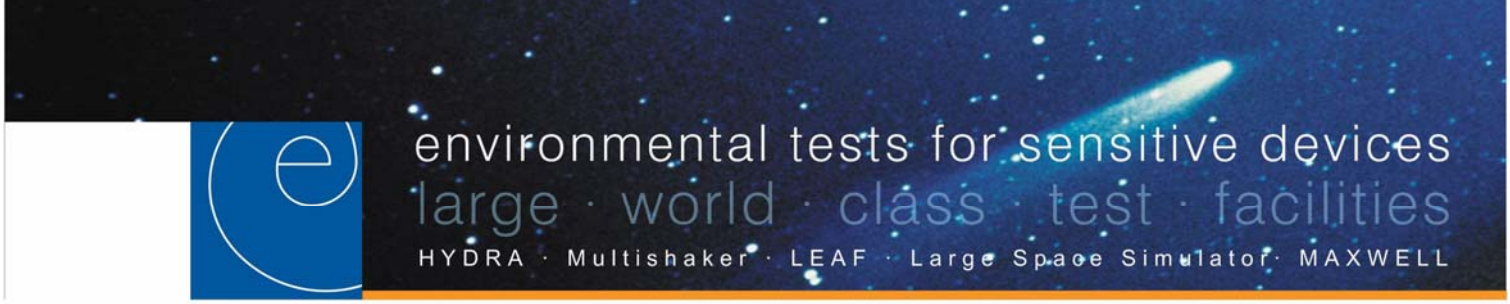

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HP-2-ETS-RP-2574_2

SPIRE-ESA-REP-003154

Herschel FM Radiated EMC Test in Fl001 clean room

ETS Facility Data report

Project : Herschel

ets european test services

Document Sign Off- and Release Record:

Visa	Name	Responsibility	Date / Signature
Prepared	C van Zijtveld	Writer	18.09.2008
Checked	J van der Meulen	EMC Test Engineer	18-09-2008
Agreed	J.L. LeCarreres	QA Manager	18 09. 08
Approved	C van Zijtveld	Technical Manager	18/9/08

Document Distribution Record:

Organisation	Name	Copies
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ETS	J van der Meulen	2 paper
ETS	Test file	Original in paper format

Document Change Record:

Issue	Date	Pages	Change
1	28-08-2008	1-20	First issue
2	16-09-2008	6 8 20 Annex A Annex B	Abbreviation EM adapted to this test - No scaffolding removed for HIFI position - PACs measurement position described in more details Conclusion modified Facility changed from Maxwell to EMC equipment Plots 10-15 removed because is related to and already reported in annex E

Contents

1. Scope

This report presents the results of the radiated EMC test on the Herschel FM S/C located in the FI001/Hydra clean room. The radiated EMC test consist of environmental monitoring of the back ground E-field level measured at HIFI, SPIRE and PACS position and radiated susceptibility test at SPIRE position. All EM and RS EMC test are performed during Herschel in SPT (Special Performance Test) mode
All measurements have been performed on 06 and 07 August for EM at HIFI position, 21 August for RS and EM at SPIRE location and 26 August for E-Field measurement at PACS position.

The purpose of this facility data report is to describe:

- the test set-ups,
- the test results.

2. Documents

2.1 Applicable Documents

The documents mentioned in this chapter are mandatory for the preparation of this document.

AD 1 Herschel FM SAT RS EMC Test procedure [HP-2-ASED-TP-0222]
Issue Draft 1, Date 11-07-08

AD 2 ETS QA Manual; [ETS/PLAN/QA/100]

AD 3 Safety and Security Manual; [AOS/4167/ESTEC]

AD 4 QA and Safety Plan for the ESTEC Test Centre; [ETS/PLAN/QA/003]

AD 5 Environmental Testing Product Assurance Manual; [QP/M/ALL/0001/C]

2.2 Reference Documents

The reference documents mentioned in this chapter are used to prepare this document and are therefore referred to.

RD 1 Declaration of Facility Readiness [ETS/REP/EMC/2548] for EM EMC test

RD 2 Facility Readiness Review [ETS/REP/MOM/2547] for EM EMC test

RD 3 Declaration of Facility Readiness [ETS/REP/EMC/2563] for RS EMC test

RD 4 Facility Readiness Review [ETS/REP/MOM/2562] for RS EMC test

RD 5 Electromagnetic Requirements for the Control of EMI [MIL-STD-461-C/D]

RD 6 Electromagnetic Interference Characteristics [MIL-STD-462-C/D]

3. Abbreviations

AM	Amplitude Modulation
BOB	Break Out Box
CW	Continuous Wave
Diff.M.	Differential Mode
EP	Electro Propulsion
ESD	Electro Static Discharge
E.Field	Electric Field
EGSE	Electrical Ground Support Equipment
EM	Environmental Monitoring
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
EUT	Equipment Under Test
FSS	Fine Sun Sensor
FM	Flight Model - or - Frequency Modulation
LNA	Low Noise Amplifier
MIL-STD	Military Standard
NB	Narrow Band
pp	peak to peak
RE	Radiated Emission
RFC	Radio Frequency Compatibility
RS	Radiated Susceptibility
SAR	Search And Rescue
w.r.t.	with respect to

4. Introduction

4.1 General Information

Order Number:	340741
Quality Assurance:	European Test Services B.V. complies with the ISO 9001:2000 Quality Management standard and is certified by TÜV CERT (Reg.N° 12.100.15987)
Location:	ESA ESTEC Test Centre, Noordwijk, The Netherlands
Activity:	EMC test
Test Dates:	06th and 07th of August for EM HIFI position 21st of August for RS and EM SPIRE position 26th of August for E-Field measurement
Facilities:	Maxwell LEMC equipment located in FI001 clean room
Test Adapters:	N.A.-

4.2 Test Item Information

Customer:	Astrium
Project:	Herschel
Test item Name:	Herschel SAT
Model:	FM

4.3 Objective

The objective of the Environmental Monitoring is to measure the background E-field level at 1 meter from the HIFI, SPIRE and PACS instrument during execution of the Herschel S/C SPT in FI001 clean room.

The objective of the RS test at SPIRE location is to determine susceptibility of the operational SPIRE unit when subjected to field level of > 80dBµV/m during execution of the Herschel S/C SPT in FI001 clean room.

5. Test Setup

5.1 Facility Configuration

The Herschel spacecraft is located in the ESTEC Hydra/Fl001 clean room.
The EMC facility equipment used during this test has been set-up in the Hyda/Fl001 clean room.

5.2 Specimen configuration

The spacecraft is positioned on Multi Purpose trolley in the Fl001 clean room.
All EGSE equipment is located close to the S/C in the Fl001 clean room.

All Interface cabling between spacecraft and EGSE are running over the Fl001 floor. No additional shielding has been applied.

During the HIFI SPT/EM the Herschel cooling unit has been positioned about one meter from the S/C at HIFI side.

For the HIFI EM monitoring no scaffolding was removed and the beam at a height of about 4 meter remains installed. The Antenna mast could not pass this beam.

For SPIRE RS and EM the scaffolding has been moved away from the S/C for about 1 meter and the corner section SPIRE/PACS corner at higher scaffolding level has been removed during the RS and EM EMC test. The antenna mast has passed the cryogenic line at 4 meter in folded condition.

During this PACS measurement position the scaffolding at PACS side stayed in position and even the intermediate walkways. The PACS monitoring was done by using a field probe is stead of an antenna due to the presence of the scaffolding at PACS side. This PACS monitoring was done during H-field susceptibility test. The probe has been positioned on top of the H-field amplifier for reference measurements and close to PACS harness by means of a wooden tripod and none-conductive extension rod placed on an intermediate walkway. The measuring bandwidth of the used E-field probe is 10 kHz to 1 GHz.

5.3 Instrumentation

Instrument	Type No	ESA Inv No
Receiver (R&S)	ESIB 26	112499
Antenna (ARA)	SAS 1/D	No Nbr
Antenna Biconical (EMCO)	EMCO 3108	No Nbr
Antenna LogPer (R&S)	HL 223	No Nbr
Coaxial cable BNC (Ferrite Cladded)	10 mtr	No Nbr
Coaxial cable BNC (Ferrite Cladded)	10 mtr	No Nbr
Holaday field sensor 10kHz-1GHz	HI-4422	97913
Holaday readout unit	HI-4416	1000001
Signal Generator 9k-3GHz (R&S) (TEC-E prop)	SMA100A	112563
Coaxial cable BNC (Ferrite Cladded)	10 mtr	No Nbr
Antenna mast and tripods	NA	NA

All test equipment is calibrated on a yearly basis with the calibration performed in January 2008. Therefore all Cal due dates are in January 2009.

6. Test Description

6.1 Responsibilities

Responsibilities of ETS	Responsibilities of Customer
Preparation of the test set-up.	Specimen handling.
Positioning of antenna around the S/C under supervision of the customer	Support and supervision of antenna positioning around the S/C
EMC equipment operation.	Specimen operation and mode setting.
Acquisition and processing of EMC measurement data.	Acquisition and processing of specimen data.

6.2 Test Sequence

The Environmental Monitoring of the E-Field as close as possible at HIFI, SPIRE and PACS position on the Herschel FM spacecraft is performed as indicated below:

06-08-2008 HIFI position: set-up of EMC test equipment in FI001 clean room
EM E-field at HIFI position run 1 and 2

07-08-2008 EM E-field at HIFI position run 3

20-08-2008 RS field calibration

21-08-2008 RS and EM at SPIRE position

26-08-2008 E-field monitoring at PACS position

26&27-08-2008 Test set-up dismantling and EMC equipment return to Maxwell EMC facility

7. Test Execution

7.1 Personnel

Test Engineer: J van der Meulen
Operator: C. van Zijtveld

7.2 Test Anomalies and Procedure Deviations

No test anomalies and no procedure deviations because no procedure available.

Compared to the ETS proposal the following items has been cancelled or replaced on request of the customer:

- Cancellation of RS in horizontal mode at SPIRE position in spectrometer mode on request of the customer based on results gained during previous RS runs at SPIRE position
- The EM of the background E-Field at PACS position has been replaced by field measurement using a field probe with a measurement bandwidth from 10 kHz to 1 GHz. This on request of the customer due to the presence of metal scaffolding at PACS side.

7.3 Environmental Parameters

Class 100.000 cleanliness conditions were required.

Temperature >18°C and <23°C
Relative humidity >40% and <60%

7.4 Summary of Test Activities and "as run" test procedures

Below is a listing of the tests performed on the Hershel FM spacecraft.
All test set up drawings and test set up photos can be found in the applicable annexes.

TEST PERFORMED		
TEST	**Annex. No**	**Plot No**
Environmental Monitoring of background E-field level	B	1 to 15

8. Facility Data Results

All required test data has been recorded.
The customer has monitored specimen performance.
Reporting on the measurement results will be done in the order listed in the table in paragraph 7.4

8.1 Grounding

The Herschel spacecraft has been grounded to the clean ground of the FI001 clean room as defined for the SPT test.
All EGSE installed around the S/C has been grounded to the reference point of the S/C.

The EMI receiver has been referred to the 230 Vac power supply ground

8.2 RS field Calibration

The E-field for RS at SPIRE position has been calibrated in the MAXWELL facility. The bi-conical antenna and field probe has been located in the chamber at 1 meter distance from each other and at a height of 2 meter. The Signal Generator and field probe display unit has been located in the customer room. See annex-C for set-up. The signal generator output has been directly connected to the antenna by means of a 10 meter cable. The same cable is used during the actual RS EMC test at SPIRE position. The calibration has been done at a level of 1V/m over a frequency range of 10-100 MHz. The number of calibration points used is 21 logarithmic spaced between 10-100 MHz. The signal generator output level corresponding to E-Field reading of > 1V/m has been recorded.

After the calibration the E-field has been replayed from the signal generator in automatic mode at > 1V/m between 10-100 MHz at 120 frequency point logarithmic spaced. In order to generated a filed of >1V/m the fixed output setting of +30 dBm has been corrected internally the signal generator by means of user correction list for vertical (freqrsvp) and horizontal polarisation (freqrshp). The user correction list are fine tuned during the replay in order to generate a field of at least 1V/m at a signal generator fixed output level of +30 dBm.

The majority of field level was measured around 1.5 V/m.

No AM modulation applied during this field calibration.

The signal generator output setting for the required field of >80 dBµV/m using the user correction tables freqrsvp and freqrshp for vertical and horizontal polarisation is **-10 dBm**

This RS field calibration has been supported by Dominique Schmitt of TEC-E

For signal generator output reading at >1 V/m and user correction tables freqrsvp and freqrshp please refer annex-C

8.3 Radiated Susceptibility at SPIRE position

The SPIRE unit has been subjected to RS field level of at least 80 dBuV/m at about 460 frequency points logarithmic spaced between 10-100 MHz and AM modulated at 1KHz squire wave with a depth of 30% using the substitution method.

The dwell time during the SPIRE in spectrometer mode was 8 seconds and during the photometer mode was 4 seconds.

It is to be noted that the initial requirement is to subject the SPIRE unit to RS field level of >80 dBµV/m at 120 frequency point logarithmic space with a dwell time 15 Seconds. Due to the fact the signal generator could not handle dwell time of >10 seconds it has been decide to double the frequency injection points and to reduce the dwell time with factor two. During the first RS run (SPIRE in Spectrometer mode) with about 460 point and 8 seconds dwell time the resulted total sweep time became too long. In order to reduce the total sweep time it has been decide to reduce to dwell time to 4 seconds for SPIRE in photometer mode.

This RS EMC at spire position has been attended by Mr. Dominique Schmitt and Mr. Filippo Marliani of ESA/ESTEC TEC-E

Setting of the Signal Generator during the RS EMC test at SPIRE at 80 dBuV/m

- Reference generator output level: -10 dbm
- Mode single
- Frequency table: 10 – 100 Mhz
  log spacing
  Shape sawtooth
  Step log 0.5% (about 460 frequency points)
  Dwell time 8 seconds for Spectrometer mode
  Dwell time 4 seconds for photometer mode
- AM mode, 1kHz square wave, 30%
- User correction table enabled: - freqrsvp for vertical polarisation
  - freqrshp for horizontal polarisation

8.4 Environmental Monitoring of background E-field level

The background E-field narrowband measurements have been performed from 10 kHz to 1 GHz in vertical polarization and from 30 MHz to 1 Ghz in horizontal polarization.

All measurements have been performed during execution of Herschel SPT (He 2 mode and avionics in basic operational mode). The EM at HIFI position has been performed with HIFI in operational mode. The EM at SPIRE position has been performed with SIPRE in operational mode. The E-field measurement at PACs position has been performed with PACs in operational mode and during execution of magnetic susceptibility test at PACS unit. This measurement at PACS position has been done using a field probe covering the frequency band width 10kHz – 1GHz in stead of using antenna and receiver as done for HIFI and SPIRE position. The magnetic test is done under responsibility of ESA.

All measurements have been performed using the ESIB 26 in receiver mode except for PACS position. During the PACS monitoring a field probe HI-4422 and readout unit HI-4412 have been used.

The used bandwidth and measuring times for the ESIB 26 can be found in the table below. The measurement bandwidth for the field probe is 1000 MHz

All monitoring has been attended by Mr. Michael Hopfgarten of Astrium

Start Frequency	Stop Frequency	Step Width	Bandwidth			Measurement time	Detector	Transducer
			Plot 1	Plot 2+3	Plot 4 to 15			
Narrowband E-Field Receiver mode								
10 kHz	100 kHz	60 Hz	10 Hz	10 Hz	10 Hz	10 msec	Max peak	SAS 1/D low
100 kHz	1 MHz	600 Hz	100 Hz	100 Hz	10 Hz	10 msec	Max peak	SAS 1/D low
1 MHz	30 MHz	6 kHz	1 kHz	100 Hz	100 Hz	10 msec	Max peak	SAS 1/D low
30 MHz	200 MHz	60 KHz	10 kHz	10 kHz	10 kHz	10 msec	Max peak	EMCO 3108
200 MHz	1 GHz	60 KHz	10 kHz	10 kHz	10 kHz	10 msec	Max peak	HL223

A summary of the results is listed in the table below. Pictures of the test set-up and all measurement data can be found in Annex B.

PLOT	MEASUREMENT at HIFI position	REMARKS
1	**E-Field Vertical Polarization** **10 kHz to 1 GHz** File name : Herschel EM plot 1 Antenna 1 meter from HIFI instrument	Plot for info only Incorrect measurement due to incorrect orientation of Bi-con antenna towards the instrument. Max background level measured at about 83 dBµV/m around 1.3 MHz
2	**E-Field Horizontal Polarization** **30 MHz to 1 GHz** File name : Herschel EM plot 2 Antenna 1 meter from HIFI instrument	Modified measurement bandwidth resulted in lower noise floor level Max background level measured at 54.2 dBµV/m at 357.76 MHz
3	**E-Field Vertical Polarization** **10 kHz to 1 GHz** File name : Herschel EM plot 3 Antenna 1 meter from HIFI instrument	Modified measurement bandwidth Max background level measured at about 85 dBµV/m around 25 kHz
4	**E-Field Vertical Polarization** **10 kHz to 1 GHz** File name : Herschel EM plot 4 Antenna 1 meter from HIFI instrument	Modified measurement bandwidth Max background level measured at about 70d BµV/m around 25 kHz
5	**E-Field Vertical Polarization** **10 kHz to 1 GHz** File name : Herschel EM plot 5 Antenna 1 meter from HIFI instrument	Max background level measured at 73.1 dBµV/m at 25.72 kHz and 80.4 dBµV/m around 51.28 kHz
6	**E-Field Horizontal Polarization** **30 MHz to 1 GHz** File name : Herschel EM plot 6 Antenna 1 meter from HIFI instrument	Max background level measured at 52.7 dBµV/m at 104.64 MHz 52.2 dBµV/m at 106.8 MHz 52.3 dBµV/m at 352.82 MHz
7	**E-Field Vertical Polarization** **10 kHz to 1 GHz** File name : Herschel EM plot 7 Antenna 1 meter from HIFI instrument	Max background level measured at 78.8 dBµV/m at 25.84 kHz 68.1 dBµV/m at 352.76 MHz
8	**E-Field Horizontal Polarization** **30 MHz to 1 GHz** File name : Herschel EM plot 8 Antenna 1 meter from HIFI instrument	Max background level measured at 55.1 dBµV/m around 352.82 MHz

PLOT	RS at SPIRE position	REMARKS
--	**21-Aug-08 from 05:20h to 06:23h** **RS SPIRE position 10-100MHz, AM 1kHz square wave and 30% depth, Vertical Polarisation** SPIRE in Spectrometer mode during SPT Antenna 1 meter from SPIRE instrument	Steplog 0.5% (460 points) 8 sec dwell time User correction file: freqrsvp Gen ref level: -10dBm No susceptibility detected by SPIRE instrument responsible
--	**21-Aug-08 from 6:48 to 07:19h** **RS SPIRE position 10-100MHz, AM 1kHz square wave and 30% depth, Vertical Polarisation** SPIRE in Photometer mode during SPT Antenna 1 meter from SPIRE instrument	Steplog 0.5% (460 points) 4 sec dwell time User correction file: freqrsvp Gen ref level: -10dBm No susceptibility detected by SPIRE instrument
--	**21-Aug-08 from 05:20h to 06:23h** **RS SPIRE position 10-100MHz, AM 1kHz square wave and 30% depth, Horizontal Polarisation** SPIRE in Photometer mode during SPT Antenna 1 meter from SPIRE instrument	Steplog 0.5% (460 points) 4 sec dwell time User correction file: freqrshp Gen ref level: -10dBm No susceptibility detected by SPIRE instrument

PLOT	MEASUREMENT at SPIRE position	REMARKS
-	**E-Field Vertical Polarization** **10 kHz to 1 GHz** File name : Herschel EM plot 9 Antenna 1 meter from SPIRE instrument	Plot lost due to crash of PC
10	**E-Field Horizontal Polarization** **30 MHz to 1 GHz** File name : Herschel EM plot 10 Antenna 1 meter from SPIRE instrument	Max background level measured at about 55 dBµV/m around 101 MHz
11	**E-Field Vertical Polarization** **10 kHz to 1 GHz** File name : Herschel EM plot 11 Antenna 1 meter from SPIRE instrument	Max background level measured at about 80 dBµV/m around 51 kHz
12	**E-Field Horizontal Polarization** **30 MHz to 1 GHz** File name : Herschel EM 12 Antenna 1 meter from SPIRE instrument	Max background level measured at 61.1 dBµV/m at 433.28 MHz
13	**E-Field Vertical Polarization** **10 kHz to 1 GHz** File name : Herschel EM plot 13 Antenna 1 meter from SPIRE instrument	Max background level measured at 88.7 dBµV/m at 51.58 kHz
14	**E-Field Horizontal Polarization** **30 MHz to 1 GHz** File name : Herschel EM plot 14 Antenna 1 meter from SPIRE instrument	Max background level measured at 80.2 dBµV/m at 25.96 kHz and 87.7 dBµV/m at 51.58 kHz
15	**E-Field Vertical Polarization** **10 kHz to 1 GHz** File name : Herschel EM plot 15 Antenna 1 meter from SPIRE instrument	Max background level measured at 55.3 dBµV/m at 104.58 MHz and 55.2 dBµV/m at 947.78 MHz

PLOT	MEASUREMENT at PACS position	REMARKS
--	**26-Aug-08 from 09:45-10:30** **E-Field measurement using field probe with measuring BW from 10kHz-1GHz** ➢ Field probe place op top of H-field amplier ➢ During SPT test and H-field susceptibility test ➢ H-field amplifier located 0.5 meter from SVM in the corner at Solar Array side	Measured field levels: 3.5-10V/m
--	**26-Aug-08 from 10:58** **E-Field measurement using field probe with measuring BW from 10kHz-1GHz** ➢ Field probe on wooden tripod and extension rod located 10 cm above PACS harness on top SVM at Solar Array corner ➢ During SPT test and H-field susceptibility test ➢ H-field amplifier located 0.5 meter from SVM in the corner at Solar Array side	Measured field levels: (0V/m) / well below the sensor sensitivity of 1V/m
--	**26-Aug-08 from 11:04** **E-Field measurement using field probe with measuring BW from 10kHz-1GHz** ➢ Field probe handheld by means of a non conductive extension rod located just above SVM top edge at the corner SVM Solar Array ➢ During SPT test and H-field susceptibility test ➢ H-field amplifier located 0.5 meter from SVM in the corner at Solar Array side	Measured field levels: 0.7 V/m
--	**26-Aug-08 from 11:09** **E-Field measurement using field probe with measuring BW from 10kHz-1GHz** ➢ Field probe handheld by means of a non conductive extension rod above PACS harness moved along the PACS side ➢ During SPT test and H-field susceptibility test ➢ H-field amplifier located 0.5 meter from SVM in the corner at Solar Array side	Measured field levels: (0V/m) / well below the sensor sensitivity of 1V/m

9. Facility Success Criteria

The test with respect to the measurement phase can be considered as successful as far as each above criterion has been reached:

☒ The specified test requirements, conditions and input levels were met satisfactorily,
☒ All required data were measured and recorded,
☒ The data have adequate quality and are suitable for exploitation,
☒ The results of the on-site evaluation and checks are satisfactory,
☒ No non-conformance affecting the results is open,
☒ No more than 10% of the measurements have been lost.

10. Conclusions

The EM monitoring at HIFI and SPIRE and the RS test at SPIRE position have been successfully completed as requested. The EM monitoring at PACS position has been done with an E-field probe having a measurement bandwidth from 10 kHz to 1 GHz in stead of antenna.

At HIFI position the E-Field background noise level above 80dBuV/m have been measured at:

- 25 kHz (85 dBµV/m)
- 51.28 kHz (80.4 85 dBµV/m)

At SPIRE position the E-Field background noise level above 80dBuV/m have been measured at:

- 51.58 kHz (88.7 dBµV/m)

At PACS position the E-Field background noise level at PACS harness on top of the SVM using the E-field probe has been measured at zero however the real measured field strength is unknown because the probe will display zero incase the field to be measured is below the sensitivity of the probe at 0.7 V/m. This PACS monitoring was done during H-field susceptibility test and close to the H-field amplifier.

During the RS test at SPIRE position no susceptibility detected.

Detailed information on the mode of operation and the behavior of the Herschel spacecraft and involved instruments during EM monitoring and RS tests should be obtained from the experimenter.

Annexes

Annex A:	Declaration of Facility Test Readiness for Herschel FM EM and RS EMC test in Floo1 clean room.
Annex B:	Environmental Monitoring E-Field level at HIFI
Annex C:	RS field calibration 10 MHz – 1000 MHz in EMC chamber
Annex D:	RS EMC test 10 MHz – 1000 MHz at >80 dBµV/m at SPIRE position
Annex E:	Environmental Monitoring E-Field level at SPIRE position
Annex F:	E-field Monitoring at PACS position using 10 kHz to 1GHz field probe

Annex A. Facility Test Readiness for EM and RS EMC in Fl001 clean room

ETS/REP/EMC/2548 Issue: 1 Date : 05 Augustus 2008	DECLARATION OF FACILITY TEST READINESS	ets
FACILITY: **EMC Equipment**	ACTIVITY: **RE environmental monitoring HIFI, SPIRE and PAC's in FI001 clean room**	
PROJECT: **Herschel**	ITEM: **S/C**	MODEL: **FM**

- Declaration -

1. The above-mentioned test facility and associated measuring facilities are in nominal condition, conform to their specifications; they have been serviced, checked and calibrated.
2. The necessary test preparation, specific to this test has been properly performed and checked.
3. The necessary or required pre-test runs and/or measurements have been properly executed. The results have been evaluated and documented.
4. Special test devices or test installations - as far as these are required or necessary - have been properly prepared, qualified and documented.
5. The four above mentioned points are addressed in the Facility Readiness Review minutes of meeting Ref: ETS/MOM/EMC/2547 and the attached action item list has been successfully completed.

VISA	NAME	FUNCTION	DATE/SIGNATURE
Reviewed by :	Technical Manager	ETS-TM	5/8/08
Approved by :	Test Engineer	ETS-TE	5/8/08
Authorized by:	JL Le Carreres	ETS-QAM	6/8/2008

ETST03.6

ETS/REP/EMC/2563 Issue: **1** Date : **20 August 2008**	**DECLARATION OF FACILITY TEST READINESS**	ets

FACILITY: **EMC Equipment** ACTIVITY: **RS at SPIRE position in FI001 clean room**

PROJECT: **Herschel** ITEM: **S/C** MODEL: **FM**

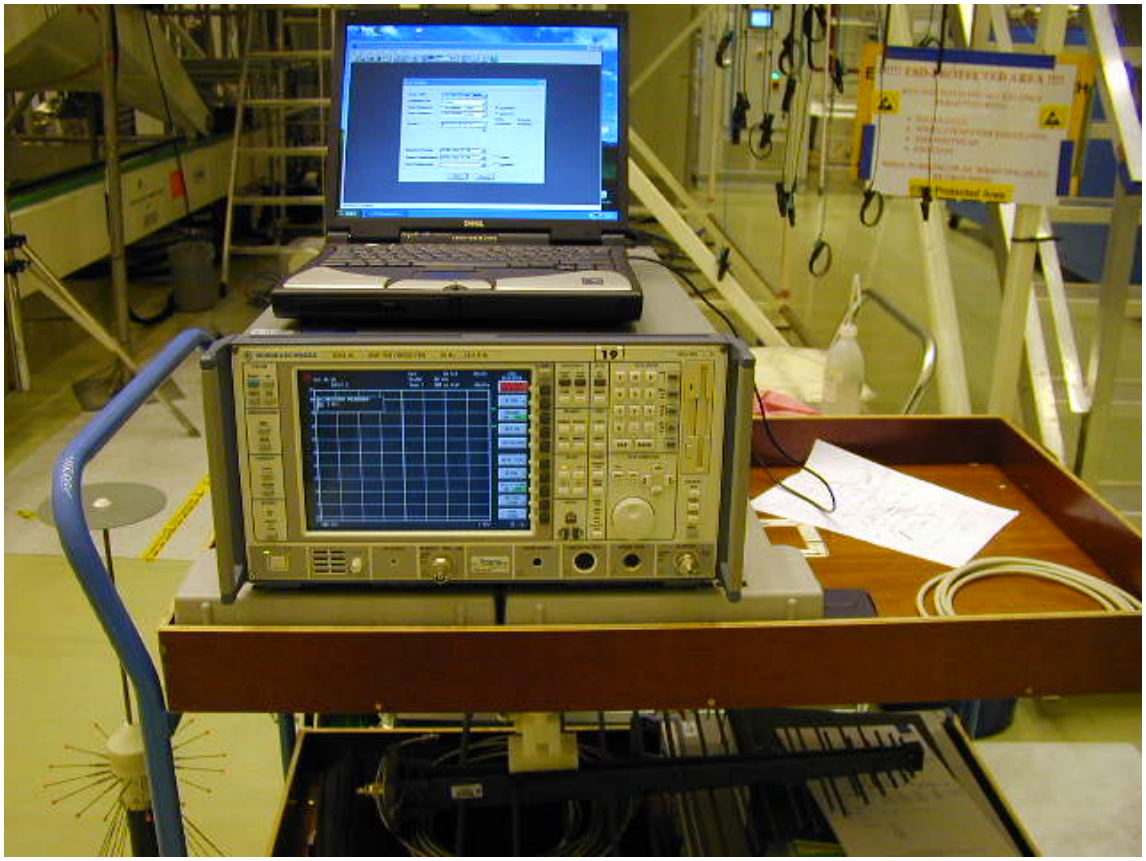
- Declaration -

1. The above-mentioned test facility and associated measuring facilities are in nominal condition, conform to their specifications; they have been serviced, checked and calibrated.
2. The necessary test preparation, specific to this test has been properly performed and checked.
3. The necessary or required pre-test runs and/or measurements have been properly executed. The results have been evaluated and documented.
4. Special test devices or test installations - as far as these are required or necessary - have been properly prepared, qualified and documented.
5. The four above mentioned points are addressed in the Facility Readiness Review minutes of meeting Ref: ETS/REP/EMC/2562 and the attached action item list has been successfully completed.

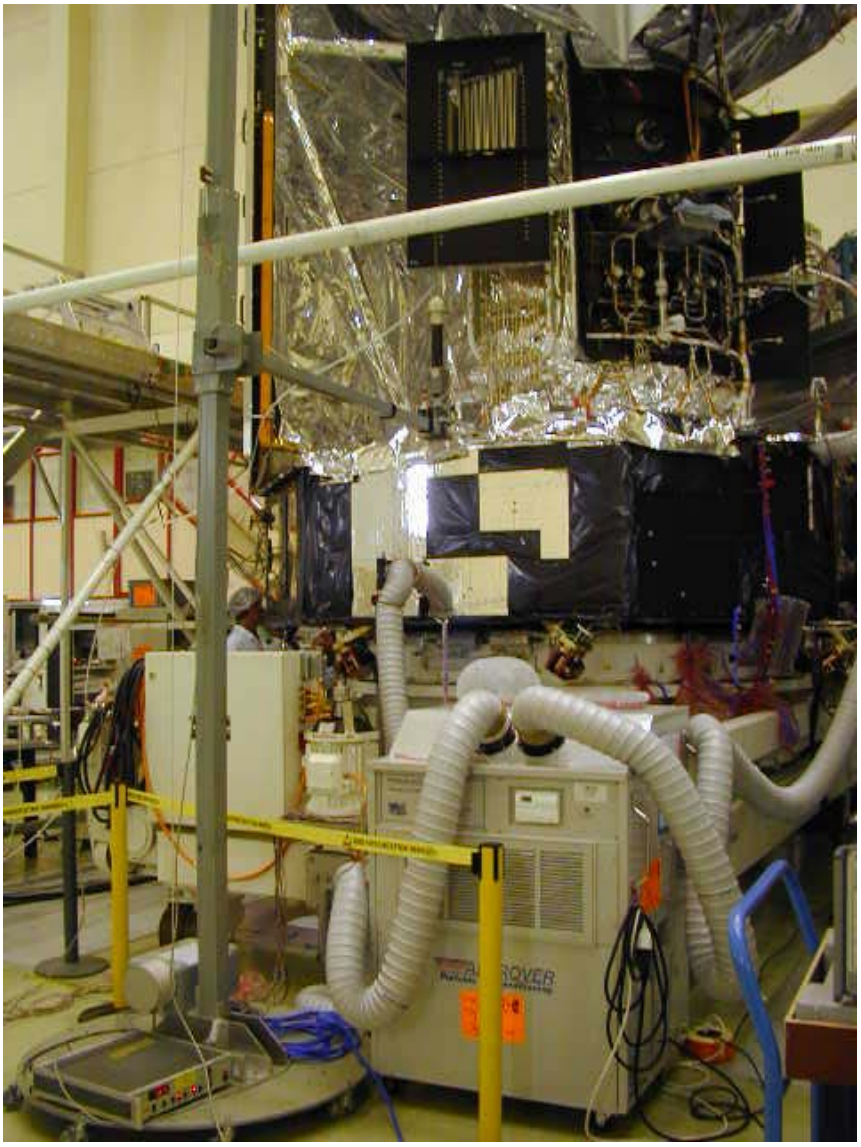
VISA	NAME	FUNCTION	DATE/SIGNATURE
Reviewed by :	Technical Manager	ETS-TM	20/8/08
Approved by :	Test Engineer	ETS-TE	20/8/08
Authorized by:	JL Le Carreres	ETS-QAM	21/8/08

ETST03.6

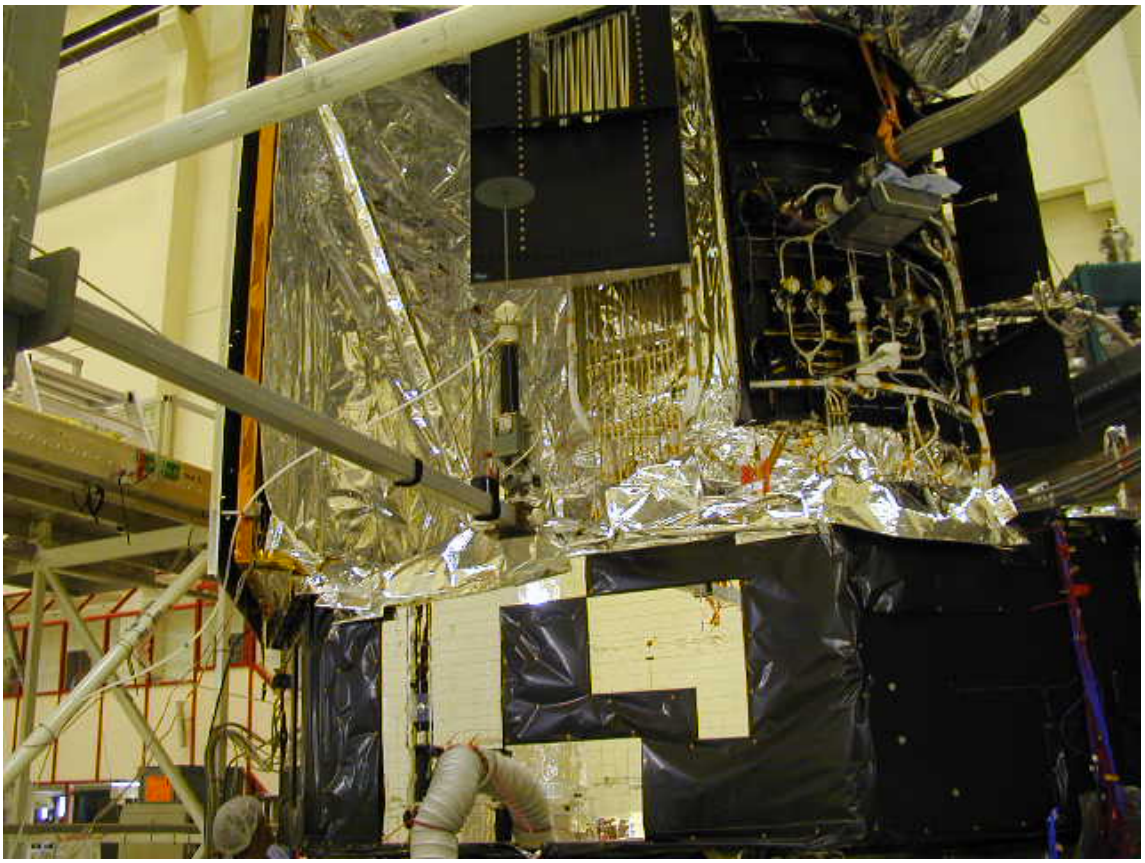
Annex B. Environmental Monitoring E-Field level at HIFI position



EM test equipment set-up in clean room

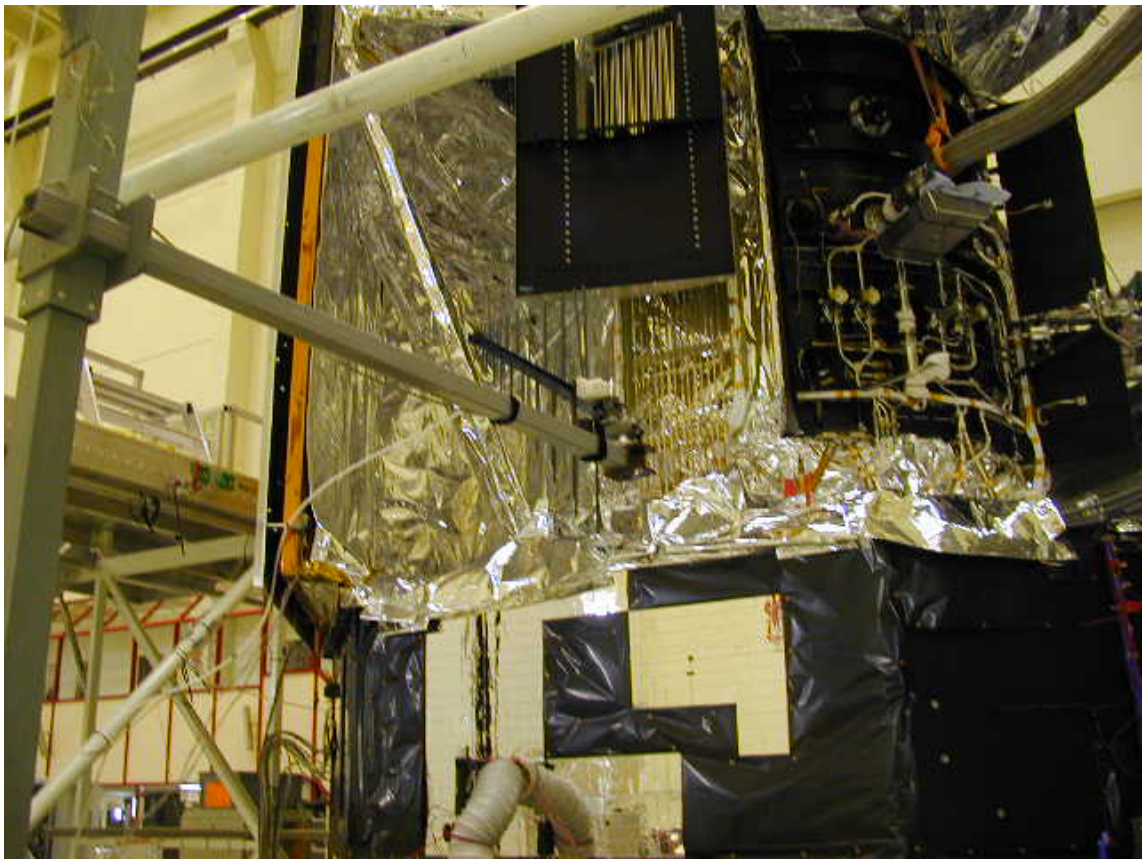


HIFI EM measurement position

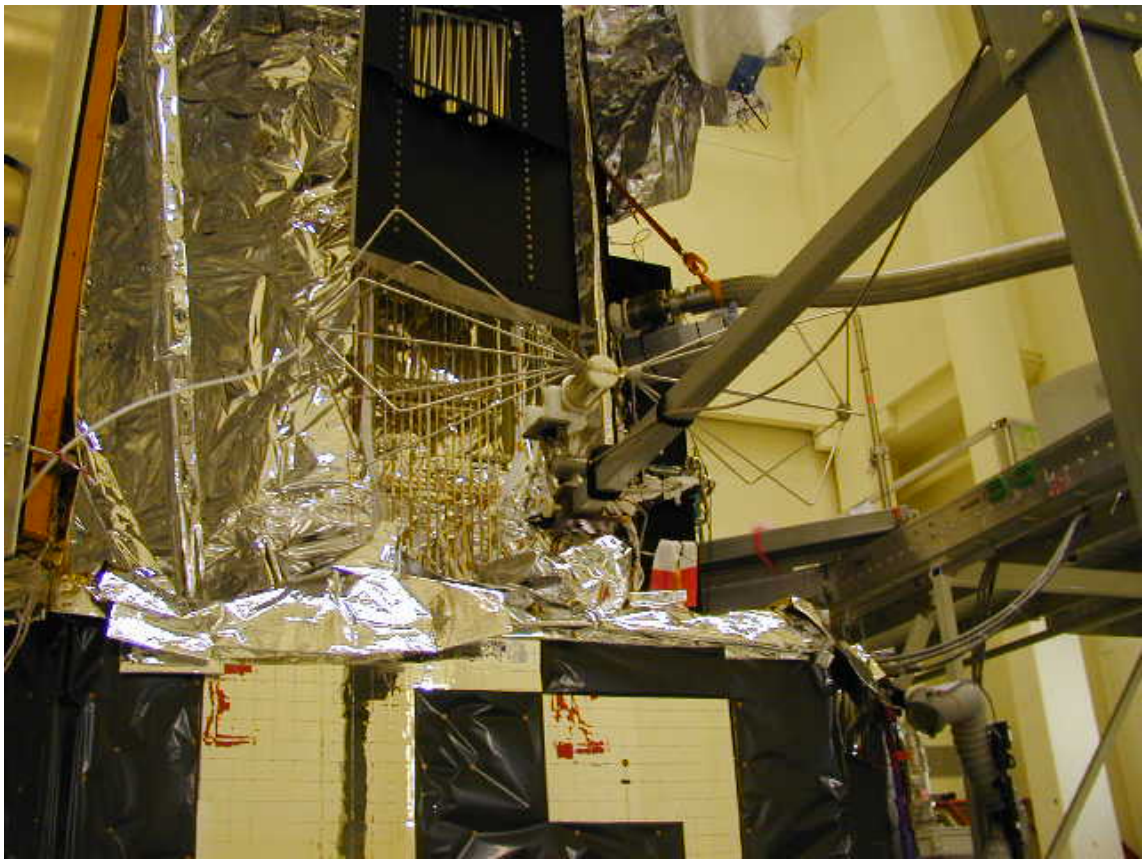


HIFI position EM 10 kHz to 30 MHz Vertical Polarisation

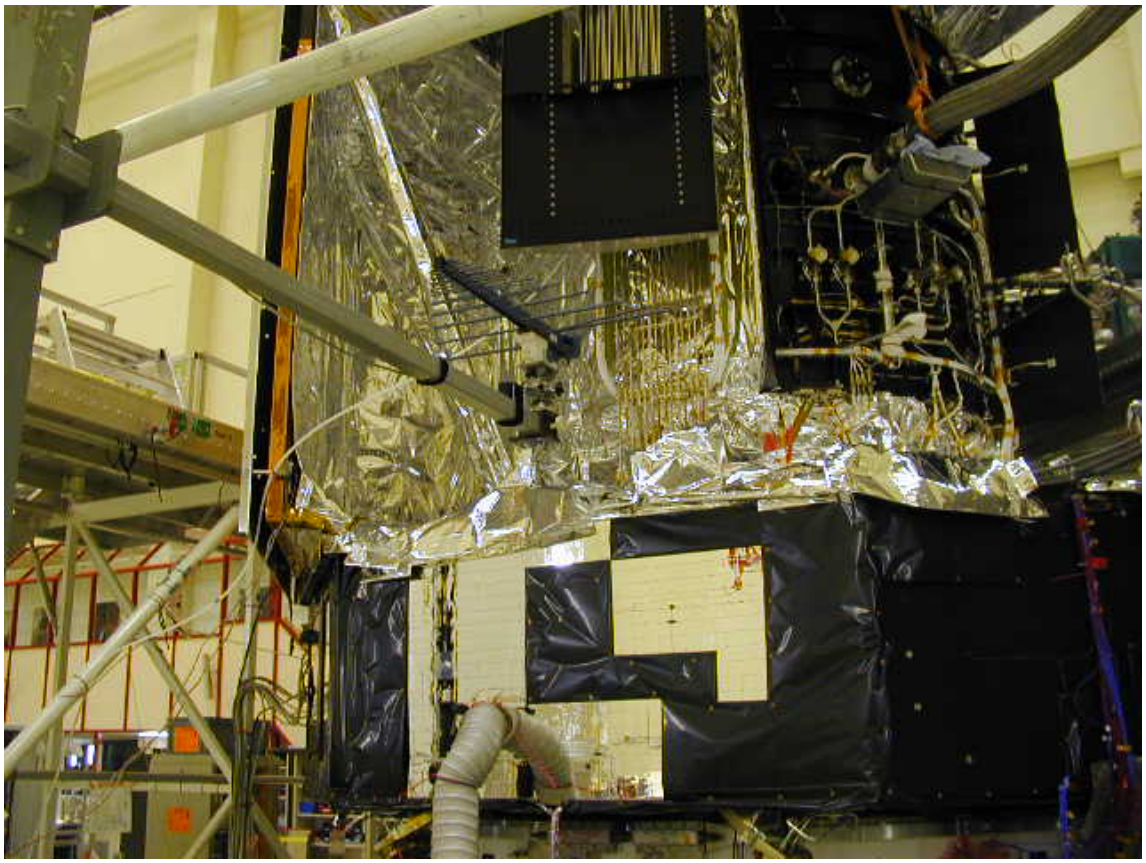
HIFI position EM 30 MHz to 200 MHz Vertical Polarisation



HIFI position EM 200 MHz to 1 GHz Vertical Polarisation

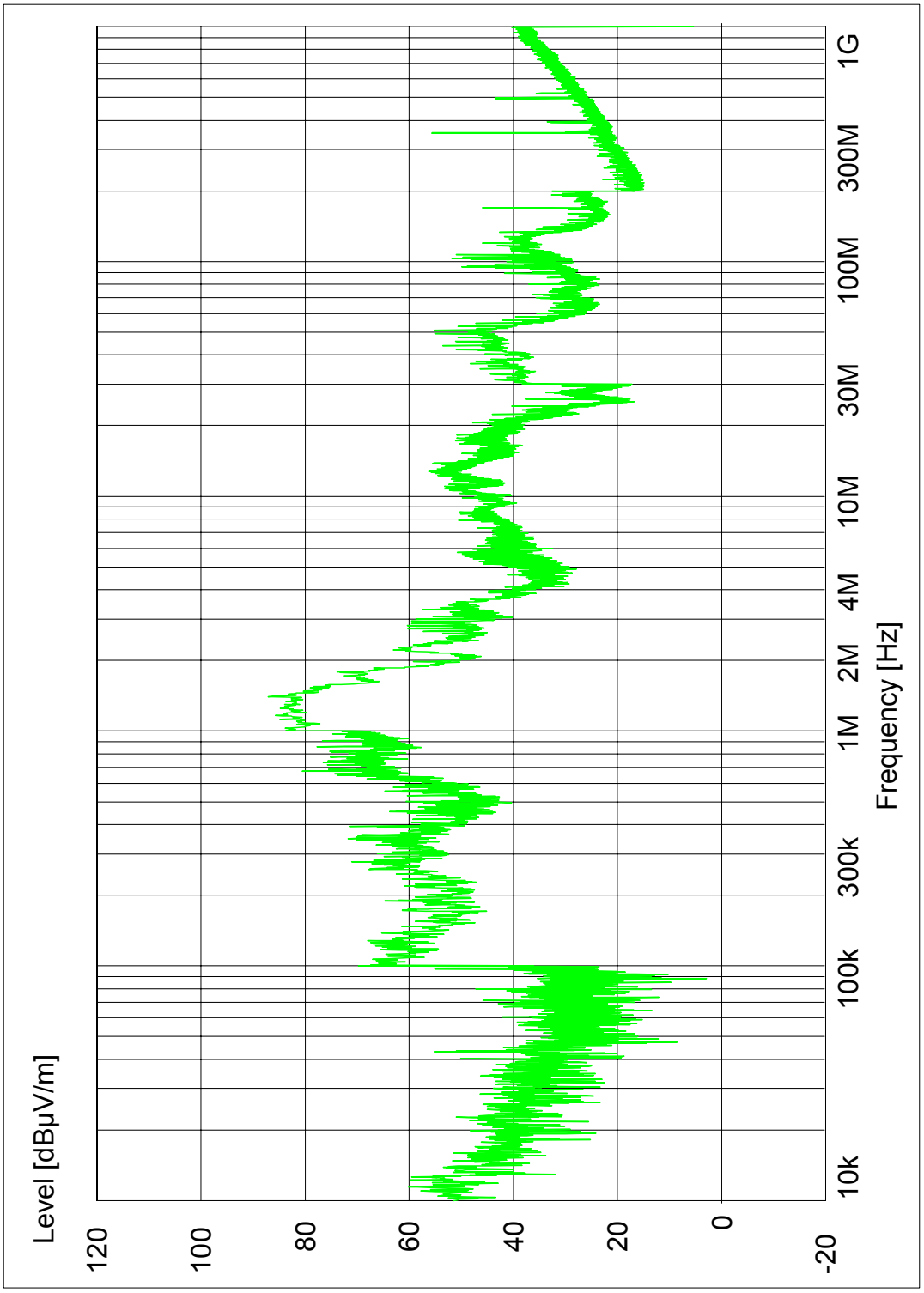


HIFI position EM 30 MHz to 200 MHz Horizontal Polarisation

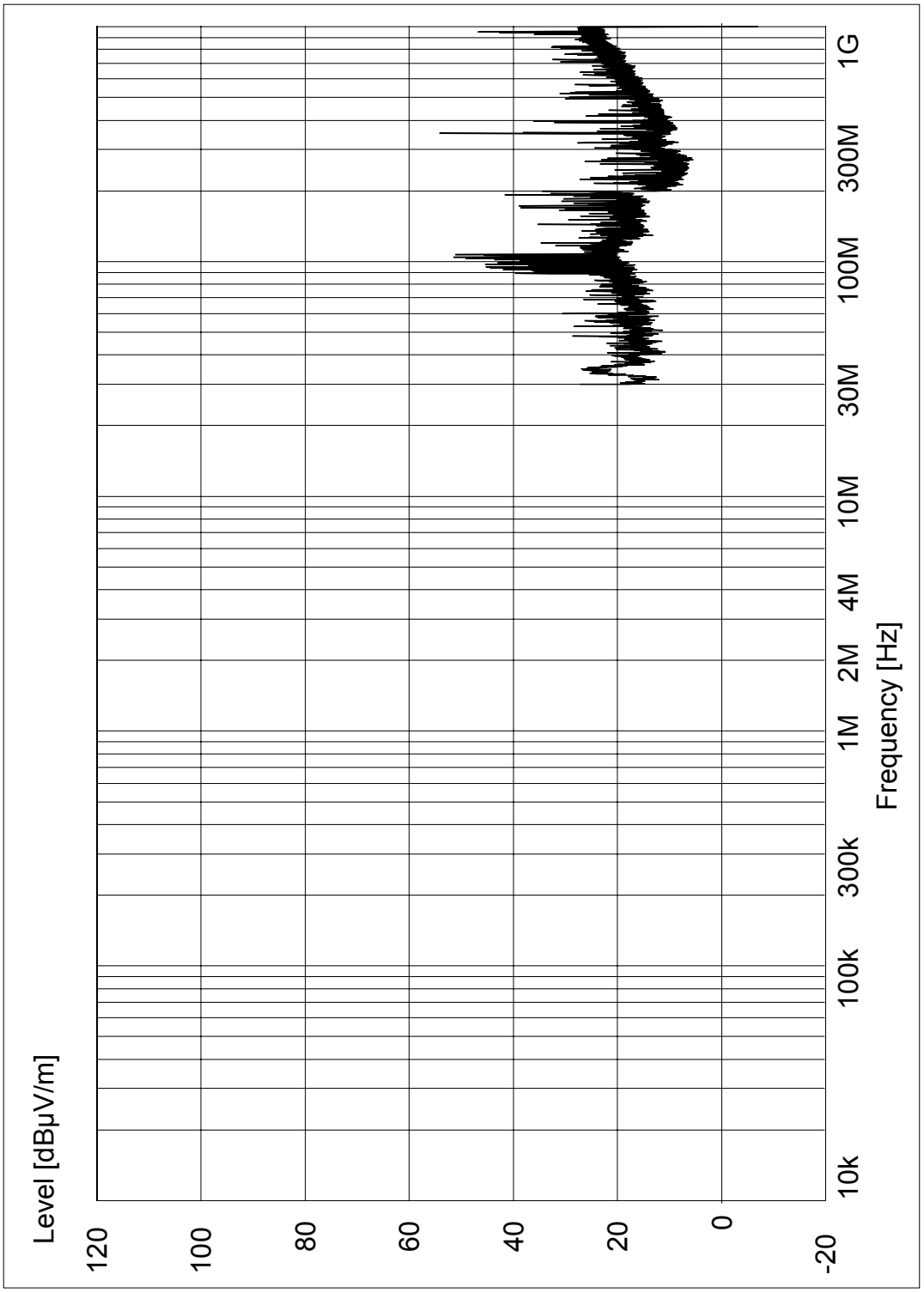


HIFI position EM 200 MHz to 1 GHz Horizontal Polarisation

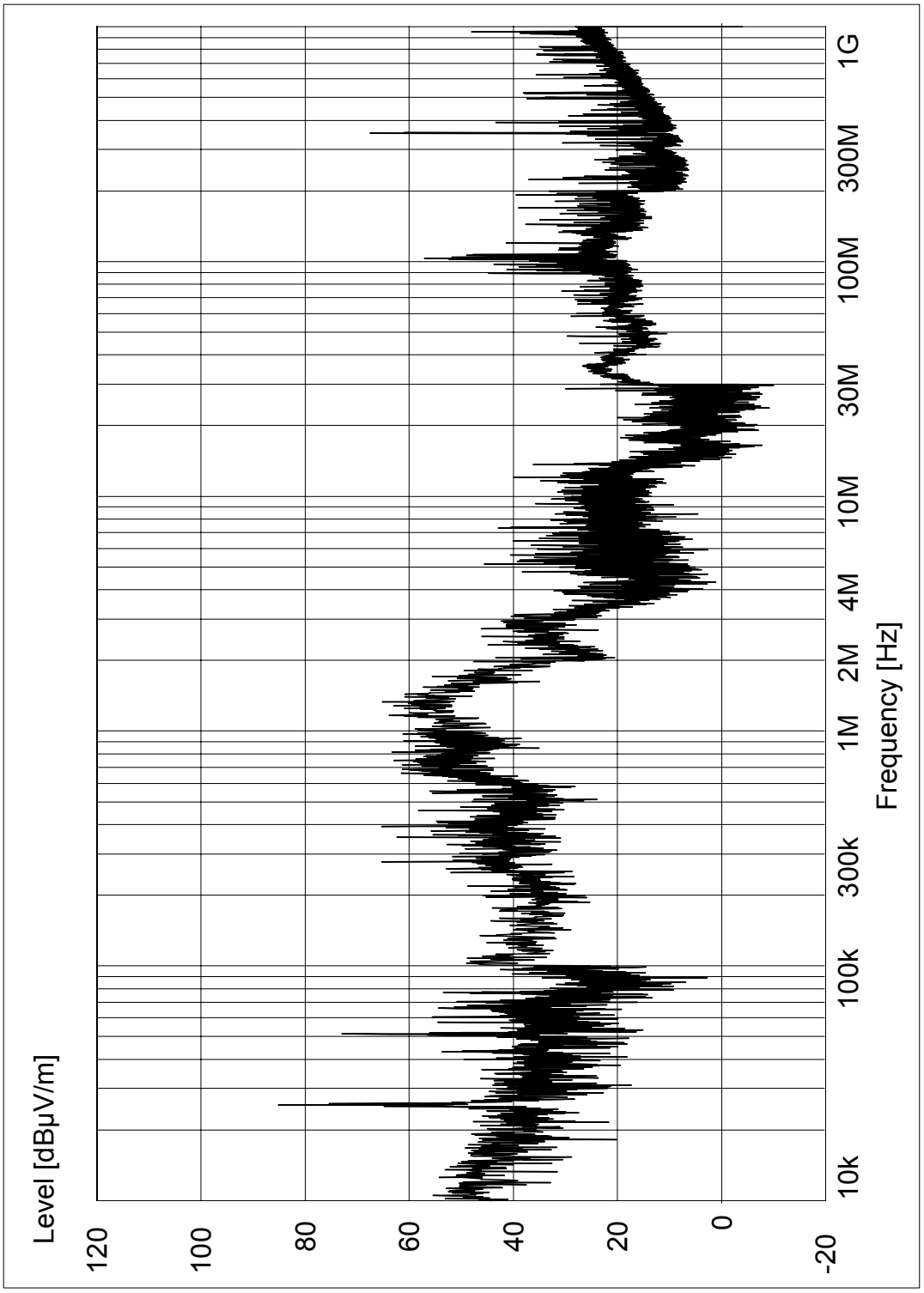
06-08-2008 15:35h
Plot 1 EM HIFI position VP run 1



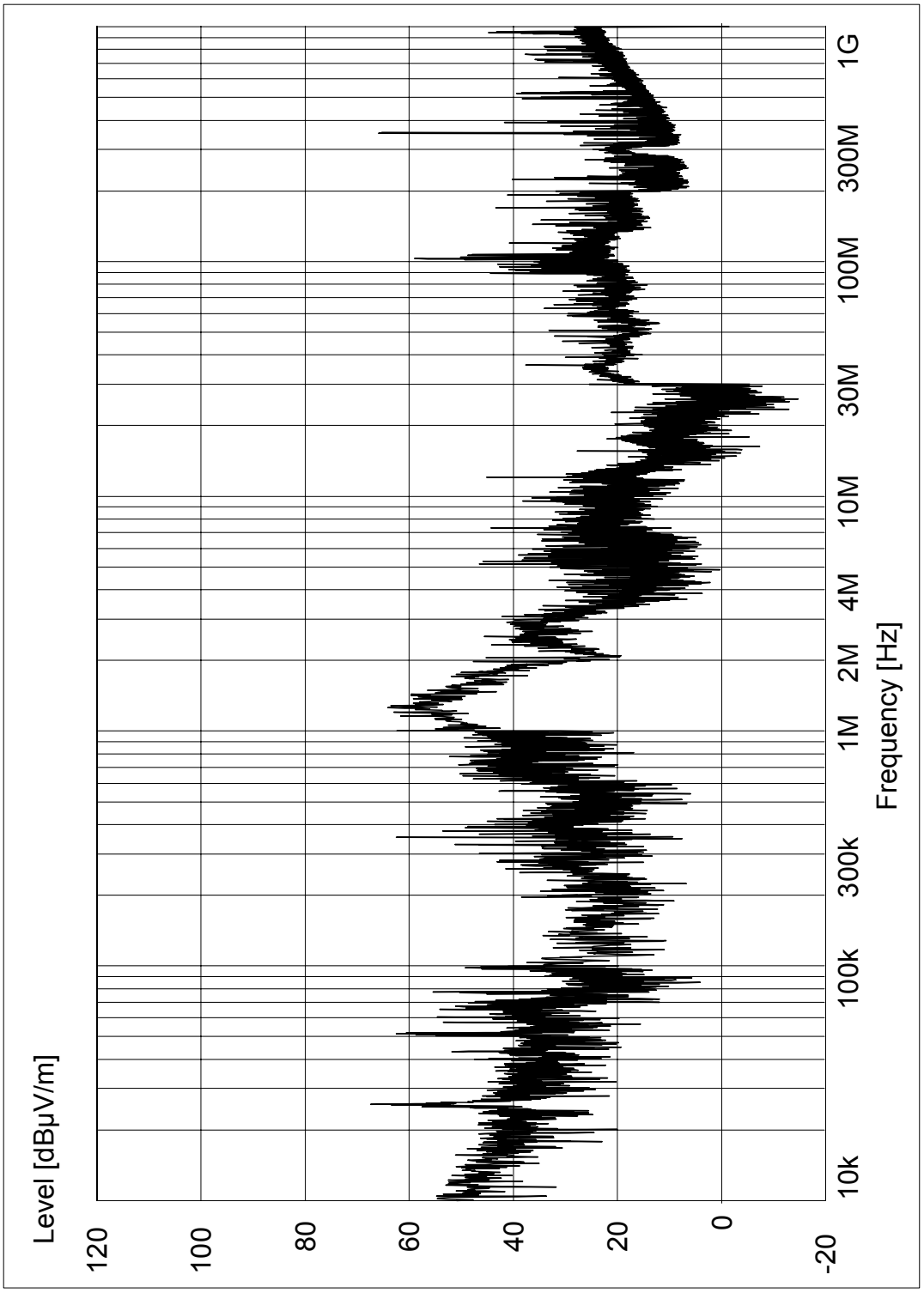
06-08-2008 16:40h
Plot 2 EM HIFI position HP run 1



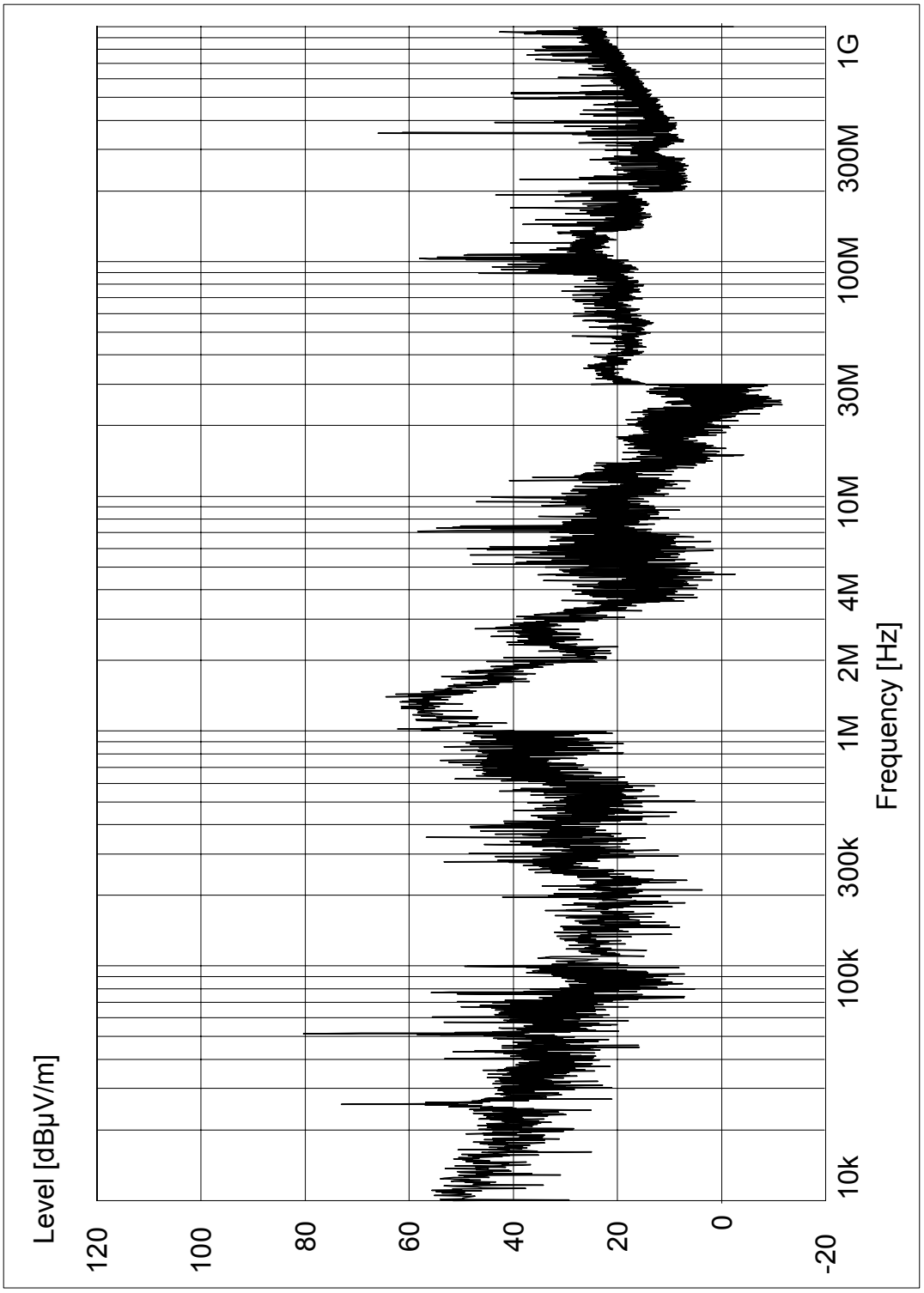
06-08-2008 17:00h
Plot 3 HIFI position EM VP run 2



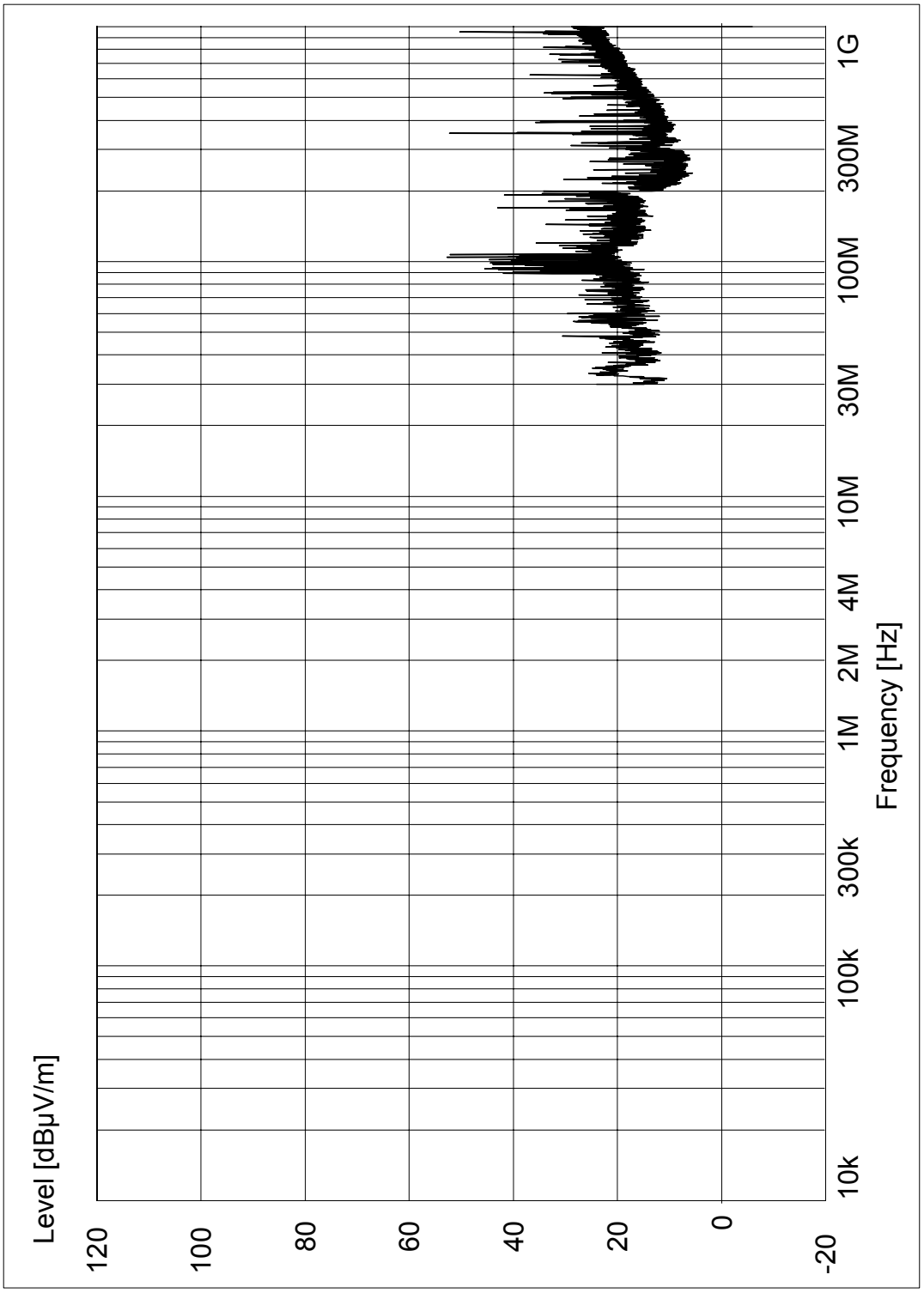
06-08-2008 17:50h
Plot 4 HIFI position EM VP run 3



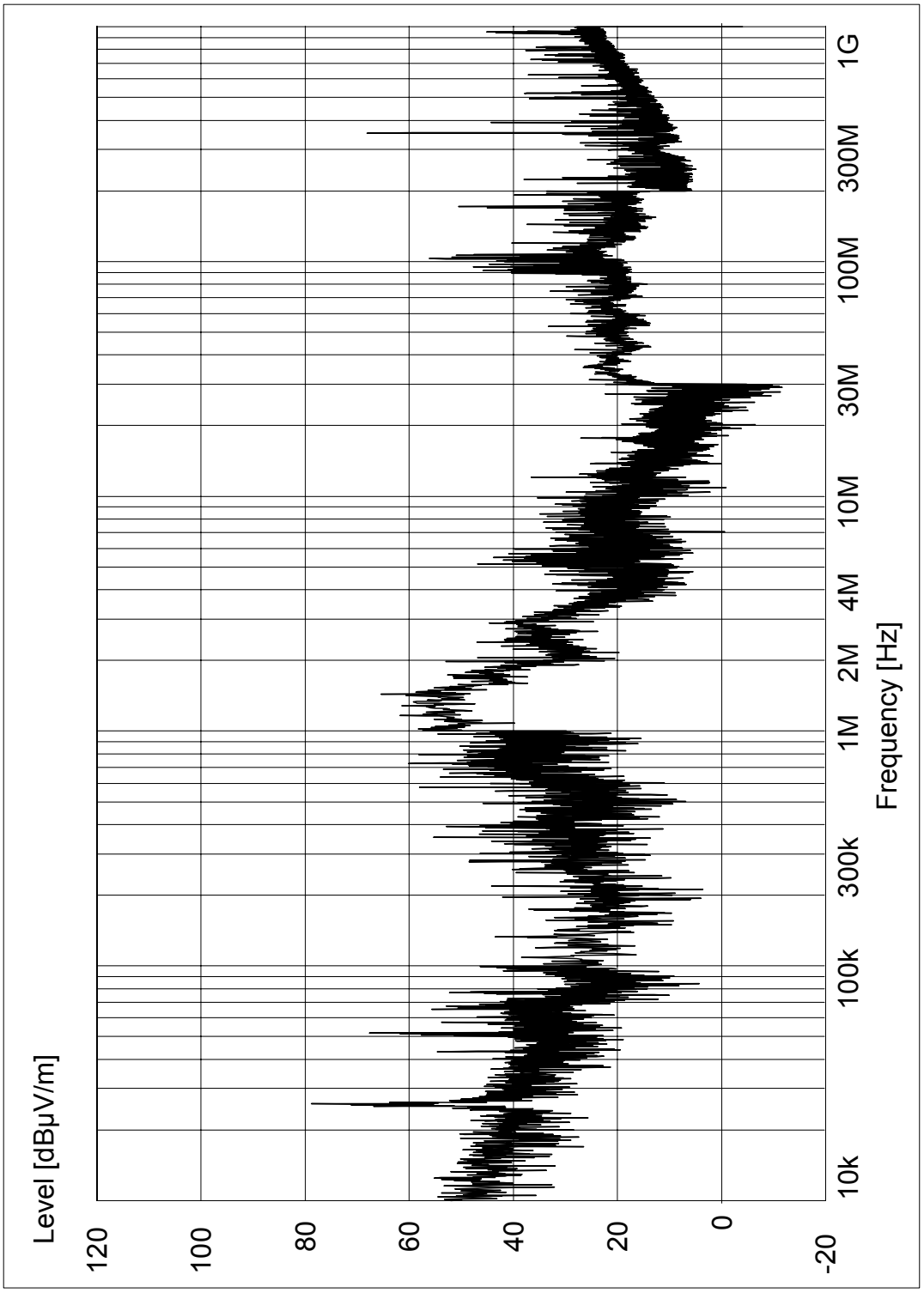
06-08-2008 20:20h
Plot 5 HIFI position EM VP run 4



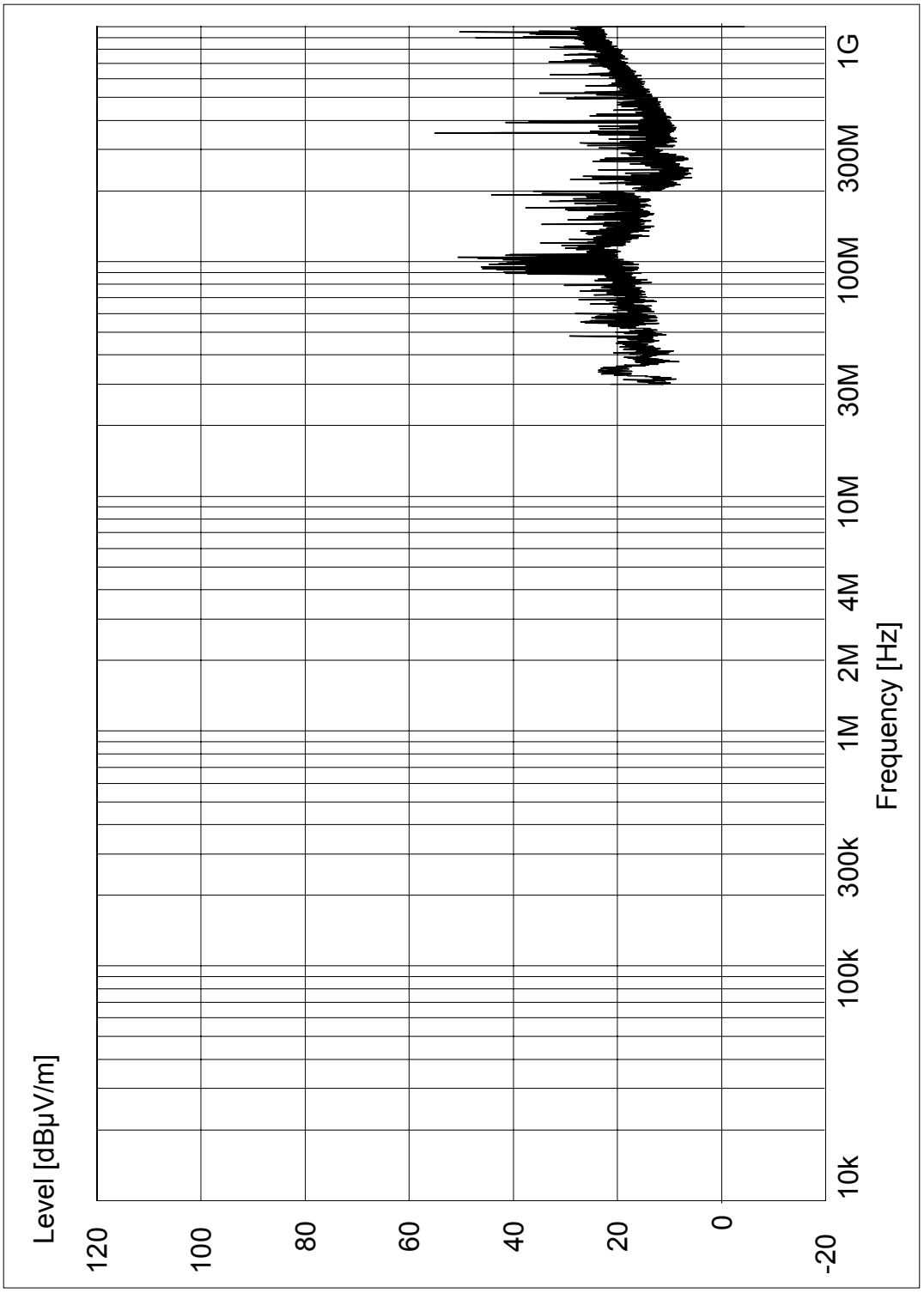
06-08-2008 21;20h
Plot 6 HIFI position EM HP run 4



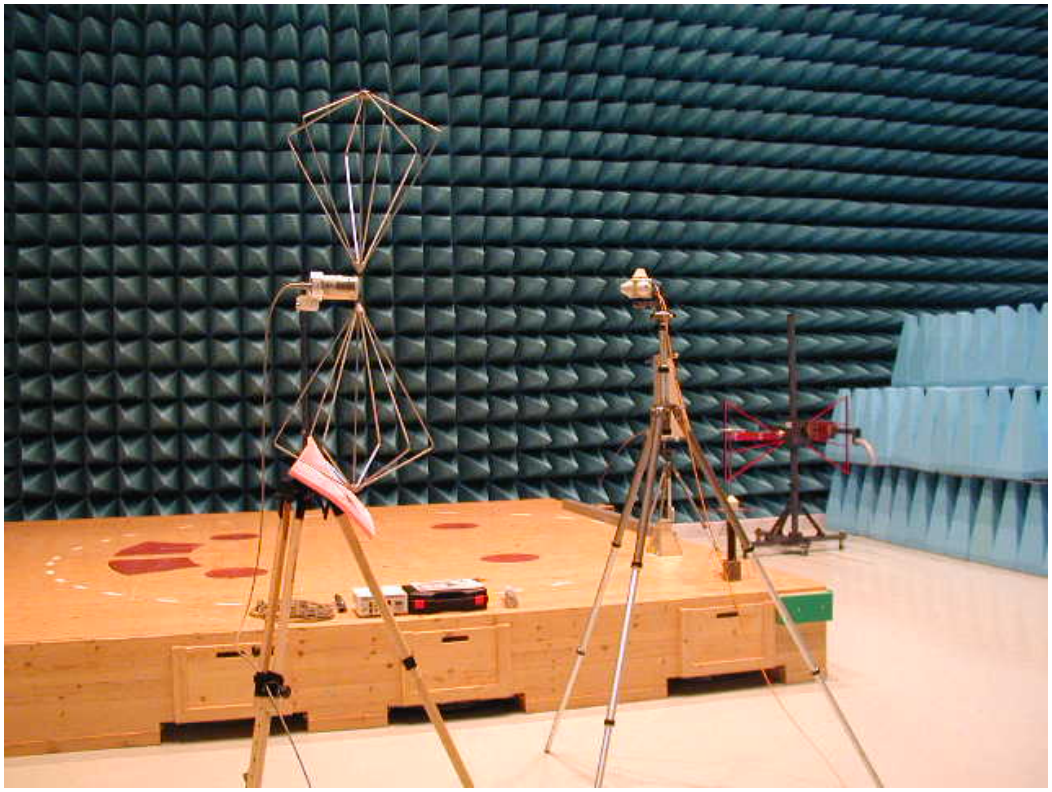
07-08-2008 08:50h
Plot 7 HIFI position EM VP run 5



07-08-2008 10:12h
Plot 8 HIFI position EM HP run 5

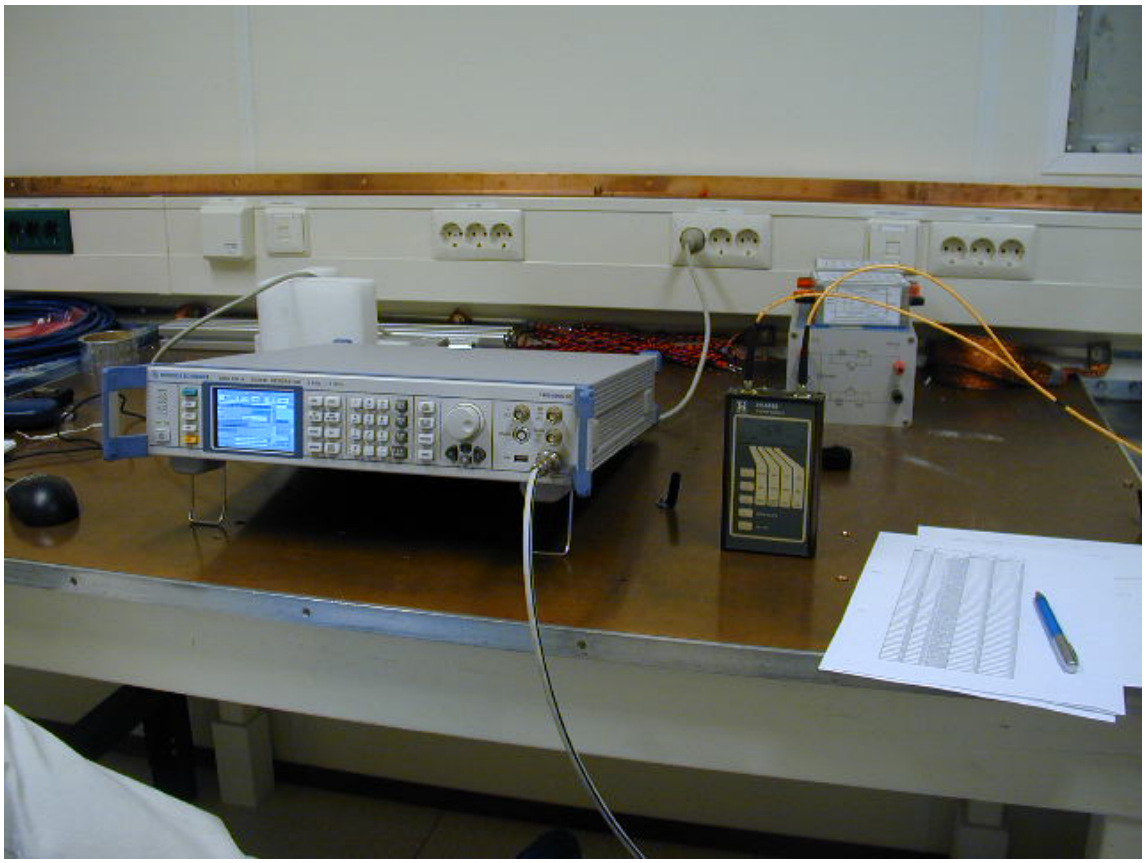


Annex C. RS Field calibration 10-100 MHz at >1 V/m in Maxwell EMC chamber



RS field calibration 10-100MHz Vertical Polarisation >1 V/m at 1 meter distance and 2 meter above floor

RS field calibration 10-100MHz Horizontal Polarisation >1 V/m at 1 meter distance and 2 meter above floor



RS Signal Generator and Field Probe Display unit in Maxwell customer room

RS E-Field calibration 10-100MHz 20 steps log spaced

			VP	HP
RS step			Sig gen o/p in dBm at 1 V/m	Sig gen o/p in dBm at 1 V/m
1	10	MHz	22.6	>30
2	11.2201845	MHz	21.7	>30
3	12.58925402	MHz	22	30
4	14.12537528	MHz	22	23
5	15.84893168	MHz	22	25
6	17.78279376	MHz	22	30
7	19.95262269	MHz	18.9	25
8	22.38721078	MHz	18.5	25
9	25.11886354	MHz	19	30
10	28.18382834	MHz	17.3	27
11	31.62277539	MHz	18.4	27
12	35.48133743	MHz	15.3	27
13	39.81071522	MHz	12.4	23
14	44.66835699	MHz	10.3	26
15	50.11872067	MHz	7.3	26
16	56.23412928	MHz	6.3	24
17	63.09573058	MHz	5.1	25
18	70.79457382	MHz	2.6	19
19	79.43281799	MHz	3.2	16
20	89.12508732	MHz	5.7	17
21	99.99999233	MHz	9.1	19

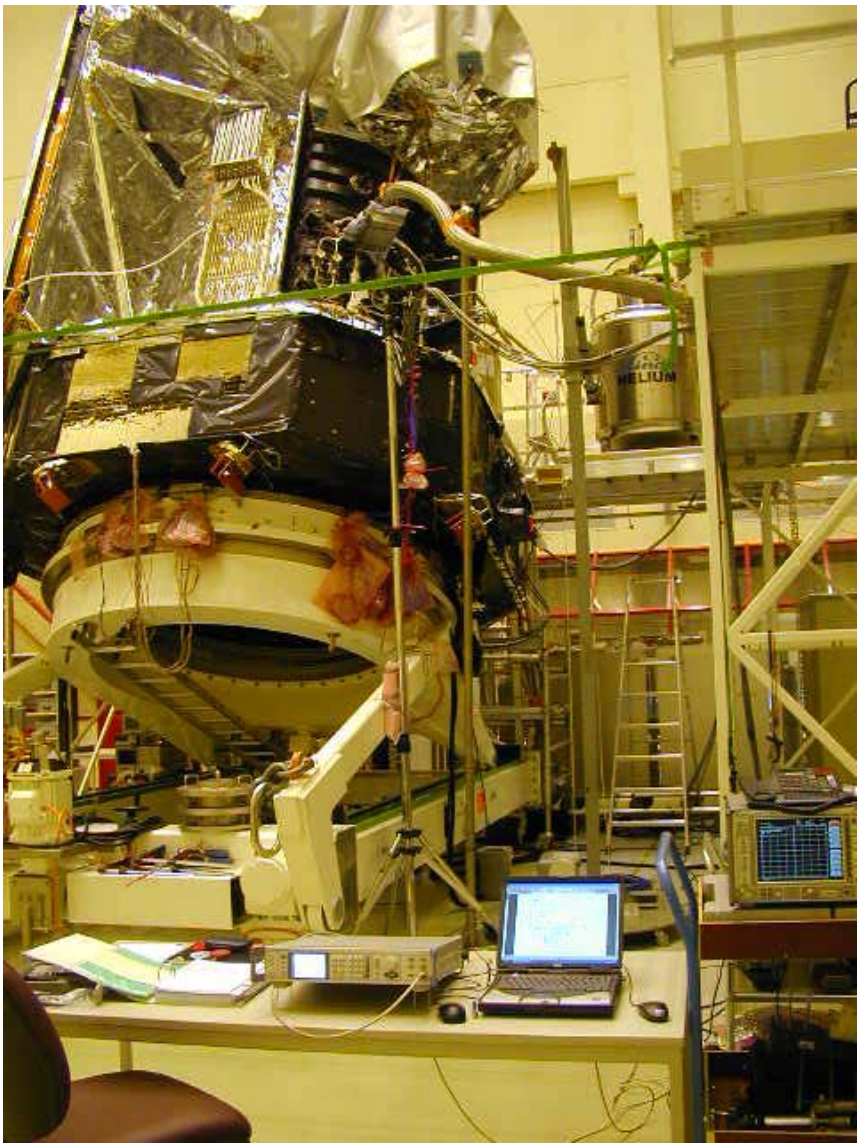
Config:
- 2 meter above floor Maxwell
- 1 meter distance antenna to field probe
- bi-con antenna only from 10-100MHz
- 10 meter ferrite BNC cable
- Antenna on wooden tripod
- Holaday field sensor HI-4422 10kHz - 1GHz
- Holaday readout unit HI 4416
- Fibre optic cable for Holaday field sensor to readout unit
- R7S SMA 100A Signal Generator 9k-3GHz borrowed from TEC-E
  sn: 100247
  inventory no: 112563

User correction tables

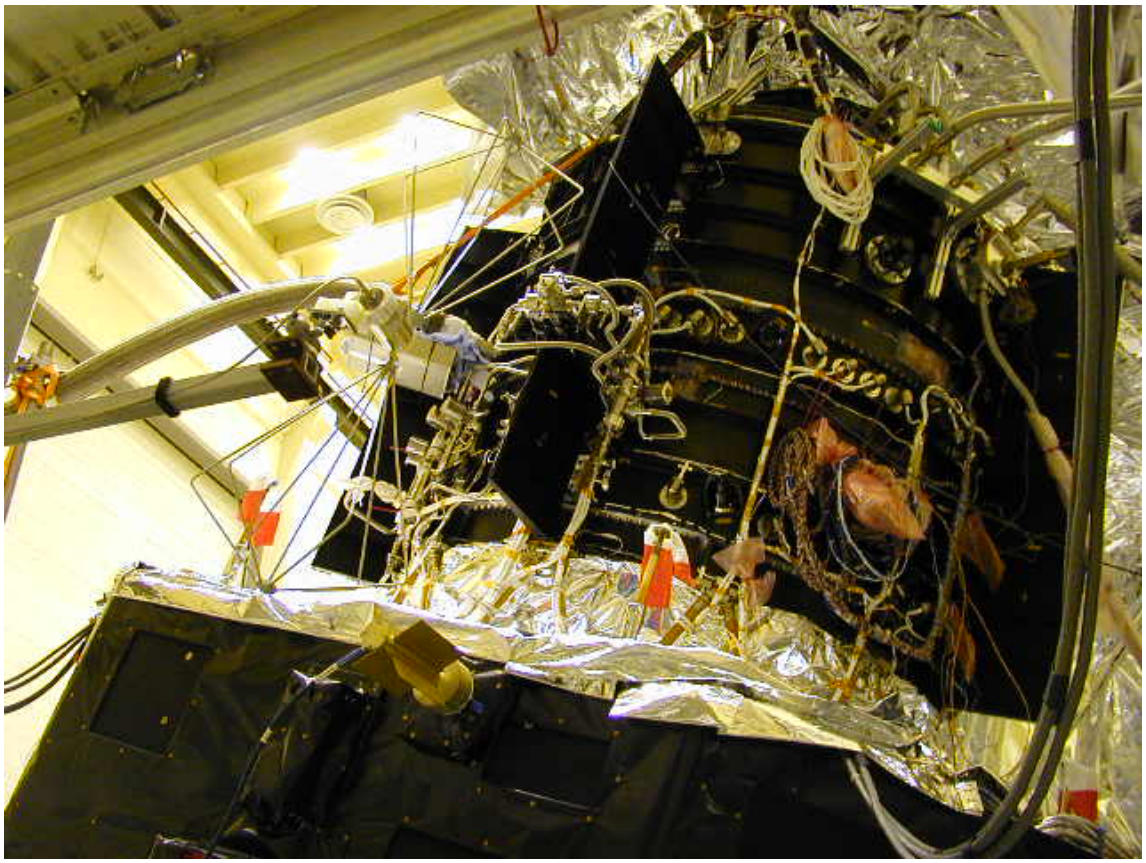
freqrsvp	
MHz	**dB**
10	-6
17.9	-9
18	-9
36	-9
36.1	-15
44.5	-15
44,6	-20
49.9	-20
50	-23
89.1	-23
100	-20

freqrshp	
MHz	**dB**
10	10
12	10
12.1	0
39.6	0
39.7	-3
69.3	-3
69.4	-11
100	-11

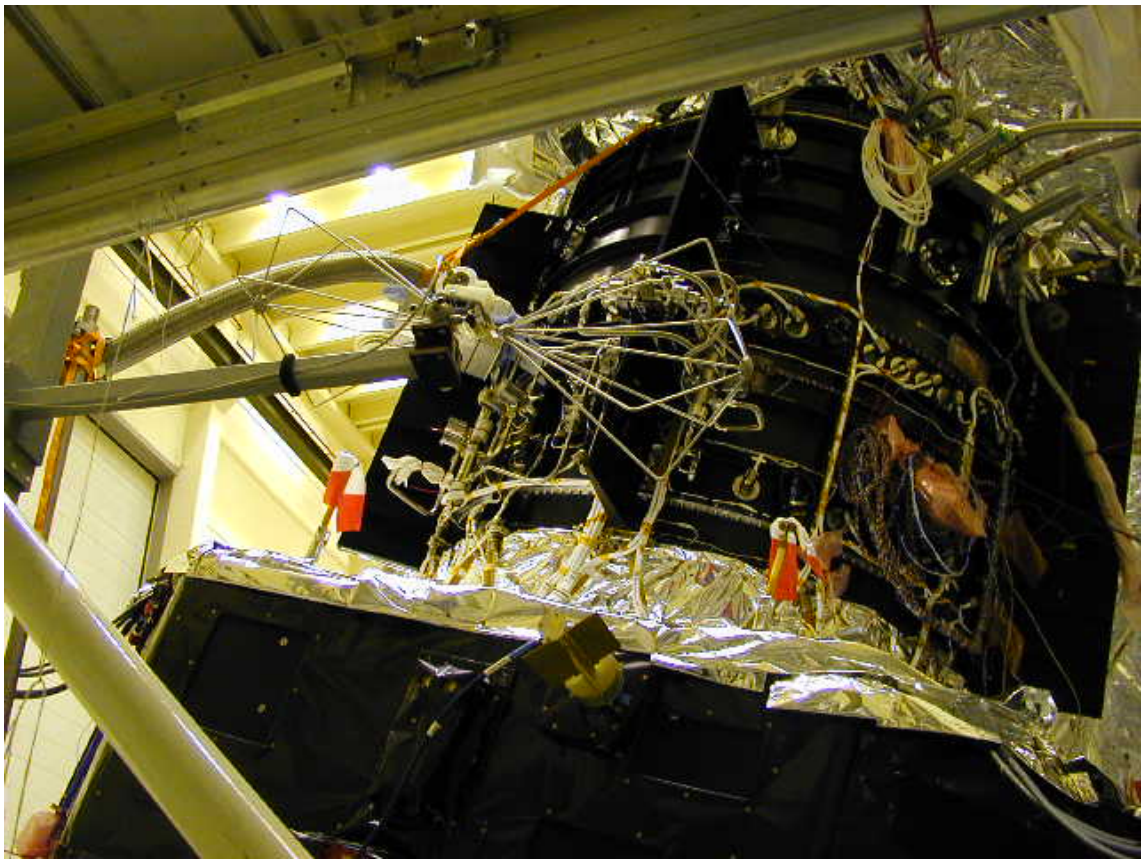
Annex D. RS EMC test 10-100 MHz at > 80 dBµV/m at 1 meter from SPIRE unit/harness



SPIRE RS set-up

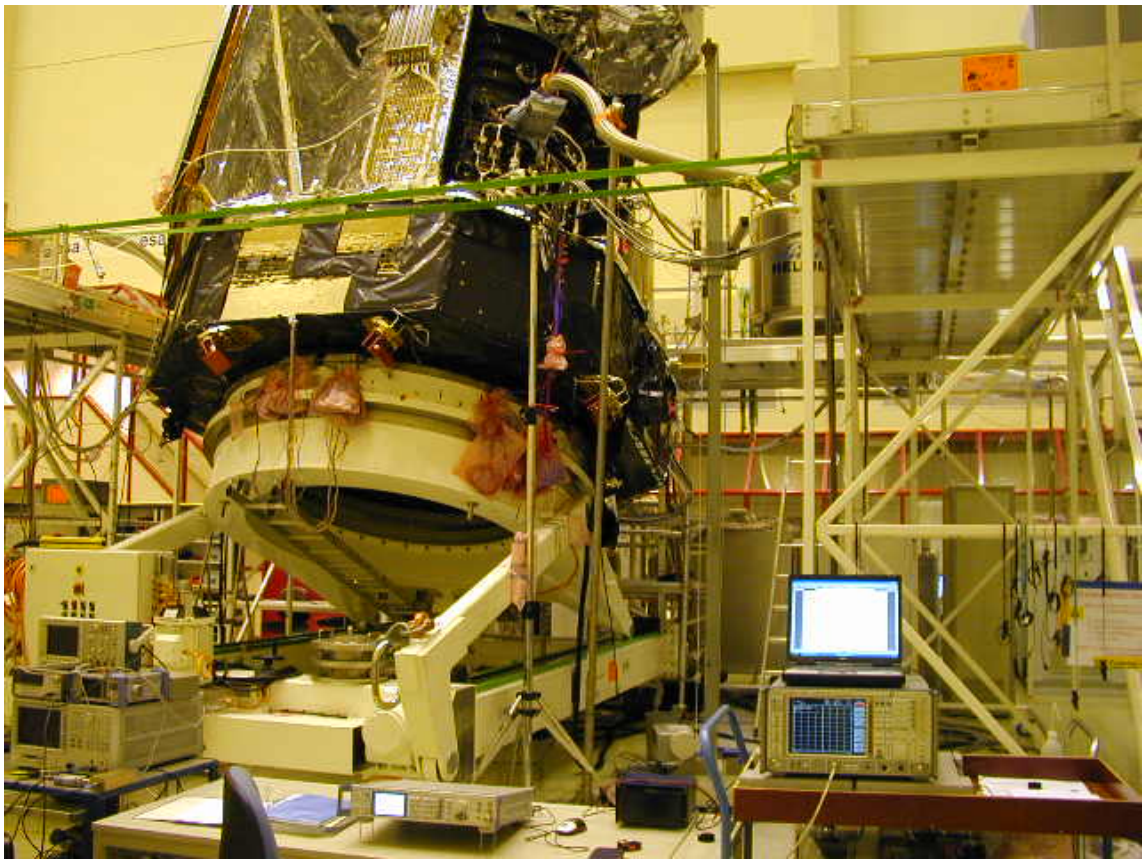


SPIRE RS 10MHz-100MHz, >80 dBµV/m Vertical Polarisation

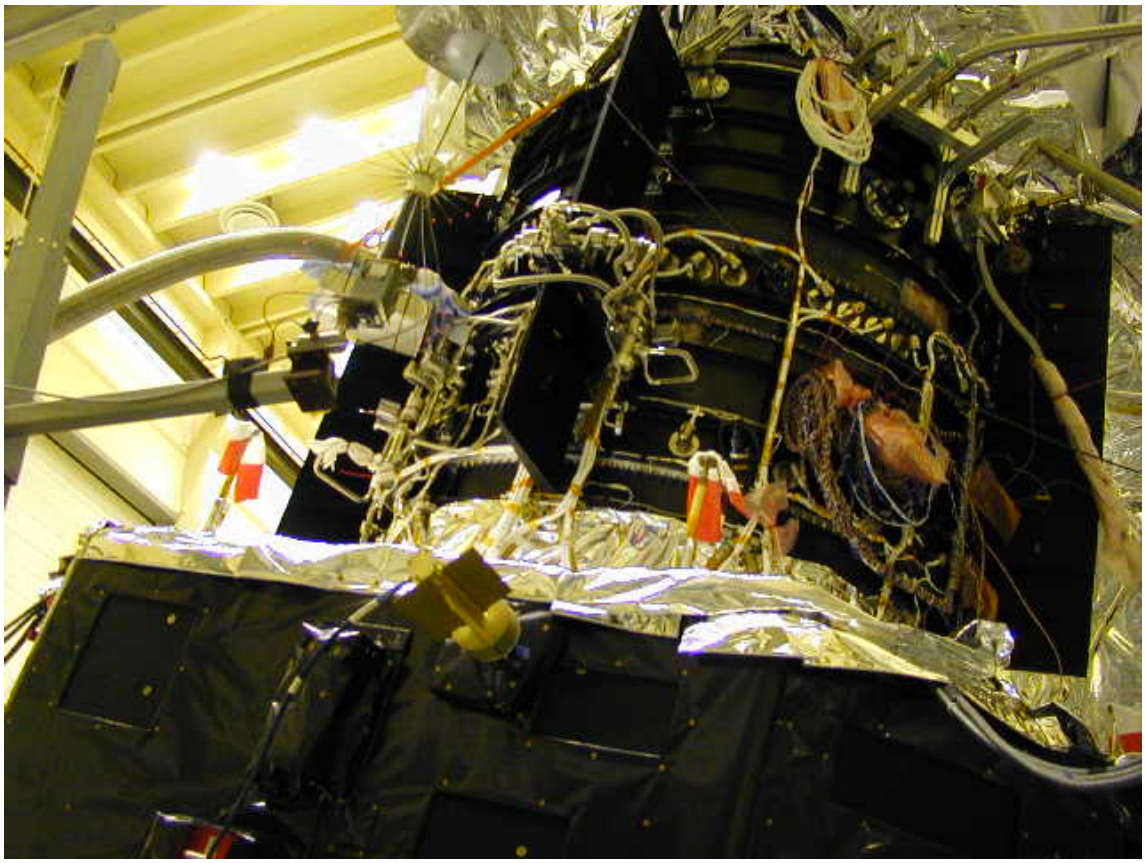


SPIRE RS 10MHz-100MHz, >80 dBµV/m Horizontal Polarisation

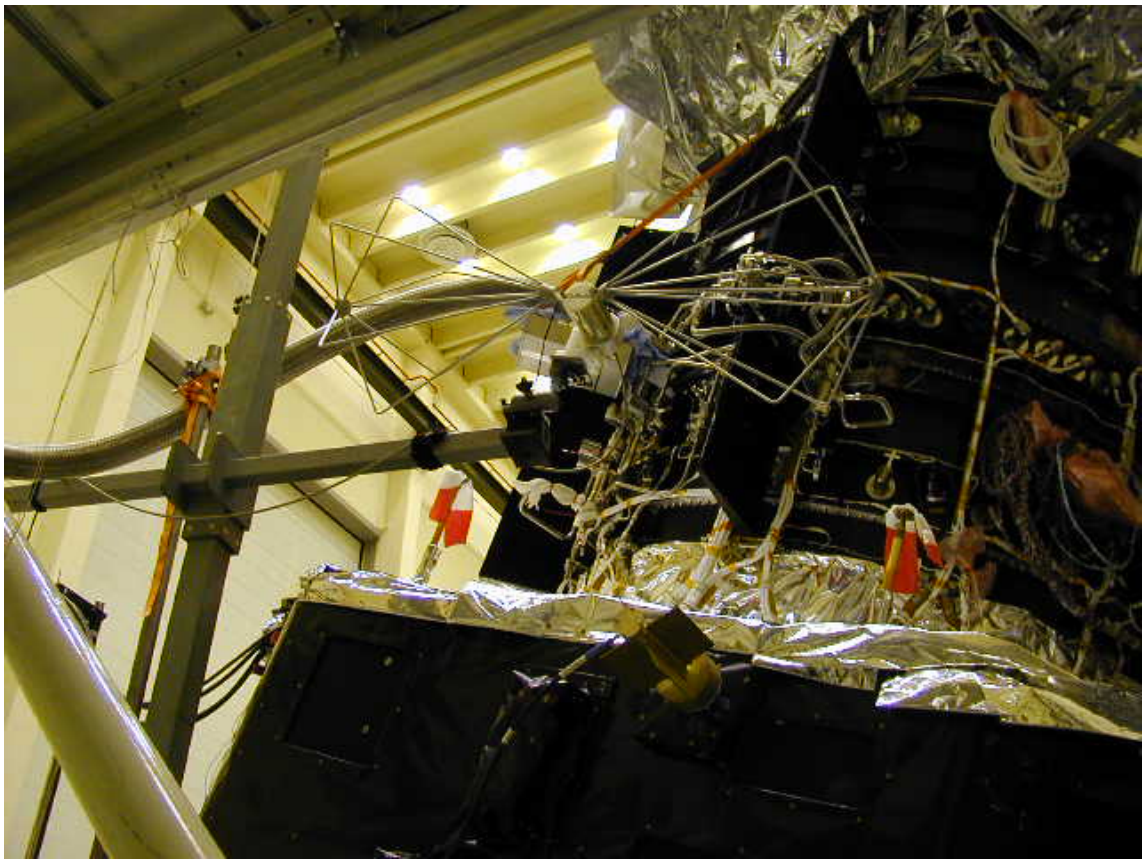
Annex E. Environmental Monitoring E-Field level at SPIRE position



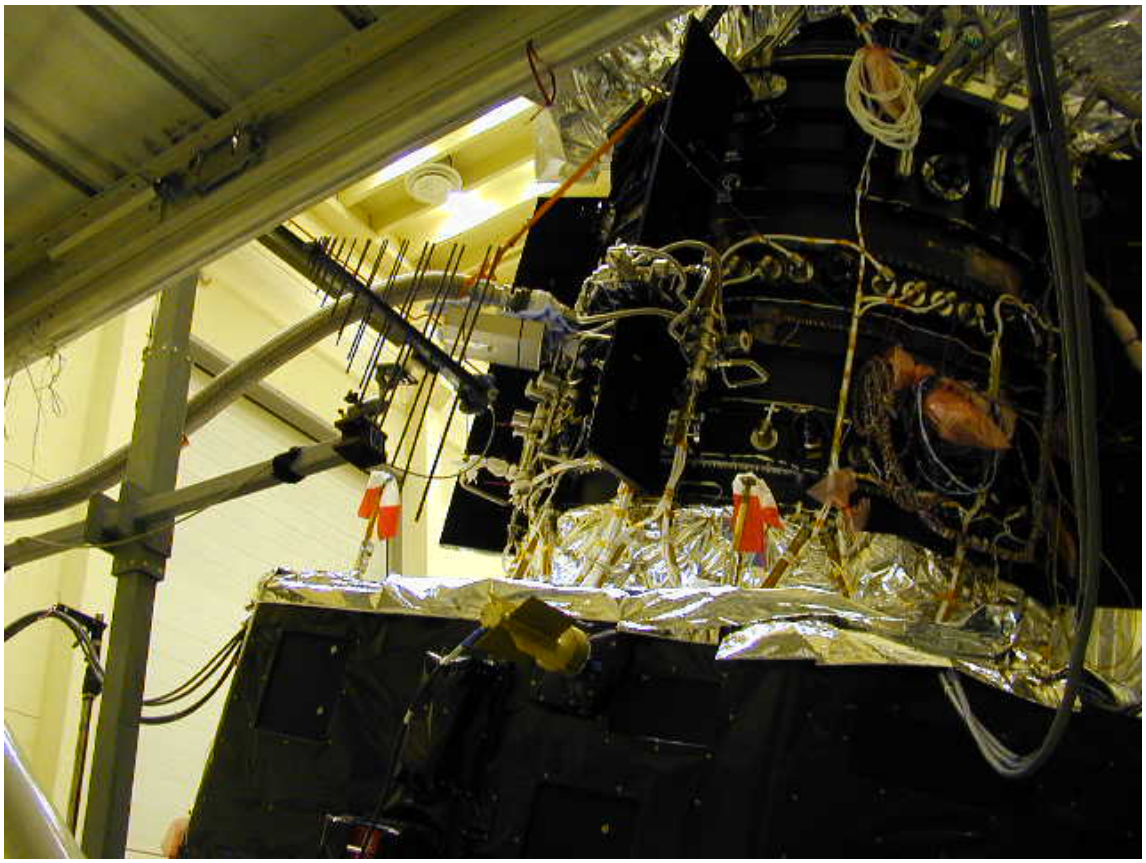
SPIRE EM measurement position



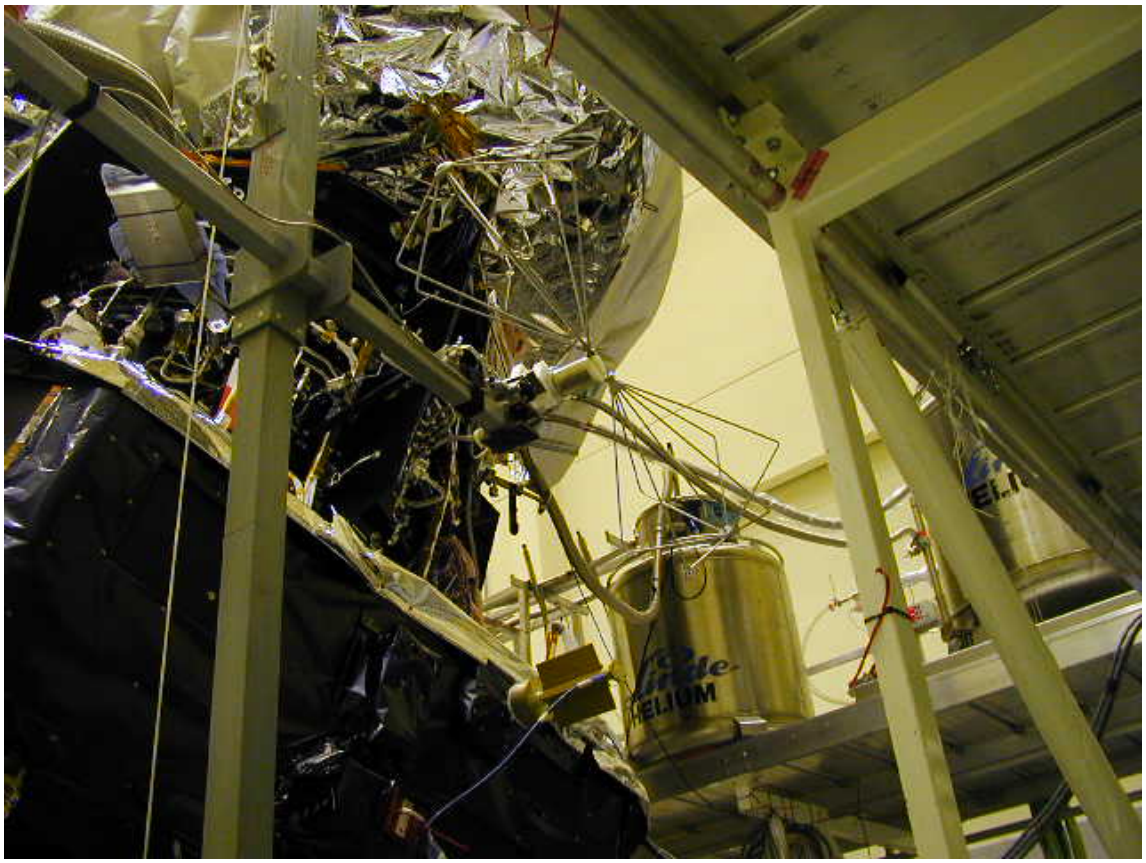
SPIRE position EM 10 kHz to 30 MHz Vertical Polarisation



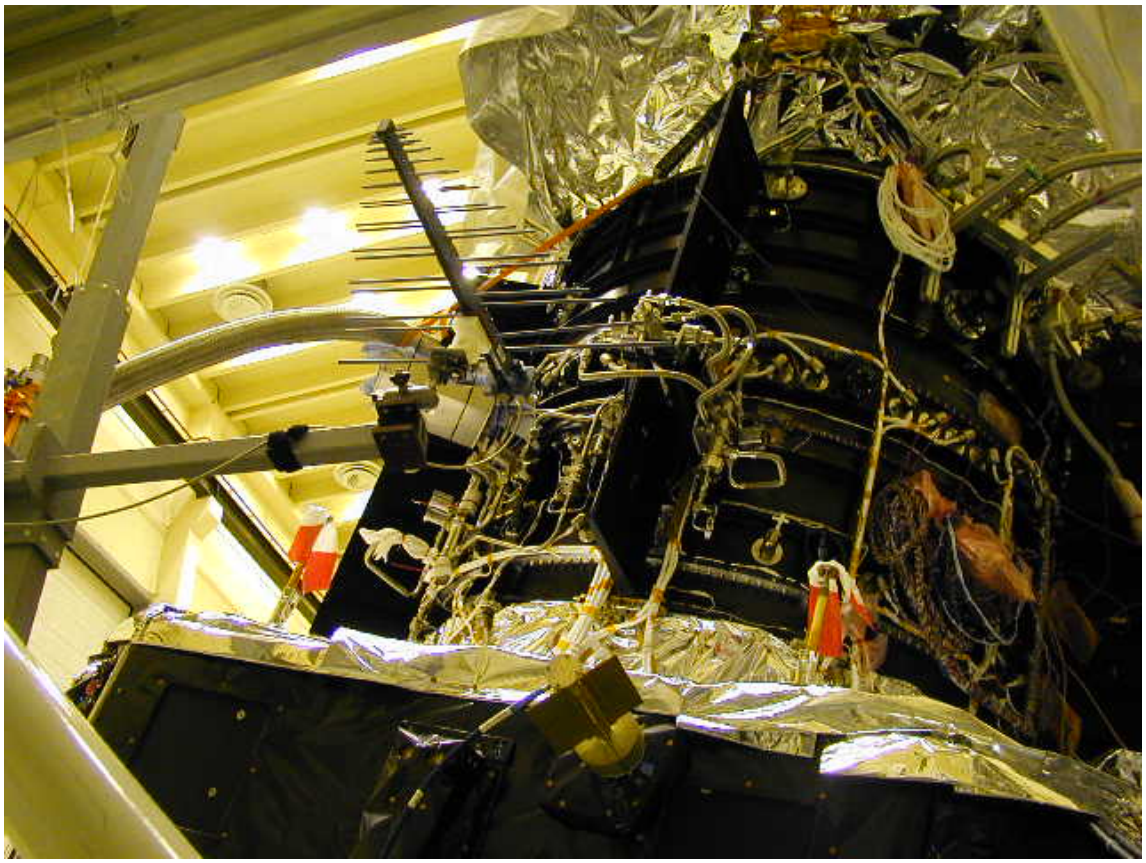
SPIRE position EM 30 MHz to 200 MHz vertical polarisation



SPIRE position EM 200 MHz to 1 GHz Vertical Polarisation

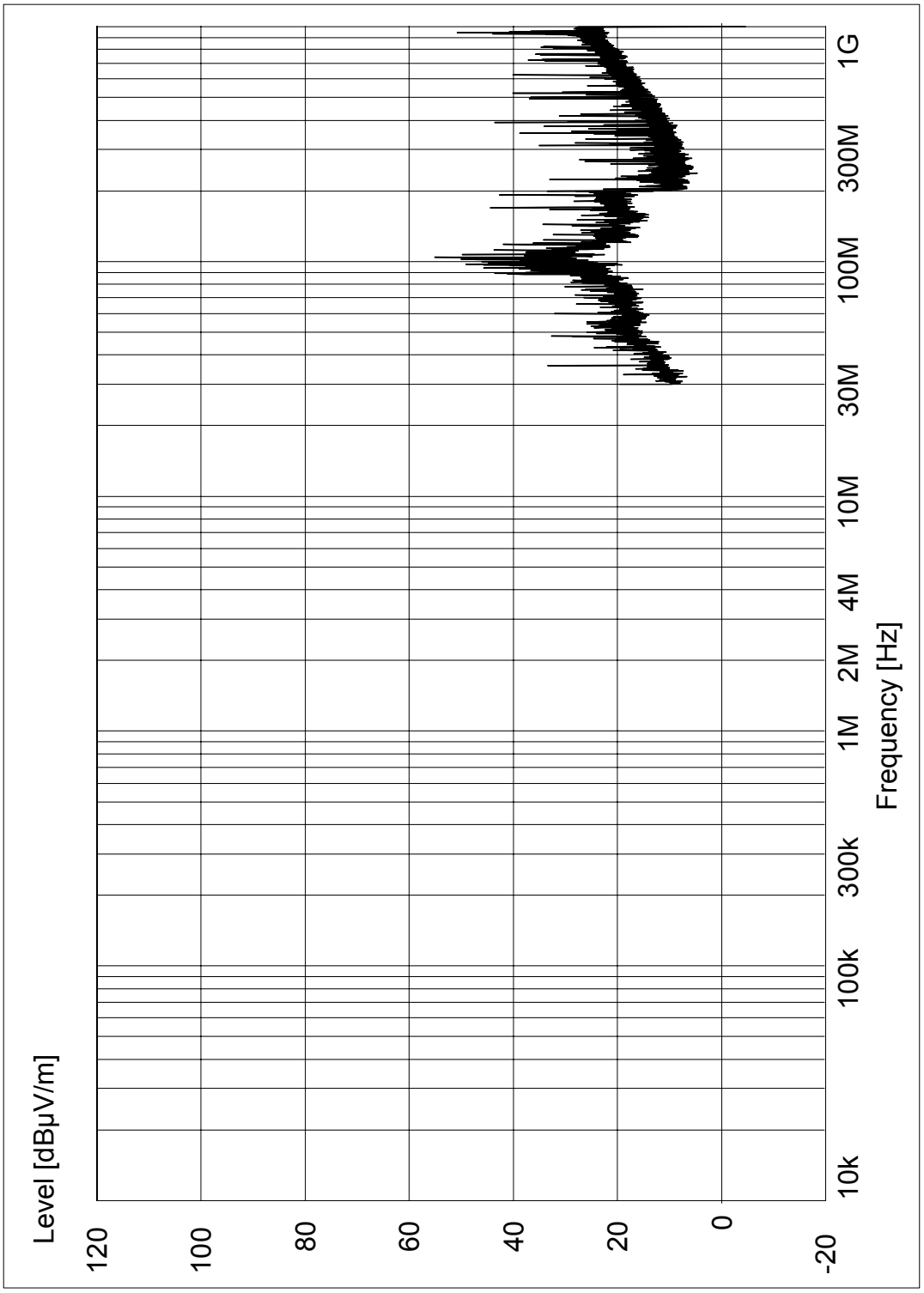


SPIRE position EM 30 MHz to 200 MHz Horizontal Polarisation

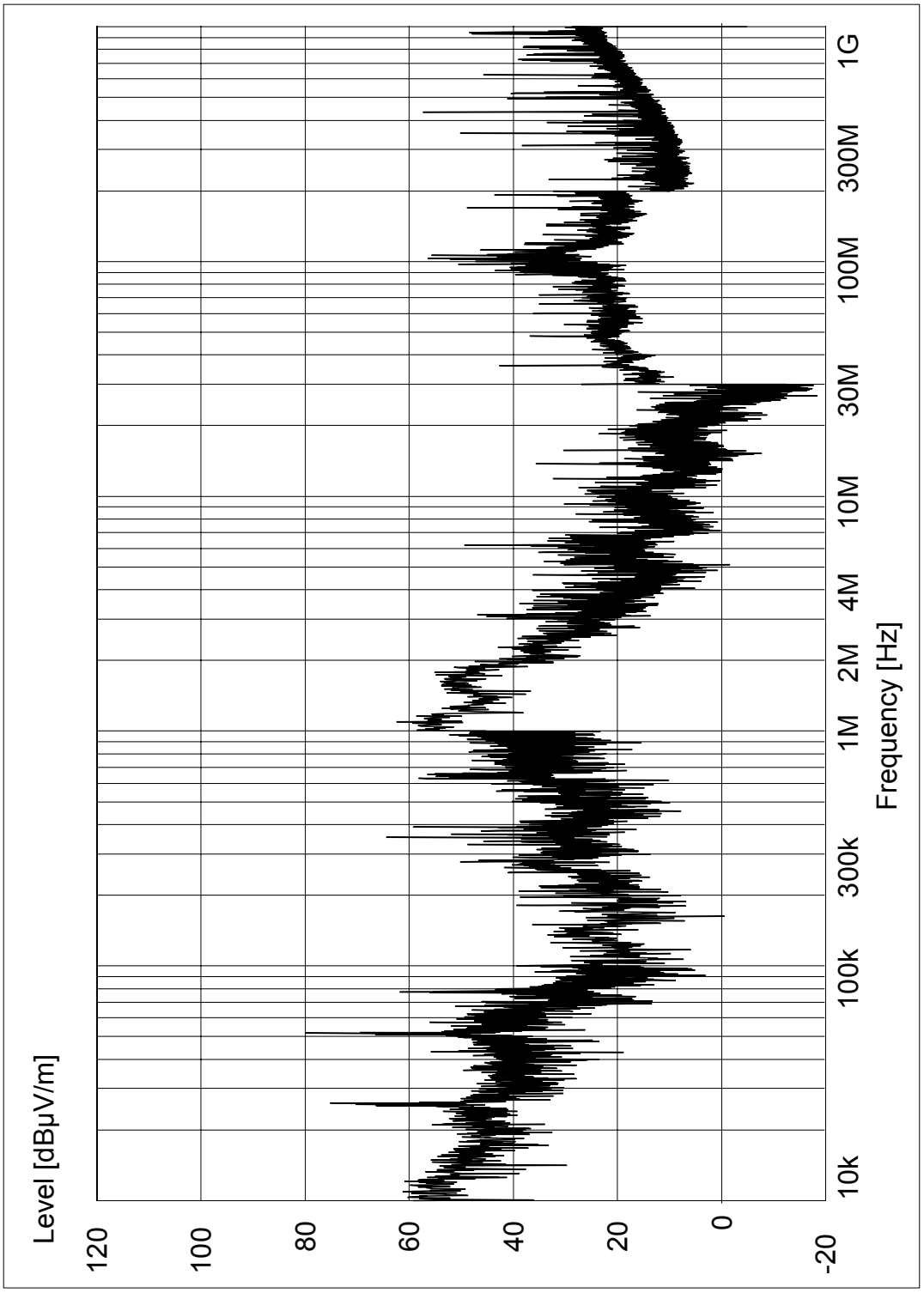


SPIRE position EM 200 MHz to 1 GHz Horizontal Polarisation

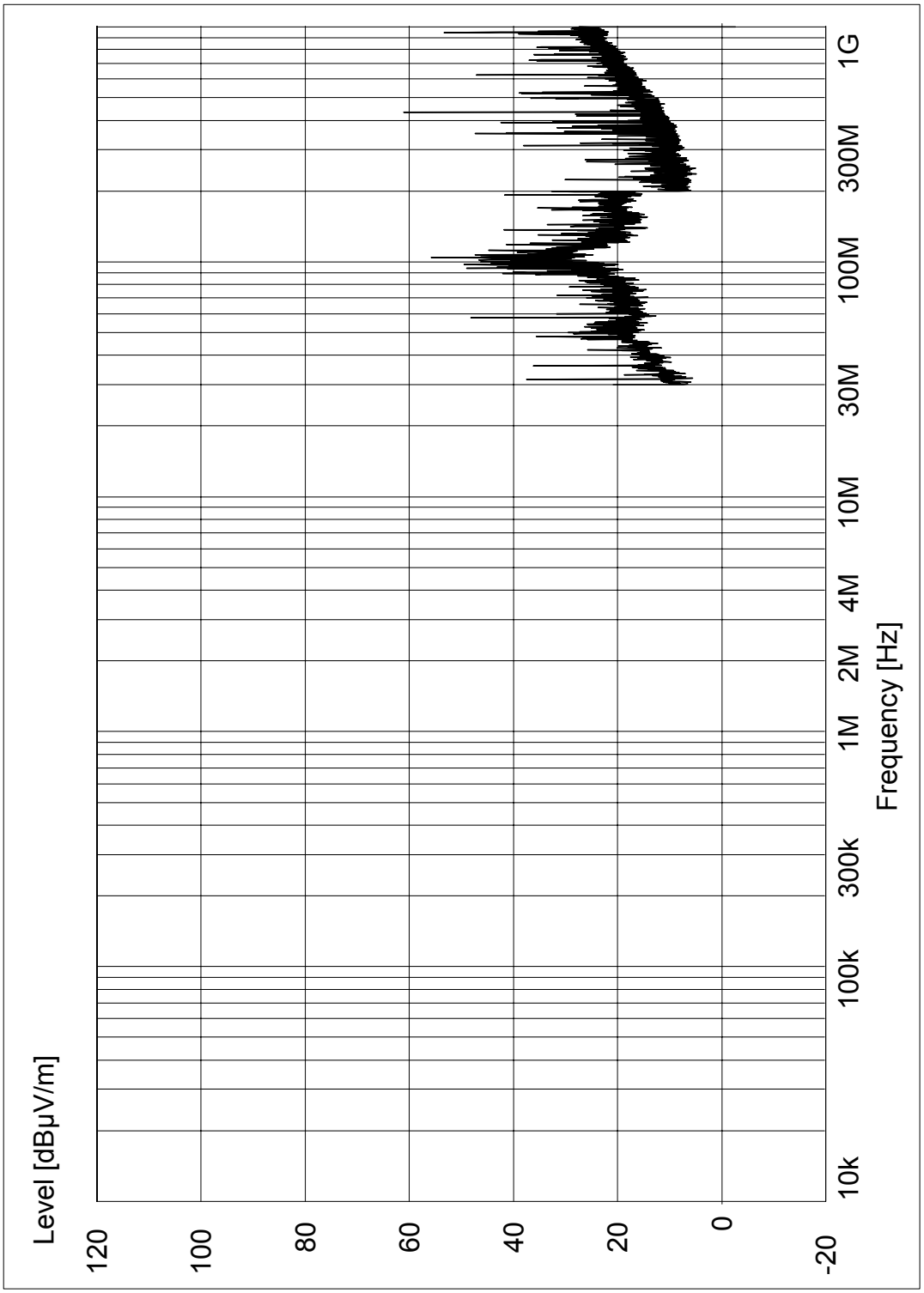
21-08-2008 12:29h
Plot 10 SPIRE position EM HP run 1



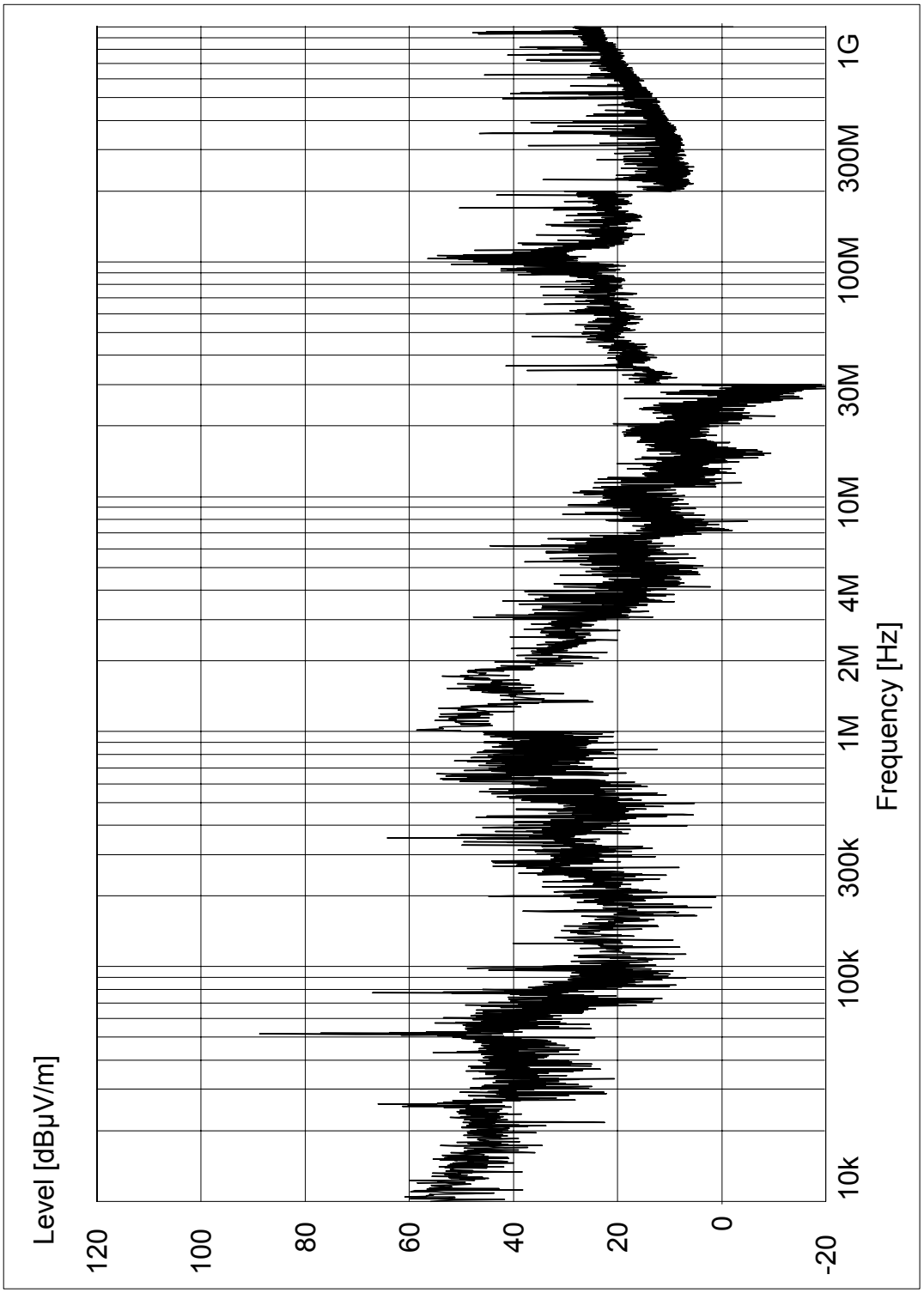
21-08-2008 14:20h
Plot 11 SPIRE position EM VP run 2



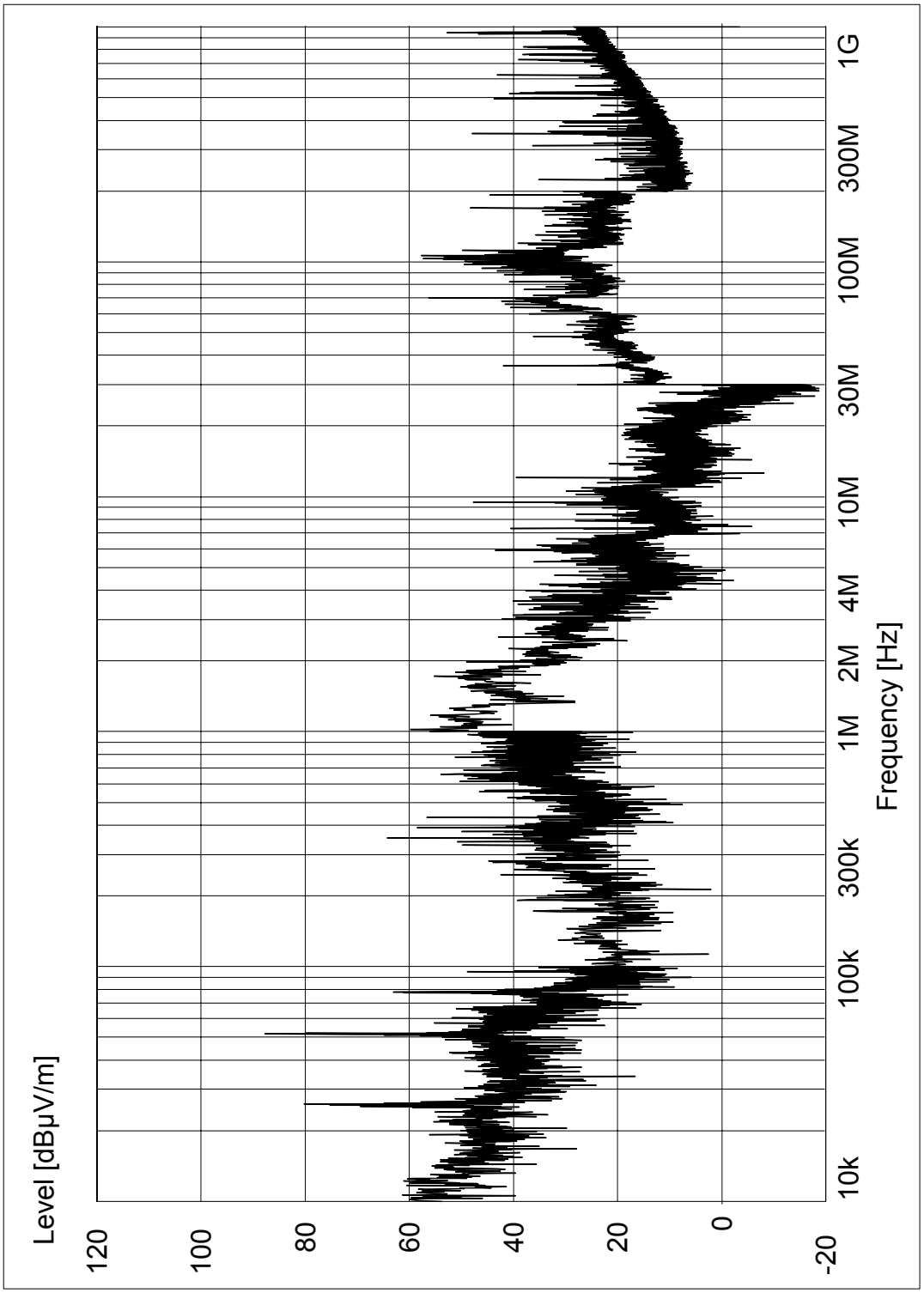
21-08-2008 15:10h
Plot 12 SPIRE position EM HP run 2



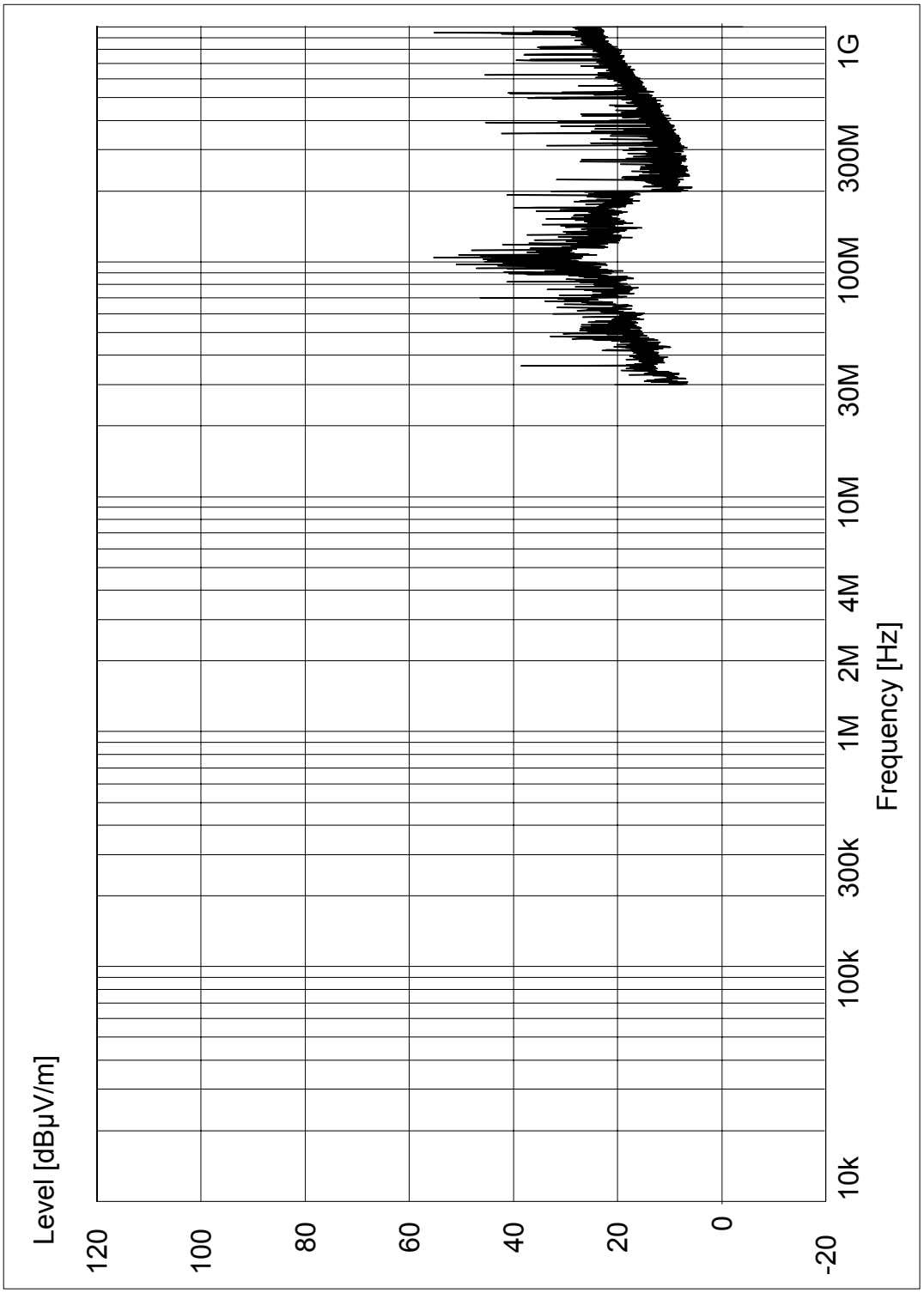
21-08-2008 15:30h
Plot 13 SPIRE position EM VP run 3



21-08-2008 17:30h
Plot 14 SPIRE position EM HP run 4

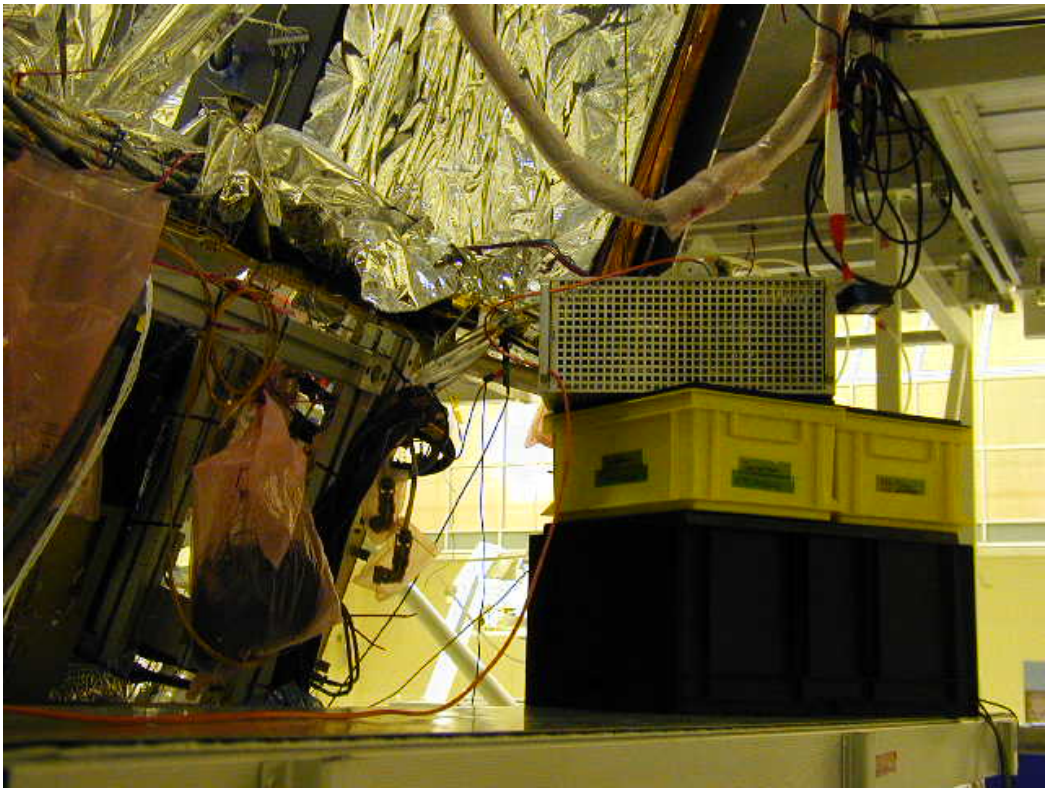


21-08-2008 18:18h
Plot 15 SPIRE position EM HP run 4

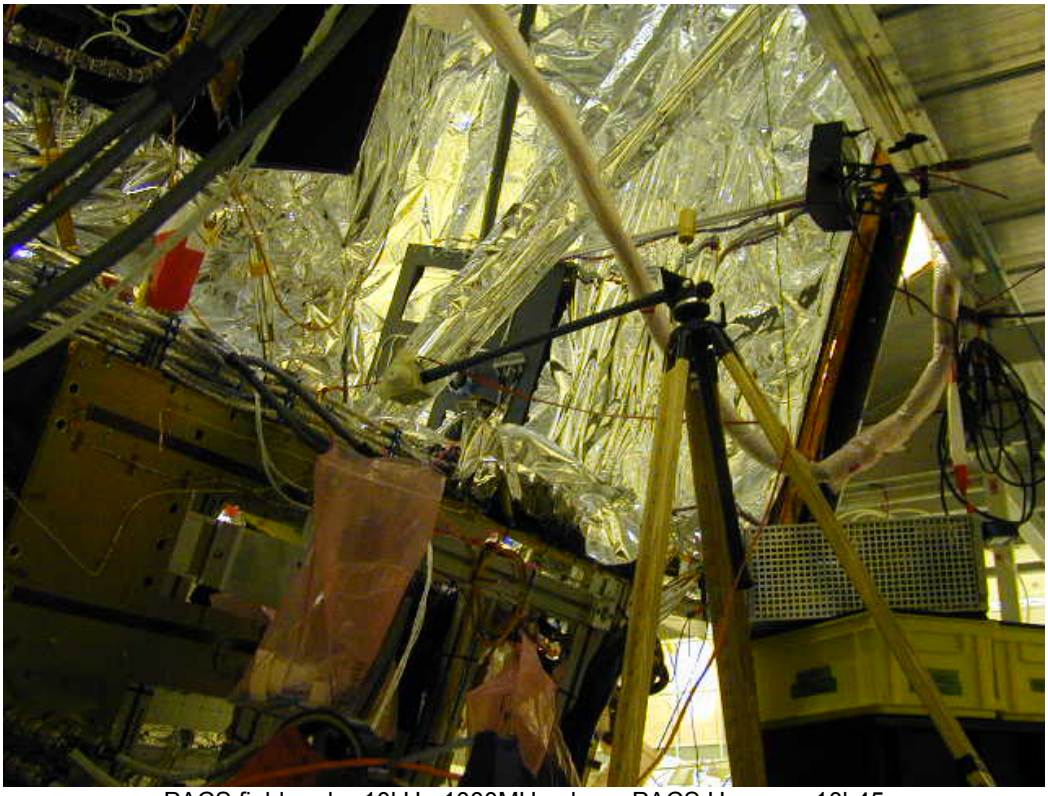


Annex F. E-field Monitoring at PACS position using 10 kHz to 1GHz field probe

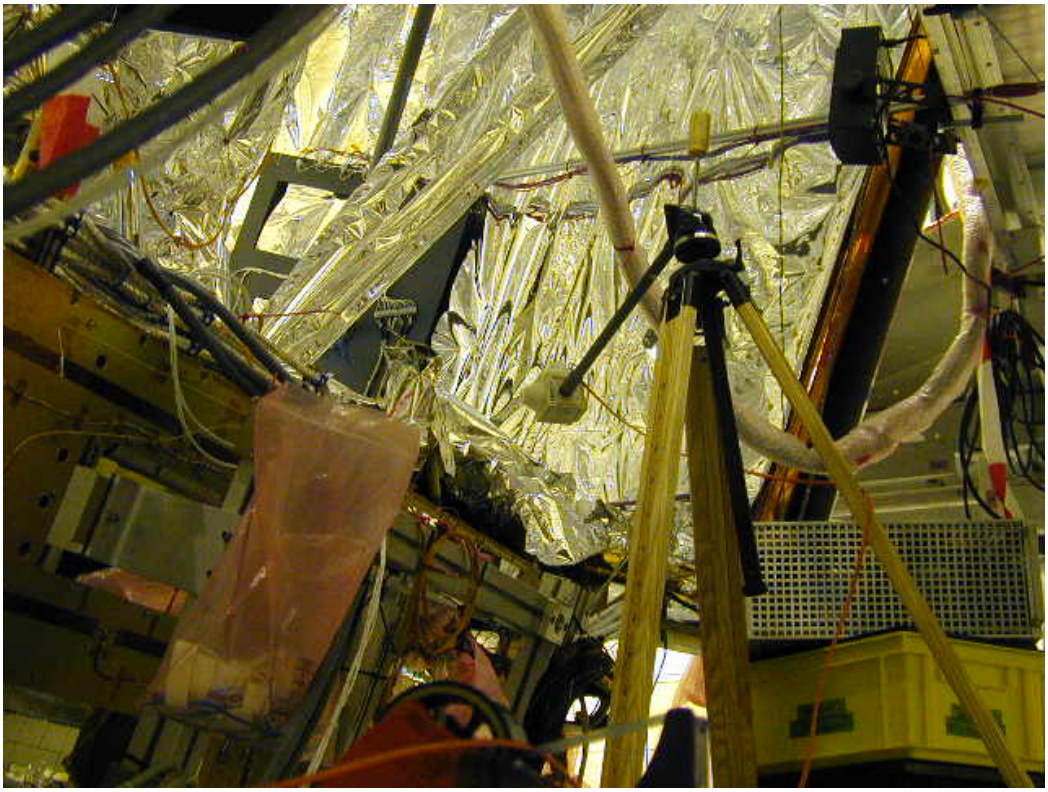
Set-up monitoring at PACS unit



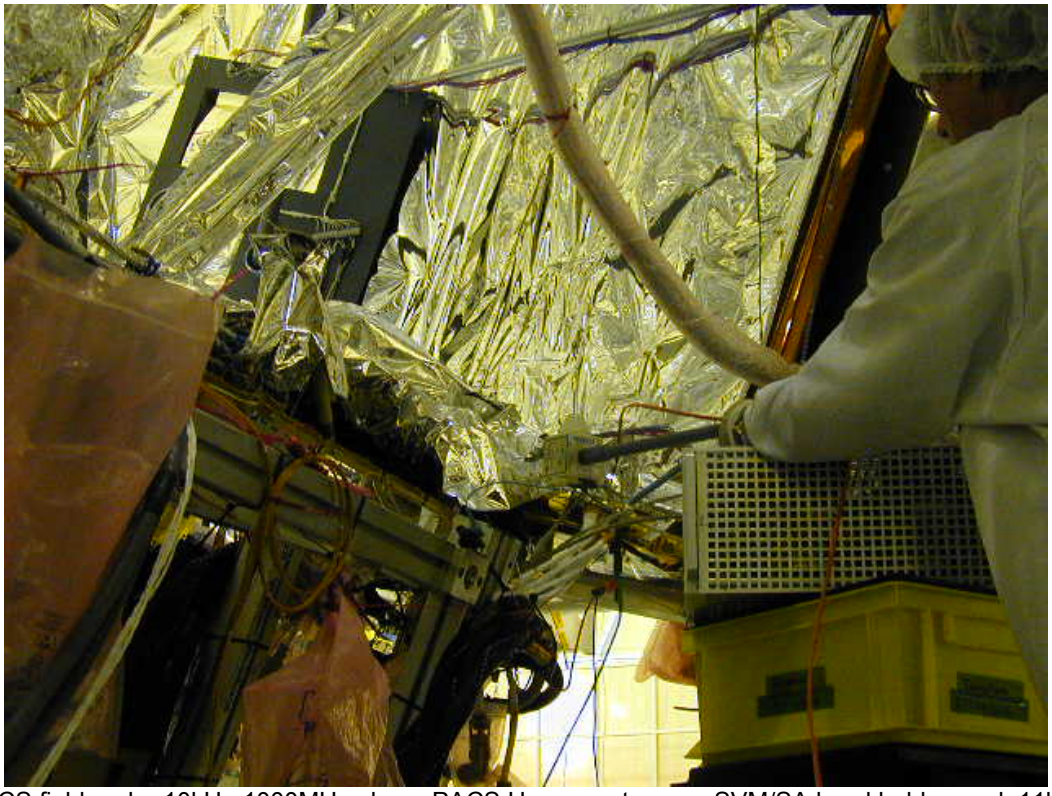
PACS field probe 10kHz-1000MHz on H-Field Amplifier several positions



PACS field probe 10kHz-1000MHz above PACS Harness_10h45



PACS field probe 10kHz-1000MHz above PACS Harness at corner SVM/SA_10h58



PACS field probe 10kHz-1000MHz above PACS Harness at corner SVM/SA head held on rod_11h04