



SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855

Issue: 1.0

Date: 14 March 2007

Page: 1 of 15

SPIRE PFM3 EMC Test Procedure
Doug Griffin

Table of Contents

Change Log	1
1. Introduction	1
2. EMC Test Equipment	2
3. General Grounding Diagram	3
4. EMC Test 1: CS, DM, Frequency Domain	4
4.1 Prerequisites.....	8
4.2 Test Procedure:	9
5. EMC Test 2: CS, CM, Frequency Domain	10
5.1 Prerequisites.....	12
5.2 Test Procedure:	12
6. EMC Test 3: RS Investigations	13
6.1 Prerequisites.....	14
6.2 Test Procedure:	14
6.2.1 Test cases.....	15

Change Log

Date	Issue	Change
Wed, 1 March	0.1	Initial drafting based on previous PTC tests
20/03/2006	0.2	Revised

1. Introduction

The aims of the test are as follows:

1. To perform qualification tests to verify compliance with the following IID-A requirements:
 - a. §5.14.3.3 Conducted Susceptibility Power Lines – Differential Mode – Steady State
 - b. §5.14.3.4 Conducted Susceptibility Power Lines – Common Mode – Steady State
2. To investigate the RS non-conformance at around 33MHz found during the SPIRE EQM testing. Specifically:
 - a. Determine if the phenomena can be reproduced by simulating the EMI coupling to the instrument via BCI
 - b. Determine if capacitive filters on the DCU can ameliorate the problem
 - c. Gather information regarding the coupling of the EMI into the instrument

The equipment under test is the PFM FPU (including JFS and JFP), QM2 DRCU, Test Cryoharness and CFM DPU. For the complete listing of the EUT, refer to the PFM-3 Build Standard log.



SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855

Issue: 1.0

Date: 14 March 2007

Page: 2 of 15

SPIRE PFM3 EMC Test Procedure
Doug Griffin

2. EMC Test Equipment

Serial Number	Part	Description	Frequency Range	
203	Fischer F-35	Current Clamp	200Hz	100MHz
222	Fischer F-12 (30mm aperture)	Current Clamp	20Hz	2MHz
241	Eaton Injection Probe	BCI Probe	20Hz	30MHz
242	Chase 36A	BCI Probe	2MHz	200MHz
267	Solar	Audio Isolation Transformer		
408	GW-PA300E	VLF Amplifier	5Hz	150kHz
502	HP 33120A	Function Generator	DC	15MHz
NA	Tti Wideband Amp			
NA	Rhode and Schwarz	Function Generator	9kHz	1GHz
NA	Amplifier Research	Amplifier	10kHz	1GHz

3. General Grounding Diagram

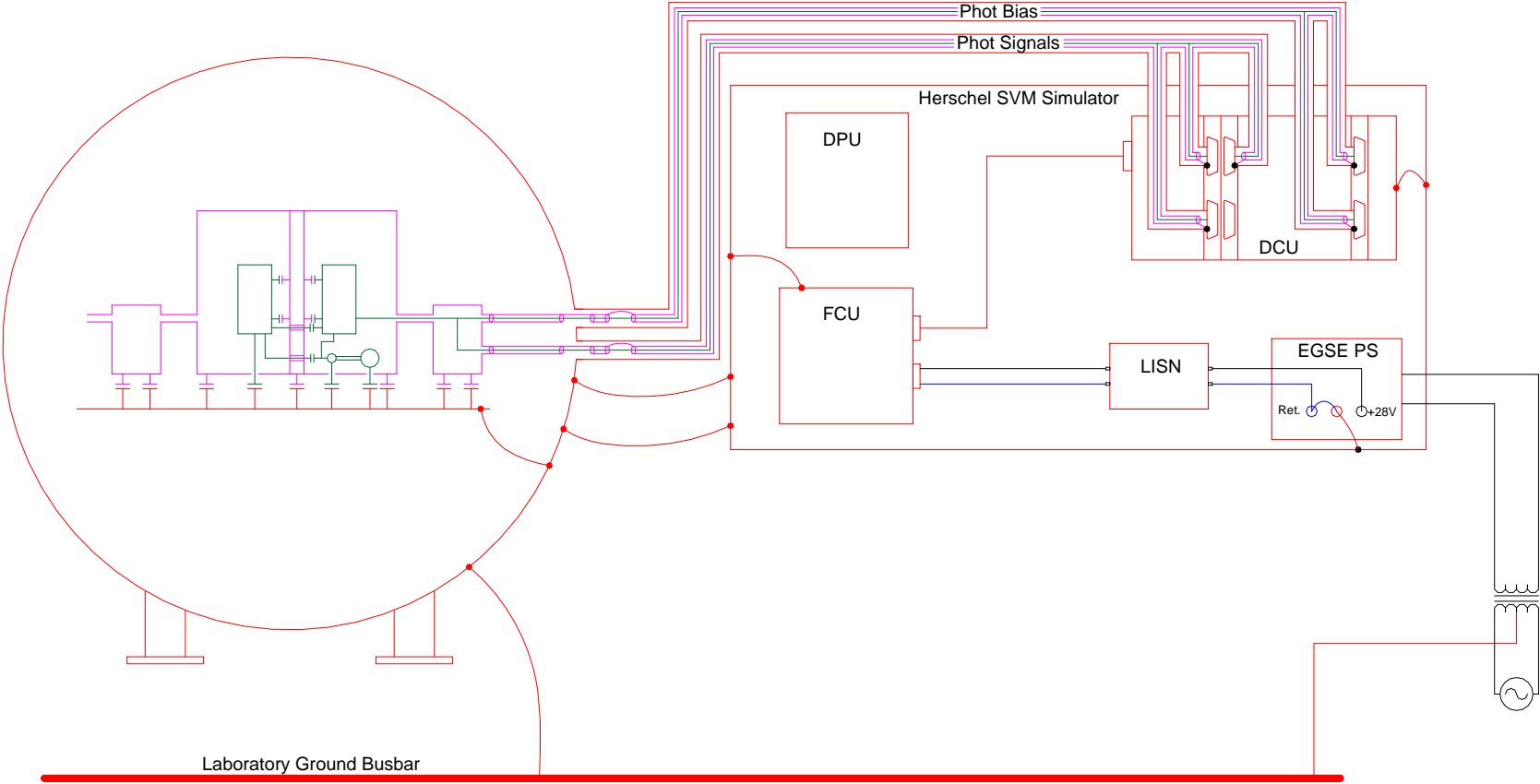


Figure 1 – Nominal grounding diagram for the ILT PFM CS Testing.



SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855

Issue: 1.0

Date: 14 March 2007

Page: 4 of 15

SPIRE PFM3 EMC Test Procedure
Doug Griffin

4. EMC Test 1: CS, DM, Frequency Domain

In the frequency range 50 kHz – 50 MHz, the applied sinusoidal voltage shall be 1 kHz amplitude modulated (30% AM).

The requirement shall be considered to have been met when:

1) Frequency range 30 Hz – 50 kHz

The specified test voltage level cannot be generated but the injected current has reached 1 A_{rms} and the subsystem equipment is still operating without malfunctions within its specified tolerances.

2) Frequency range 50 kHz – 50 MHz

A power source of 1 Watt, 50 Ω impedance cannot develop the required voltage at the equipment power input terminals and the subsystem equipment is still operating without malfunctions within its specified tolerances.



SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855

Issue: 1.0

Date: 14 March 2007

Page: 5 of 15

SPIRE PFM3 EMC Test Procedure
Doug Griffin

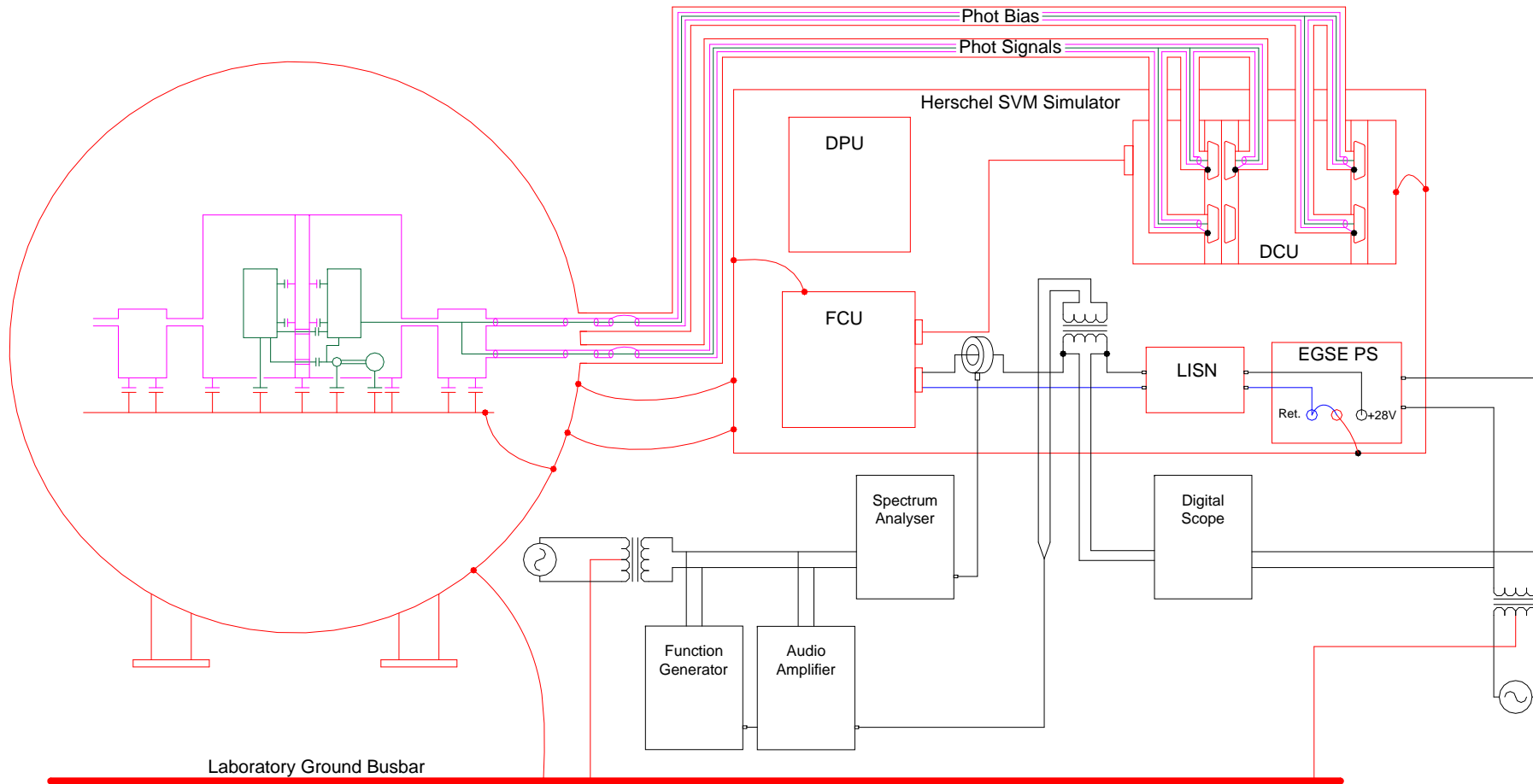


Figure 2– Test setup for CS DM Testing 30Hz - 50kHz



SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855

Issue: 1.0

Date: 14 March 2007

Page: 6 of 15

SPIRE PFM3 EMC Test Procedure
Doug Griffin

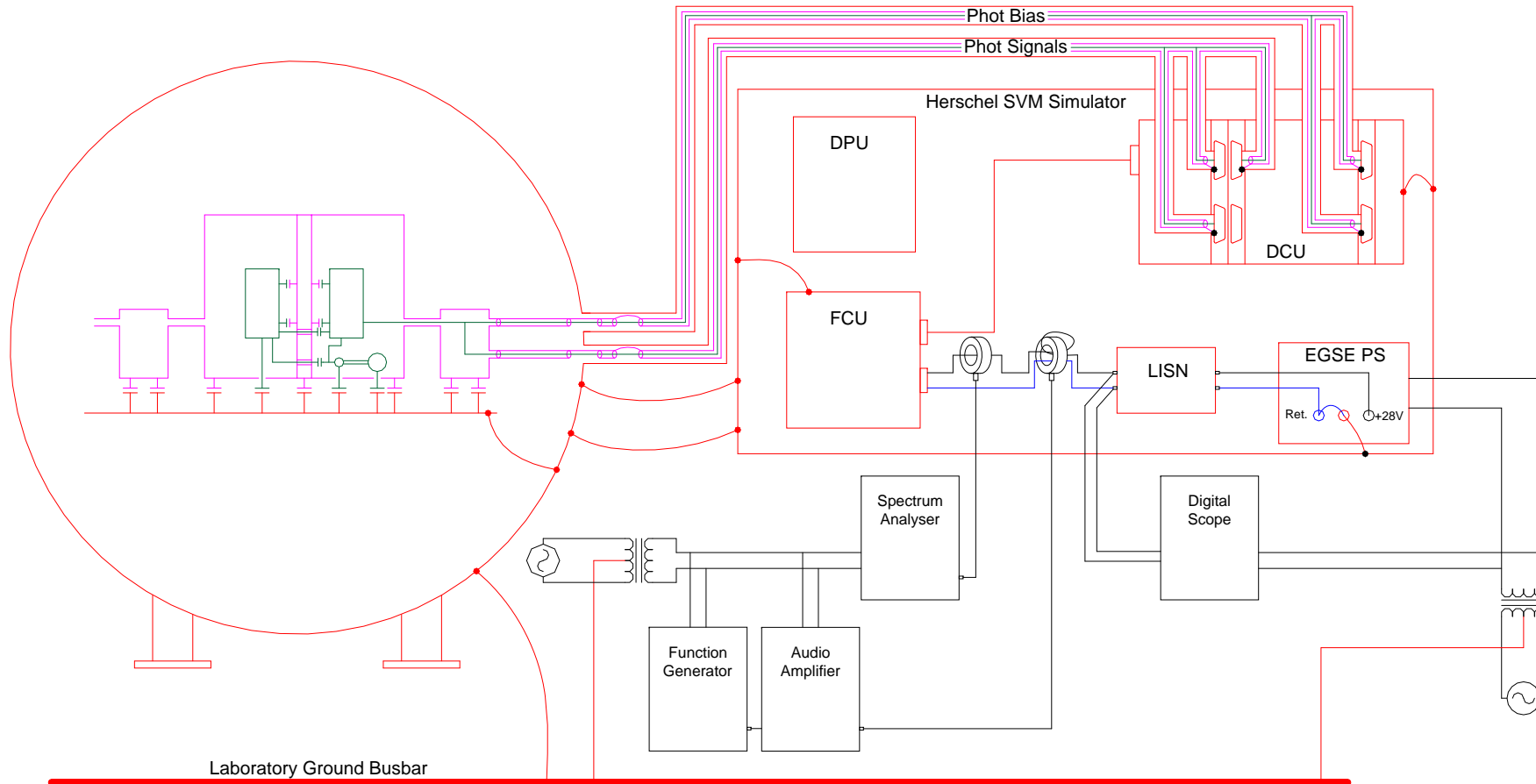


Figure 3 – Test setup for CS DM Testing 50kHz-50MHz



SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855

Issue: 1.0

Date: 14 March 2007

Page: 7 of 15

SPIRE PFM3 EMC Test Procedure
Doug Griffin

Time per step: 1500ms

Step	Fo	Fn	Oct	dF Step	Steps	Max Sweep Speed min / dec	Synthesier	Power Amp	Coupling	Level	Limit	PWM 86%, 2Hz	Sweep Time min
1							Reference						00:03:00
2	30 Hz	100 Hz	1.74	0.2 Hz	350	8.66	HP 33120A	GW-PA300E	Solar Xfomer	1 Vrms	1 Arms	No	00:08:45
3	100 Hz	500 Hz	2.32	0.7 Hz	571	8.25	HP 33120A	GW-PA300E	Solar Xfomer	1 Vrms	1 Arms	No	00:14:17
4	500 Hz	2000 Hz	2.00	3.5 Hz	429	8.25	HP 33120A	GW-PA300E	Solar Xfomer	1 Vrms	1 Arms	No	00:10:43
5	2000 Hz	10 kHz	2.32	14 Hz	571	8.25	HP 33120A	GW-PA300E	Solar Xfomer	1 Vrms	1 Arms	No	00:14:17
6	10 kHz	50 kHz	2.32	70 Hz	571	8.25	Rhode & Schwarz	GW-PA300E	Solar Xfomer	1 Vrms	1 Arms	Yes	00:14:17
							Configuration Change						00:03:00
7	50 kHz	150 kHz	1.58	350 Hz	286	8.25	Rhode & Schwarz	AR	Eaton BCI	1 Vrms	1 W	Yes	00:07:09
							Configuration Change						00:03:00
8	150 kHz	300 kHz	1.00	0.5 kHz	300	17.30	Rhode & Schwarz	AR	Eaton BCI	See Table	1 W	Yes	00:07:30
9	300 kHz	1000 kHz	1.74	2.0 kHz	350	8.66	Rhode & Schwarz	AR	Eaton BCI	0.5 Vrms	1 W	Yes	00:08:45
10	1 MHz	5 MHz	2.32	5.0 kHz	800	11.54	Rhode & Schwarz	AR	Eaton BCI	0.5 Vrms	1 W	Yes	00:20:00
11	5 MHz	20 MHz	2.00	25 kHz	600	11.54	Rhode & Schwarz	AR	Eaton BCI	0.5 Vrms	1 W	Yes	00:15:00
12	20 MHz	30 MHz	0.58	100 kHz	100	11.54	Rhode & Schwarz	AR	Eaton BCI	0.5 Vrms	1 W	Yes	00:02:30
							Configuration Change						00:03:00
13	30 MHz	50 MHz	0.74	150 kHz	133	11.54	Rhode & Schwarz	AR	Chase 36A BCI	0.5 Vrms	1 W	Yes	00:03:20
												Total	02:18:33

Table 1 – Test sequence for CS DM 30Hz – 50MHz



SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855

Issue: 1.0

Date: 14 March 2007

Page: 8 of 15

SPIRE PFM3 EMC Test Procedure
Doug Griffin

150.0 kHz	1.00 V
157.5 kHz	0.97 V
165.0 kHz	0.94 V
172.5 kHz	0.91 V
180.0 kHz	0.88 V
187.5 kHz	0.86 V
195.0 kHz	0.83 V
202.5 kHz	0.81 V
210.0 kHz	0.78 V
217.5 kHz	0.76 V
225.0 kHz	0.73 V
232.5 kHz	0.71 V
240.0 kHz	0.68 V
247.5 kHz	0.66 V
255.0 kHz	0.64 V
262.5 kHz	0.61 V
270.0 kHz	0.59 V
277.5 kHz	0.57 V
285.0 kHz	0.55 V
292.5 kHz	0.52 V
300.0 kHz	0.50 V

Figure 4

Table 2 - Test levels: 150kHz - 300kHz DM

4.1 Prerequisites

:

1. The detectors are thermally stable.



SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855

Issue: 1.0

Date: 14 March 2007

Page: 9 of 15

SPIRE PFM3 EMC Test Procedure
Doug Griffin

2. The instrument is switched on in Phot mode and generating Phot data
3. QLA is running and monitoring the instrument in real time
4. Phot Detectors set up for 130Hz bias, nominal bias amplitude and nominal phase (phase-up detectors if necessary).
5. Vdd and Vss nominal
6. Detector sampling 32.5Hz
7. Automatic offset generation carried out for Phot detectors

4.2 Test Procedure:

1. Execute SPIRE-EQM-EMC-SPOT.tcl
2. Run through the steps outlined in Table 1
3. Execute Stop-test.tcl
4. Return to Spot Frequencies and carry out reference



5. EMC Test 2: CS, CM, Frequency Domain

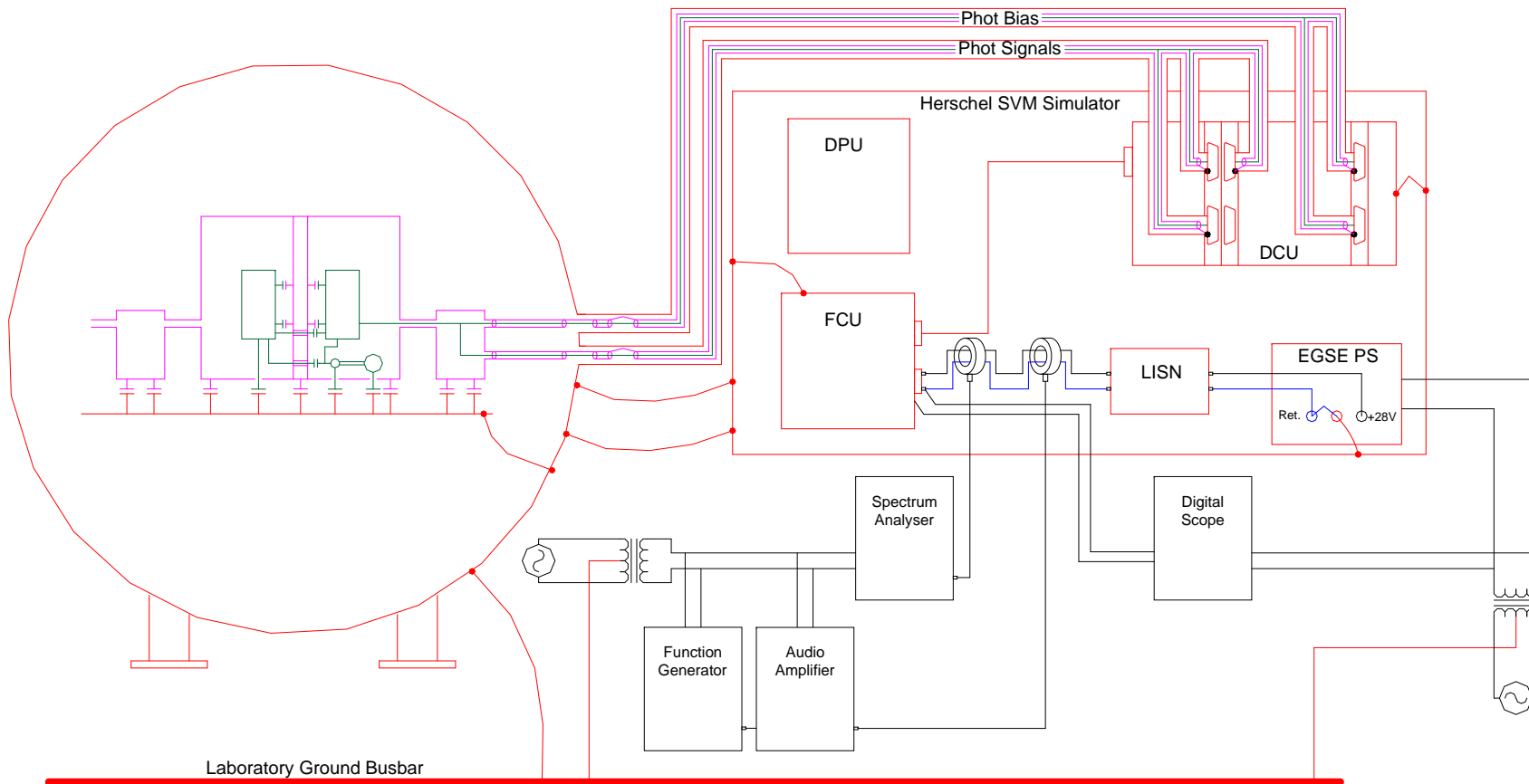


Figure 5 – Test setup for CM CS Tests

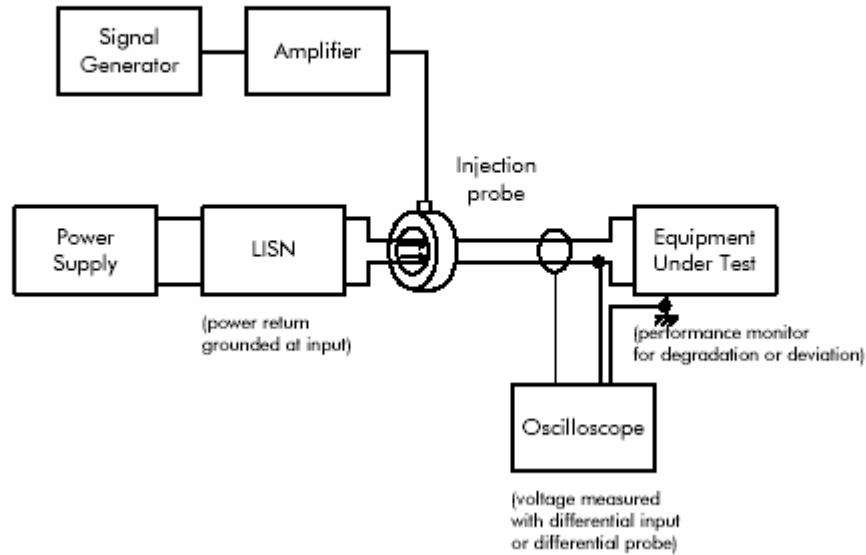


SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855
 Issue: 1.0
 Date: 14 March 2007
 Page: 11 of 15


SPIRE PFM3 EMC Test Procedure
 Doug Griffin

The test set-up for common mode susceptibility on primary power lines and on signal bundles is shown in Figure 9.5.6-7. The signal lines shall be loaded with electrical simulators of the interfacing circuits.



Step	Fo	Fn	Oct	dF Step	Steps	Max Sweep Speed min / dec	Synthesier	Power Amp	Coupling	Level	Limit	PWM 86%, 2Hz	Sweep Time min
1							Reference						00:03
2	10 kHz	50 kHz	2.32	80 Hz	500	7.22	Rhode & Schwarz	AR	Eaton BCI	2 Vpp	1 A peak	Yes	12:30
3	50 kHz	200 kHz	2.00	320 Hz	469	9.02	Rhode & Schwarz	AR	Eaton BCI	2 Vpp	1 A peak	Yes	11:43
4	200 kHz	1 MHz	2.32	2.0 kHz	400	5.79	Rhode & Schwarz	AR	Eaton BCI	2 Vpp	1 A peak	Yes	10:00
5	1 MHz	5 MHz	2.32	10.0 kHz	400	5.79	Rhode & Schwarz	AR	Eaton BCI	2 Vpp	1 A peak	Yes	10:00
							Configuration Change						00:03
6	5 MHz	15 MHz	1.58	20.0 kHz	500	14.42	Rhode & Schwarz	AR	Chase 36A	2 Vpp	1 A peak	Yes	12:30
7	15 MHz	50 MHz	1.74	50.0 kHz	700	17.30	Rhode & Schwarz	AR	Chase 36A	2 Vpp	1 A peak	Yes	17:30
													Total
													01:20:13

Table 3

	SPIRE Test Procedure	Ref: SPIRE-RAL-PRC-002855 Issue: 1.0 Date: 14 March 2007 Page: 12 of 15
SPIRE PFM3 EMC Test Procedure Doug Griffin		

5.1 Prerequisites

- :
1. The detectors are thermally stable.
 2. The instrument is switched on in Phot mode and generating Phot data
 3. QLA is running and monitoring the instrument in real time
 4. Phot Detectors set up for 130Hz bias, nominal bias amplitude and nominal phase (phase-up detectors if necessary).
 5. Vdd and Vss nominal
 6. Detector sampling 32.5Hz
 7. Automatic offset generation carried out for Phot detectors

5.2 Test Procedure:

1. Execute SPIRE-EQM-EMC-SPOT.tcl
2. Run through the steps outlined in Table 3
3. Execute Stop-test.tcl
4. Return to Spot Frequencies and carry out reference case

6. EMC Test 3: RS Investigations

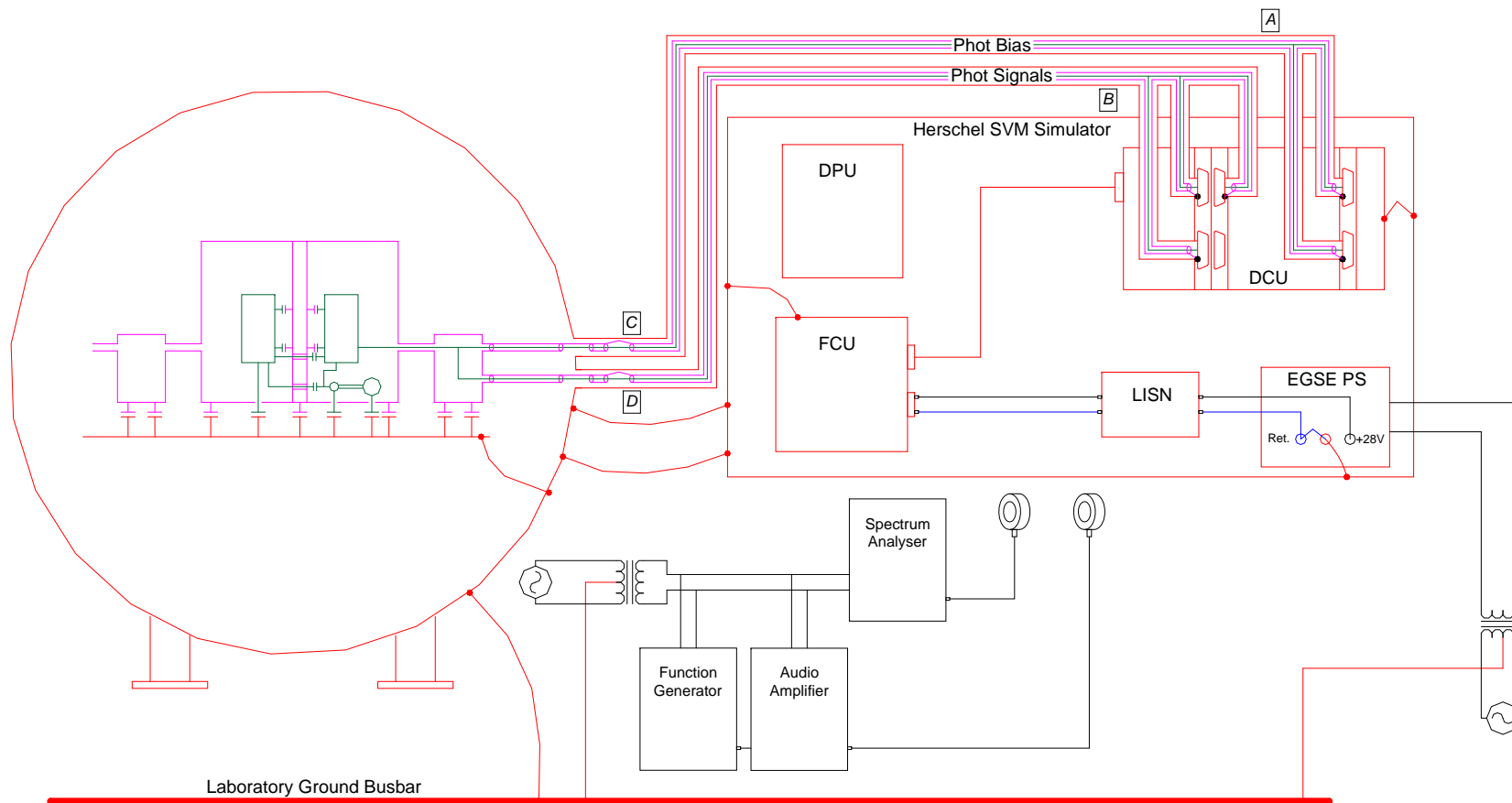


Figure 6 – Test setup for RS Investigations.



SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855

Issue: 1.0

Date: 14 March 2007

Page: 14 of 15

SPIRE PFM3 EMC Test Procedure
Doug Griffin

6.1 Prerequisites

:

6.2 Test Procedure:

J05	PSW	EE Seal 0.27
J06	PSW	None
J07	PSW	CEA
J08	PSW	None
J09	PSW	None
J10	PSW	EE Seal 0.27
J11	PSW	None
J12	PSW	None
J13	PSW	CEA
J14	PLW	EE Seal 0.27
J15	PLW	CEA
J16	PLW	None
J17	PMW	EE Seal 0.27
J18	PMW	None
J19	PMW	CEA
J20	PMW	None
J21	PMW	None
J22	PMW	None

Table 4



SPIRE Test Procedure

Ref: SPIRE-RAL-PRC-002855

Issue: 1.0

Date: 14 March 2007

Page: 15 of 15

SPIRE PFM3 EMC Test Procedure
Doug Griffin

6.2.1 Test cases

Reference sweeps w/o filter on bias
Sweep bias close to DRCU
Sweep bias close to CVV
Sweep J05 close to DCU
Sweep J05 close to CVV
Sweep J06 close to DCU
Sweep J06 Close to CVV
Sweep J07 close to DCU
Sweep J08 close to CVV

With CEA filter on bias close to DCU
With CEA filter on bias close to CVV

With EESeal on bias close to DCU
With EESeal on bias close to CVV