (LCL # 26)	ZCA02999 (LCL#26 CLOSE)	✓

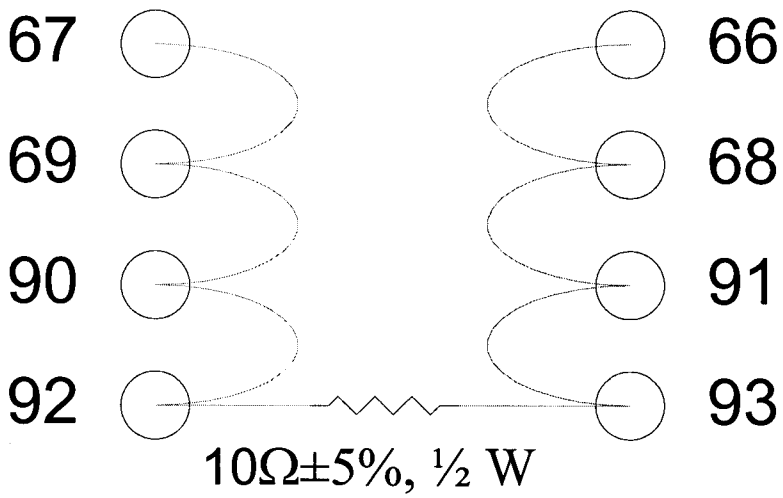
No:	Activity	Remarks/Results	Sign off
38	Send Prime HL #5 (hold)	DCT01170 (HLC5)	✓
39	Send Red. HL #21 (hold)	DCT01170 (HLC21)	✓
40	Verify that the voltage on all contacts of FCU P29 is less than 0.1V	PIN 26 = 28 V PIN 29 = 28 V PIN 27 = 28 V PIN 30 = 28 V PIN 25 = 28 V	✓
41	Verify that the voltage on all contacts of FCU P30 is less than 0.1V	~~PIN 20 = 0.14 V~~ ~~PIN 23, 24, 25 = 0.14 V~~ ~~PIN 21 = 0.14 V~~ PIN's 26, 27, 28, 29, 30 = 28 V ~~PIN 22 = 0.14 V~~	✓
42	Send Prime HL #6 (release)	DCT01170 (HLC6)	✓
43	Send Red. HL #22 (release)	DCT01170 (HLC22)	✓
44	Power off Prime LPU LCL (LCL #25)	ZC142999 (LCL#25 OPEN)	✓
45	Power off Red. LPU LCL (LCL #26)	ZCA42999 (LCL#26 OPEN)	✓
46	Mate FCU P29 to J29		✓
47	Mate FCU P30 to J30		✓
48	Prepare 128-way SMEC Launch Latch Coil Simulator according to §5 and mate to 312300 P04		✓
49	Power on SPIRE in prime mode SI02999SCVT005_ASDSFTSPIR_PWR_ON_P	The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 SPIRE-FM-SFT-DPU-ON-P SPIRE-FM-SFT-DRCU-ON-P	✓
50	Set SPIRE to REDY mode	The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 SPIRE-FM-SFT-FUNC-MCU-01-P	✓
51	Connect an isolated input Digital Storage Oscilloscope to contacts 92 and 93 of the Launch Latch Simulator (92 = hot)		✓
52	Send a latch command and record voltage across contacts 92 and 93 on oscilloscope (note: pulse duration 50±10 ms)	SEND_DRCU_COMMAND (0x90430001,0) Measurement on PIN 93 (CH2)	✓
53	Power on Prime LPU LCL (LCL #25)	ZC102999 (LCL#25 CLOSE)	✓
54	Send prime High level command HL #5 and record voltage across contacts 92 and 93 on oscilloscope (10ms/div time base)	DCT01170 (HLC5)	✓
55	Verify the polarity of the voltage drop across contacts 92 and 93 is positive (92 = hot)	V = - 1.65	✓

No:	Activity	Remarks/Results	Sign off
56	Verify that the current across Latch Simulator resistor is 153<X<185mA	I = 165 mA	✓
57	Record current drawn by Prime LPU LCL (LCL #25) in S/C TM	not possible, see step 12	✓
58	Send prime High level command HL #6 and record voltage across contacts 92 and 93 on oscilloscope (10ms/div time base)	DCT01170 (HLC6) V = -15.4 on DVM	✓
59	Unpower Prime LPU LCL (LCL #25)	ZC142999 (LCL#25 OPEN)	✓
60	Power off SPIRE S102999SCVT007_ASDSFTSPIR_PWR_OFF_P	**The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 in the order below** **SPIRE-FM-SFT-FUNC-MCU-OFF-P** **SPIRE-FM-SFT-DRCU-OFF-P** **SPIRE-FM-SFT-DPU-OFF-P**	✓
61	Remove 128-way SMEC Launch Latch Coil Simulator from 312300 P04		✓
62	Mate 128-way SMEC Launch Latch Coil Simulator to 312300 P03		✓
63	Power on SPIRE in redundant mode S102999SCVT006_ASDSFTSPIR_PWR_ON_R	The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 SPIRE-FM-SFT-DPU-ON-R SPIRE-FM-SFT-DRCU-ON-R	✓
64	Set SPIRE to REDY mode	The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 SPIRE-FM-SFT-FUNC-MCU-01-R	✓
65	Connect an isolated input Digital Storage Oscilloscope to contacts 92 and 93 of the Launch Latch Simulator		✓
66	Send a latch command and record voltage across contacts 92 and 93 on oscilloscope (note: pulse duration 50±10 ms)	SEND_DRU_COMMAND (0x90430001,0)	✓
67	Power on Redundant LPU LCL (LCL #26)	ZCA02999 (LCL#26 CLOSE)	✓
68	Send redundant High level command HL #21 and record voltage across contacts 92 and 93 on oscilloscope (10ms/div time base)	DCT01170 (HLC21)	✓

No:	Activity	Remarks/Results	Sign off
69	Verify the polarity of the voltage drop across contacts 92 and 93 correspond to the polarity from the latch command	V = - 1.617	✓
70	Verify that the current across Latch Simulator resistor is 153<X<185mA	I = - 162 mA	✓
71	Send redundant High level command HL #22 and record voltage across contacts 92 and 93 on oscilloscope (10ms/div time base)	DCT01170 (HLC22)	✓
72	Unpower redundant LPU LCL (LCL # 26)	ZCA42999 (LCL#26 OPEN)	✓
73	Power off SPIRE S102999SCVT008_ASDSFTSPIR_PWR_OFF_R	**The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 in the order below** **SPIRE-FM-SFT-FUNC-MCU-OFF-R** **SPIRE-FM-SFT-DRCU-OFF-R** **SPIRE-FM-SFT-DPU-OFF-R**	✓
74	Remove 128-way SMEC Launch Latch Coil Simulator from 312300 P03		✓
75	~~Complete the final mechanical integration of the LPU to FCU~~	Removed in Iss. 0.3 (Should have been completed already)	
76	~~Remove and store safing plugs from 312300 P04 and P03~~	**Deleted in 0.4 as this can only be carried out once the panel is closed**	
77	~~Mate 312300 J04 to P04~~	**Deleted in 0.4 as this can only be carried out once the panel is closed**	
78	~~Mate 312300 J03 to P03~~	**Deleted in 0.4 as this can only be carried out once the panel is closed**	
79	End of procedure.		✓

5. ANNEX 1 – 128-WAY SMEC LAUNCH LATCH COIL SIMULATOR

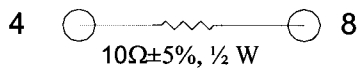
Simulator is a 128-Way Break-out Box prepared as follows:



Contacts 67, 69, 90 and 92 daisy chained as indicated above
Contacts 66, 68, 91 and 93 daisy chained as indicated above
Contacts 92 and 93 bridged by a resistor as indicated above
All other contacts left open circuit

6. ANNEX 1 – 9-WAY SMEC LAUNCH LATCH COIL SIMULATOR

Simulator is a 9-Way DEMA Break-out Box prepared as follows:



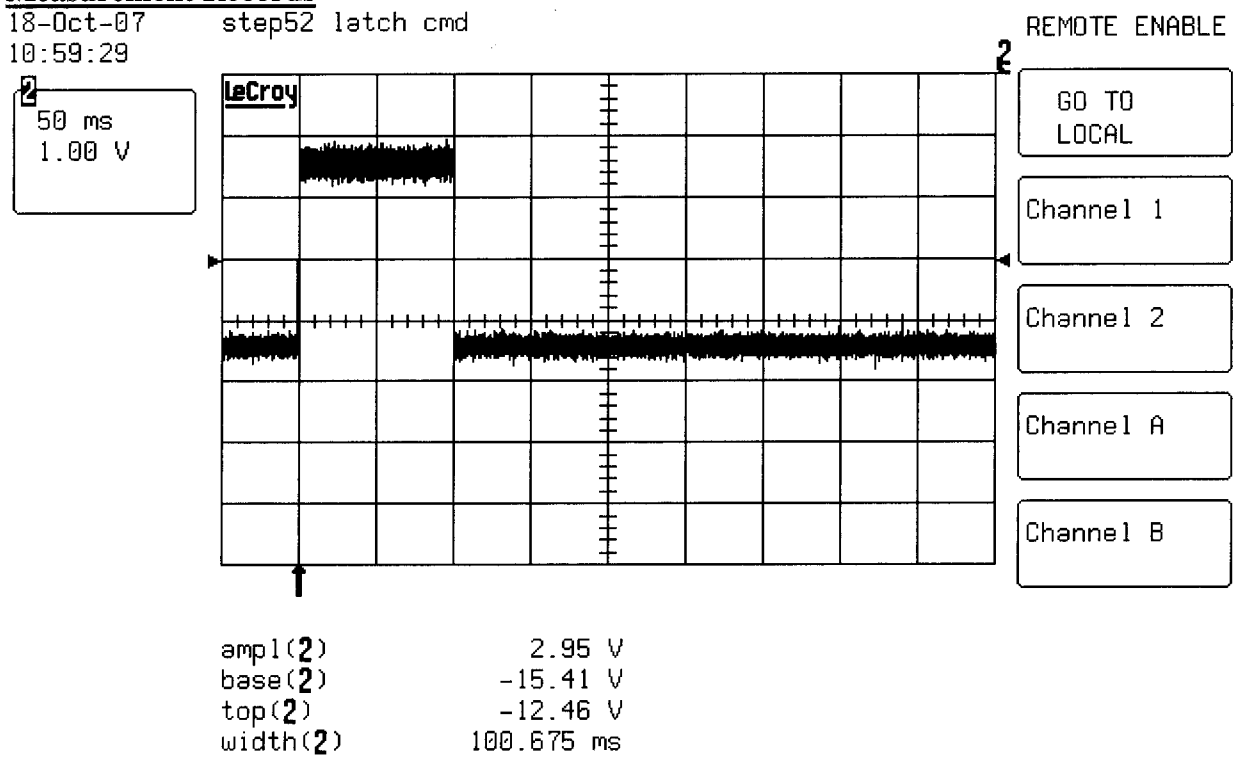
Contacts 4 and 8 bridged by a resistor as indicated above
All other contacts left open circuit

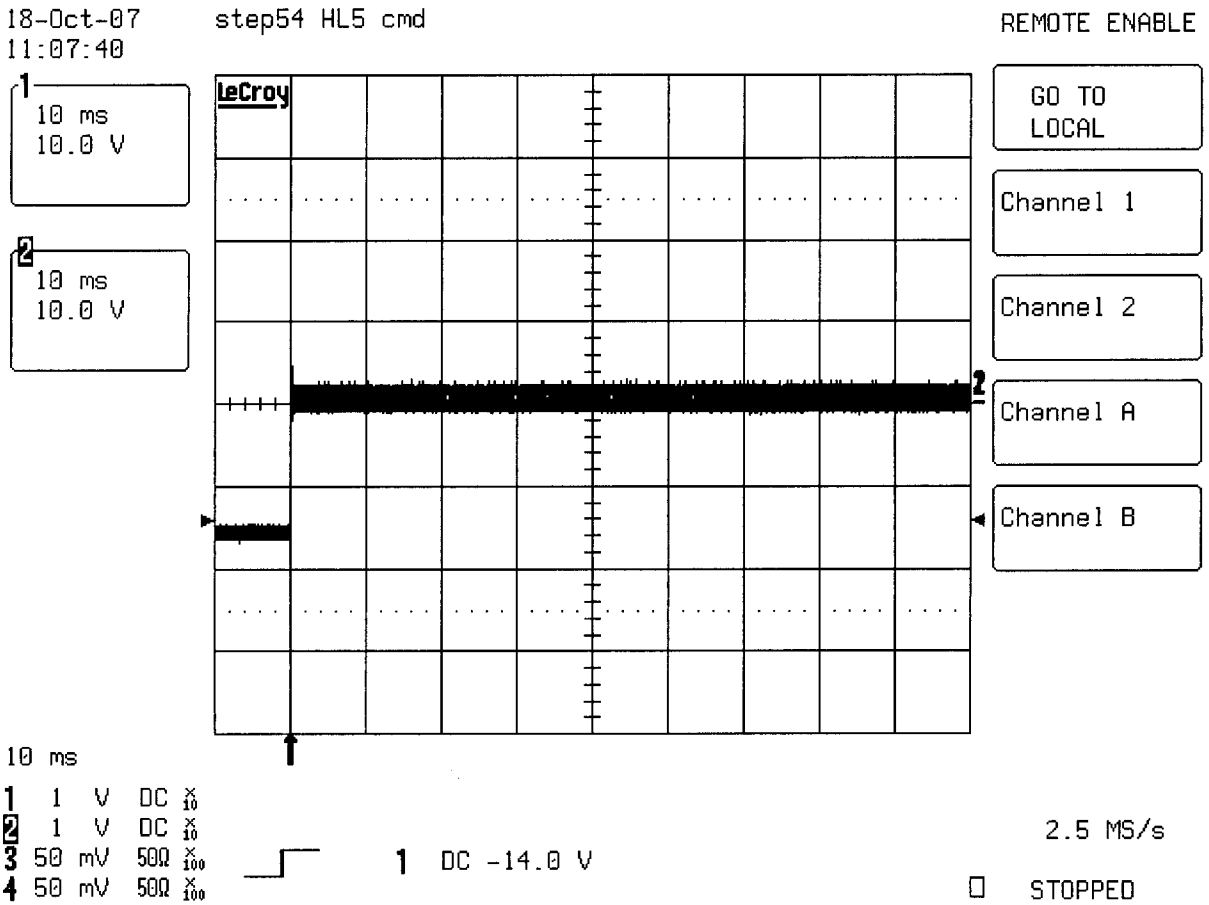
Procedure Sign Off Sheet

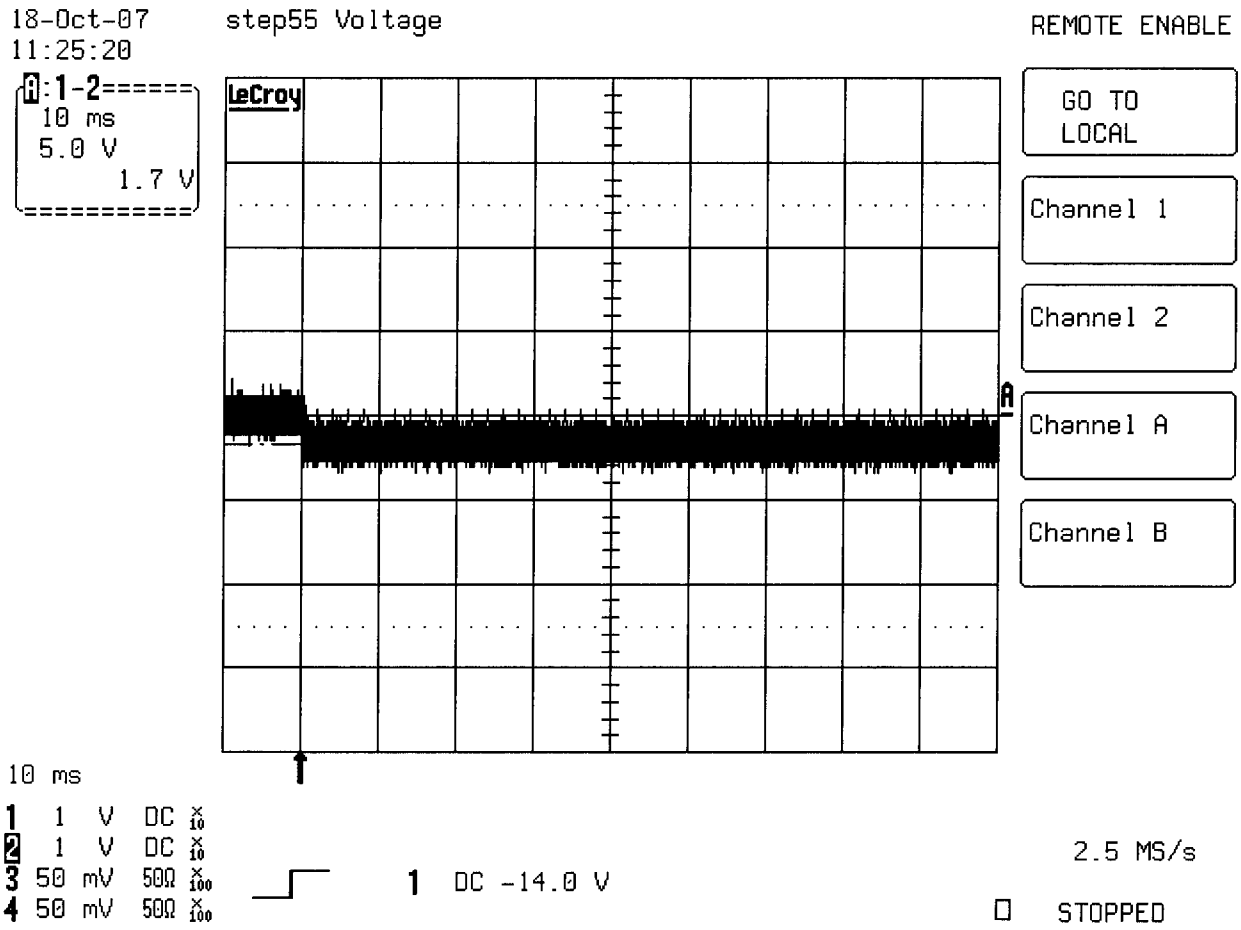
This test has been successfully performed and all open issues are covered by NCR´s or Procedure Variations.

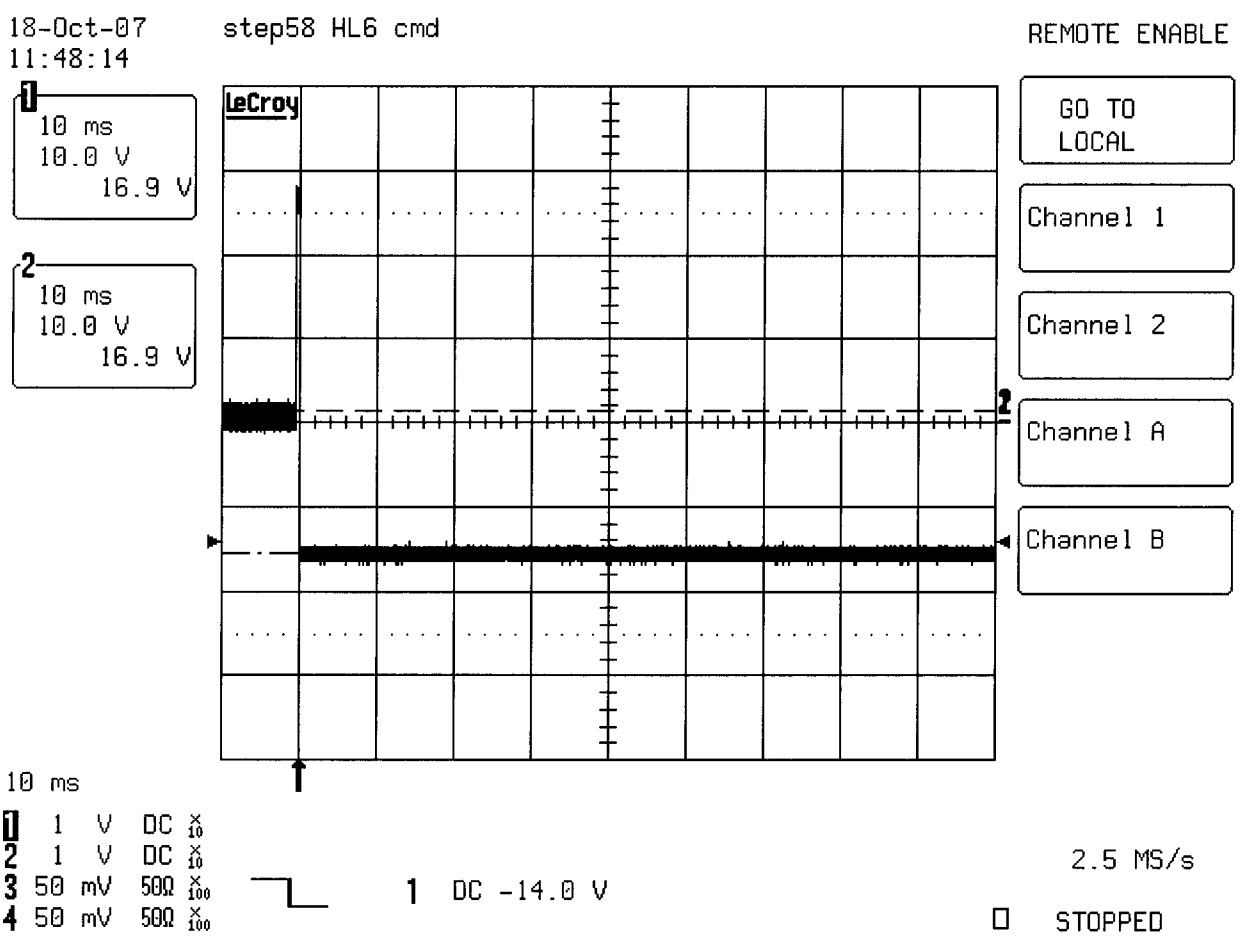
	Date	Signature
Test Manager	18.10.07	
Operator	18.10.07	
PA Responsible	20.10.07	
ESA Representative	19-10-2007	

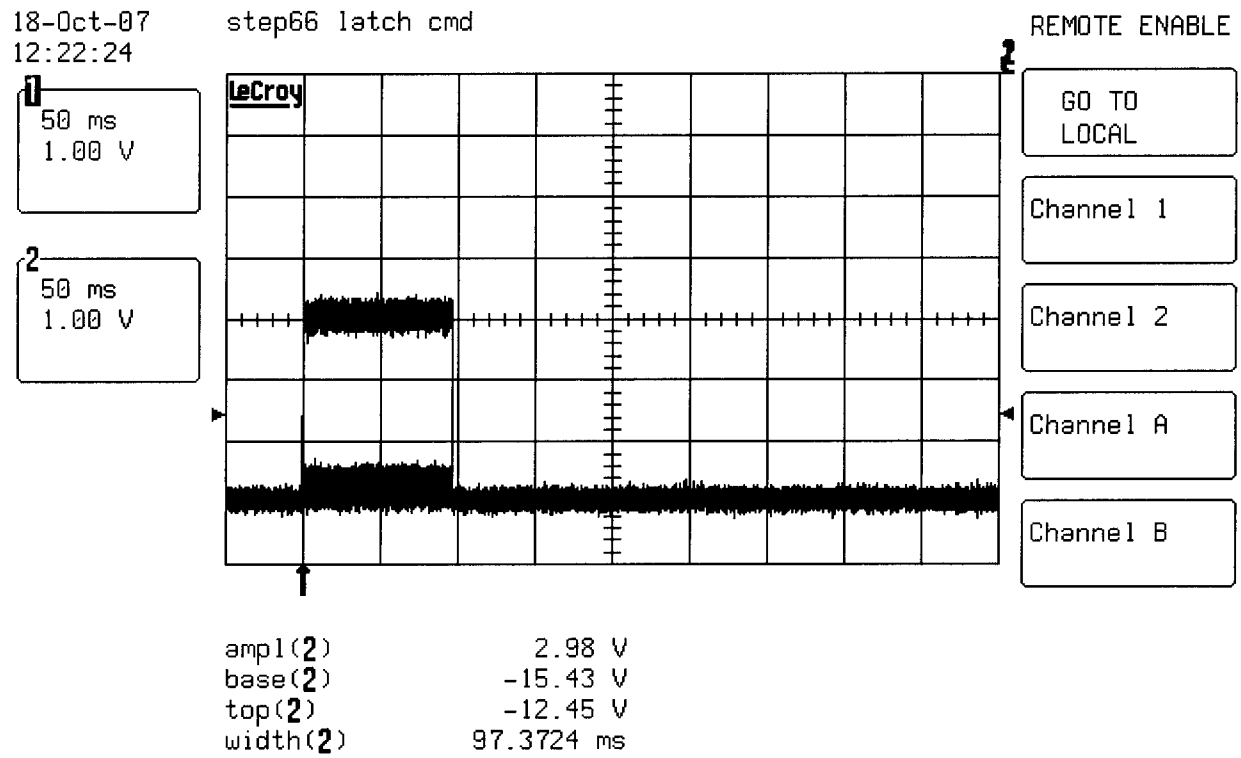
Measurement Records

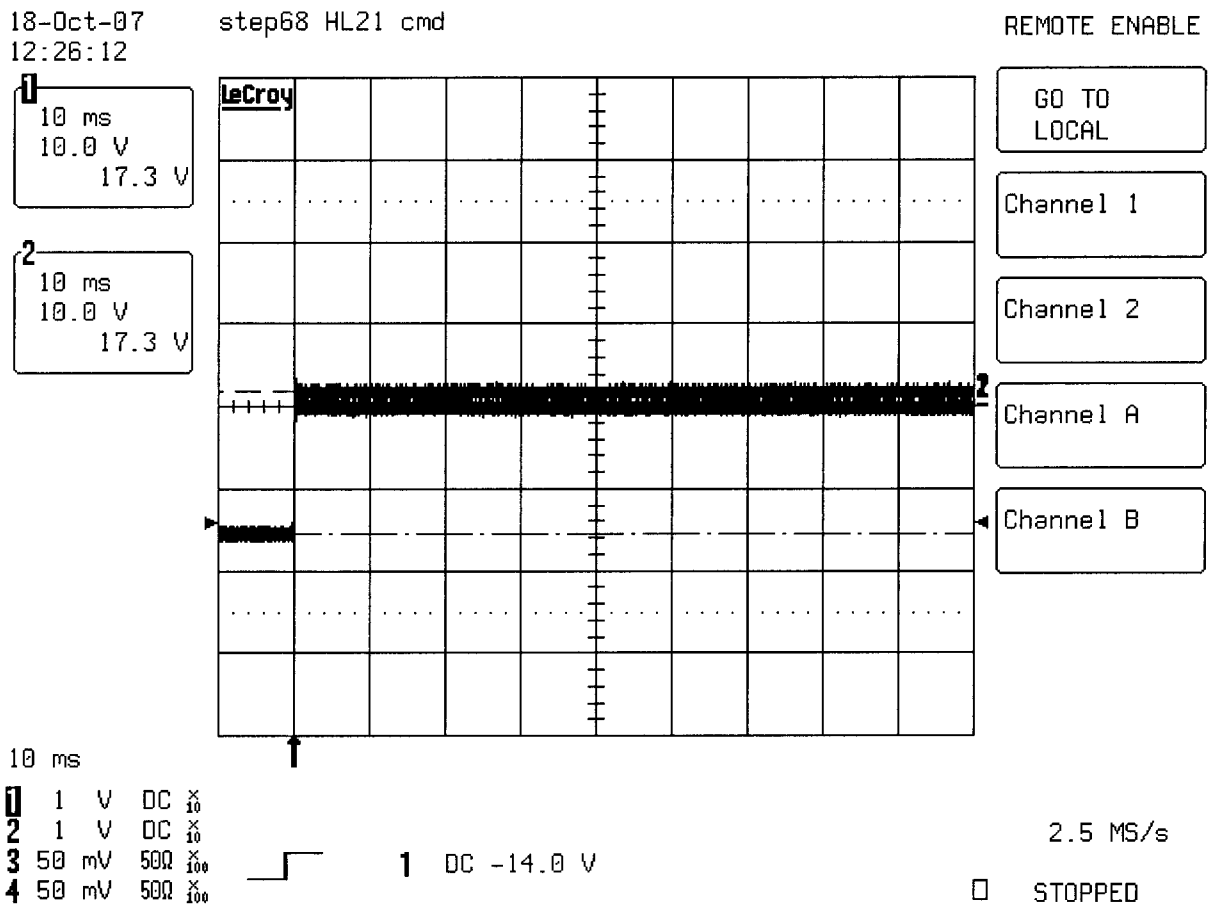


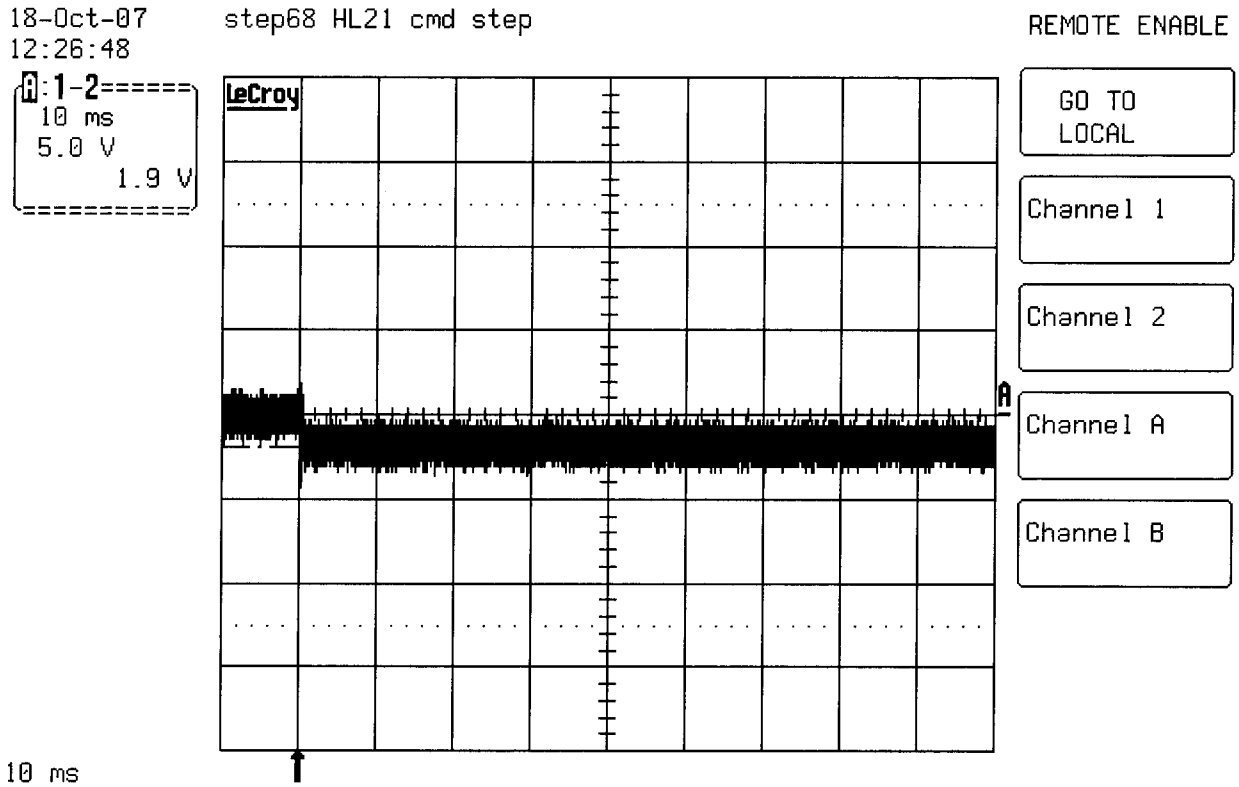


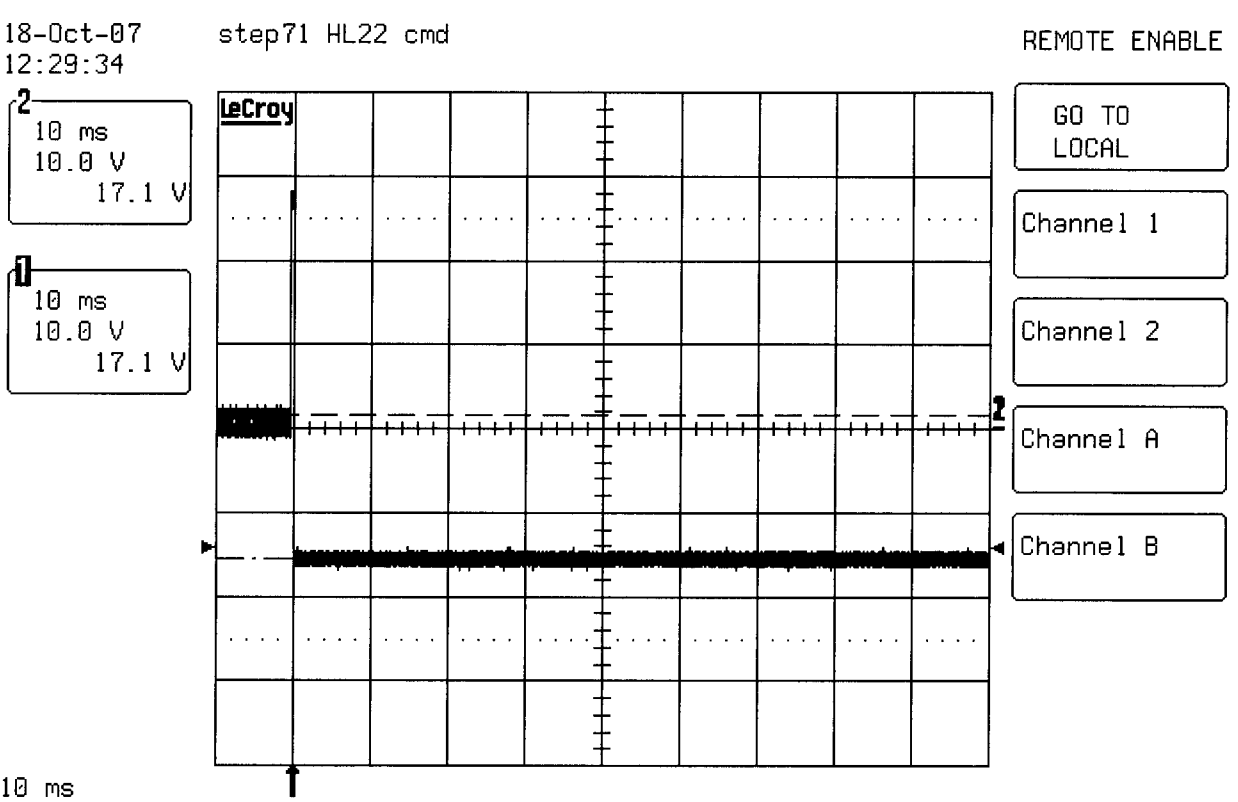

18-Oct-07
11:25:20
step55 Voltage
REMOTE ENABLE
A:1-2======
10 ms
5.0 V
1.7 V
==========
LeCroy
GO TO LOCAL
Channel 1
Channel 2
Channel A
Channel B
A
10 ms
1 1 V DC
2 1 V DC
3 50 mV 50Ω
4 50 mV 50Ω
1 DC -14.0 V
2.5 MS/s
STOPPED


18-Oct-07
11:48:14
step58 HL6 cmd
REMOTE ENABLE
1
10 ms
10.0 V
16.9 V
2
10 ms
10.0 V
16.9 V
LeCroy
GO TO LOCAL
Channel 1
Channel 2
Channel A
Channel B
2
10 ms
1 1 V DC
2 1 V DC
3 50 mV 50Ω
4 50 mV 50Ω
1 DC -14.0 V
2.5 MS/s
STOPPED


18-Oct-07
12:22:24
step66 latch cmd
REMOTE ENABLE
LeCroy
1
50 ms
1.00 V
2
50 ms
1.00 V
GO TO LOCAL
Channel 1
Channel 2
Channel A
Channel B
ampl(2) 2.98 V
base(2) -15.43 V
top(2) -12.45 V
width(2) 97.3724 ms
50 ms
1 .1 V DC
2 .1 V DC
3 50 mV 50Ω
4 50 mV 50Ω
2 DC -14.00 V
500 kS/s
STOPPED


18-Oct-07
12:26:12
step68 HL21 cmd
REMOTE ENABLE
LeCroy
1
10 ms
10.0 V
17.3 V
2
10 ms
10.0 V
17.3 V
GO TO LOCAL
Channel 1
Channel 2
Channel A
Channel B
10 ms
1 1 V DC
2 1 V DC
3 50 mV 50Ω
4 50 mV 50Ω
1 DC -14.0 V
2.5 MS/s
STOPPED


18-Oct-07
12:26:48
step68 HL21 cmd step
REMOTE ENABLE
A:1-2======
10 ms
5.0 V
1.9 V
==========
LeCroy
GO TO LOCAL
Channel 1
Channel 2
Channel A
Channel B
A
10 ms
1 1 V DC
2 1 V DC
3 50 mV 50Ω
4 50 mV 50Ω
1 DC -14.0 V
2.5 MS/s
STOPPED


18-Oct-07
12:29:34
step71 HL22 cmd
REMOTE ENABLE
2
10 ms
10.0 V
17.1 V
1
10 ms
10.0 V
17.1 V
LeCroy
GO TO LOCAL
Channel 1
Channel 2
Channel A
Channel B
2
10 ms
1 1 V DC
2 1 V DC
3 50 mV 50Ω
4 50 mV 50Ω
1 DC -14.0 V
2.5 MS/s
STOPPED

End of Document

	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	ASG23		Schweickert Gunn	ASG23
	Baldock Richard	FAE12		Sonn Nico	ASG51
	Barlage Bernhard	AED13		Steininger Eric	AED32
	Bayer Thomas	ASA42	X	Stritter Rene	AED11
	Brune Holger	ASA45		Suess Rudi	OTN/ASA44
	Edelhoff Dirk	AED2		Theunissen Martijn	DSSA
	Fehringer Alexander	ASG13		Vascotto Riccardo	HE Space
X	Fricke Wolfgang Dr.	AED 65		Wagner Klaus	ASG23
	Geiger Hermann	ASA42	X	Wietbrock Walter	AET12
	Grasl Andreas	OTN/ASA44		Wöhler Hans	ASG23
	Grasshoff Brigitte	AET12		Wössner Ulrich	ASE252
X	Hamer Simon	Terma		Zumstein Armin	ASQ42
	Hendrikse Jeffrey	HE Space			
	Hendry David	Terma			
	Hengstler Reinhold	ASA42			
	Hinger Jürgen	ASG23			
X	Hohn Rüdiger	AED65			
	Hölzle Edgar Dr.	AED32			
X	Hopfgarten Michael	AED32			
	Huber Johann	ASA42			
	Hund Walter	ASE252			
X	Idler Siegmund	AED312			
	Ivády von András	FAE12			
	Jahn Gerd Dr.	ASG23			
	Kalde Clemens	ASM2			
	Kettner Bernhard	AET42	X	ESA/ESTEC	ESA
	Knoblauch August	AET32	X	Thales Alenia Space Cannes	TAS-F
X	Koelle Markus	ASA43		Thales Alenia Space Torino	TAS-I
X	Koppe Axel	AED312			
X	Kroeker Jürgen	AED65		**Instruments:**	
	La Gioia Valentina	Terma		MPE (PACS)	MPE
X	Lang Jürgen	ASE252	X	RAL (SPIRE)	RAL
	Langenstein Rolf	AED15		SRON (HIFI)	SRON
	Langfermann Michael	ASA41			
	Martin Olivier	ASA43			
	Maukisch Jan	ASA43		**Subcontractors:**	
	Much Christoph	ASA43		Austrian Aerospace	AAE
	Müller Jörg	ASA42		Austrian Aerospace	AAEM
	Müller Martin	ASA43		BOC Edwards	BOCE
	Peltz Heinz-Willi	ASG13		Dutch Space Solar Arrays	DSSA
	Pietroboni Karin	AED65		EADS Astrium Sub-Subsyst. & Equipment	ASSE
	Platzer Wilhelm	AED2		EADS CASA Espacio	CASA
	Reichle Konrad	ASA42		EADS CASA Espacio	ECAS
	Runge Axel	OTN/ASA44		European Test Services	ETS
	Sauer Maximilian Dr.	AED65		Patria New Technologies Oy	PANT
	Schink Dietmar	AED32		SENER Ingenieria SA	SEN
	Schmidt Thomas	AED15		Thales Alenia Space, Antwerp	TAS-ETCA