SECTION 9
CONDUCTED EMISSIONS

9.1 SCOPE

The purpose of this test was to measure emissions conducted through the power and interconnecting leads of the EUT. Conducted emissions were measured over the frequency range of 150 kHz to 30 MHz. The EUT was tested to the requirement of RTCA/DO-160E, Section 21, Category L.

9.2 LEADS SUBJECT TO TEST

P1 +28 Vdc
P1 Return
P2 Return
P2 +28 Vdc
P1 Cable
P2 Cable
CAM COAX
NAV COAX

9.3 TEST PROCEDURE

The general test setup is shown in Figure 9-1. The EUT was operated as described in Section 3 of this test report.

All power, signal, and control leads were separated from the ground plane by 5 centimeters. The following test procedure was repeated for all leads subject to testing.

A current probe (see Figure 9-2 for current-probe correction factors) was attached around each test lead, in turn.

The automated spectrum analyzer was used to measure emissions within the frequency range from 150 kHz to 30 MHz. All signals within the frequency range from 150 kHz to 30 MHz were measured and recorded, including all out-of-spec signals.

While the measurement system was scanning through the frequency range, the appropriate current probe factor (impulse bandwidth) was added to the reading, using the equations found in the sample calculation section. The data was then plotted against the appropriate limit.

The following data was noted:

1. Receiver/analyzer and current probe used
2. Frequency and level (dBµA) of the emission signal
3. Calculated level compared to the appropriate limit level
4. All correction factors (for manual data)
5. Identification of offending leads

9.4 SAMPLE CALCULATION

Total Level (dBµA) =

Reading (dBµV) + Current Probe Factor (dB)

9.5 TEST RESULTS

RTCA/DO-160E	Conducted Emissions	Section 21	Category L
Manufacturer:	L3 Communications/GNS		
Model:	ADR7050	S/N:	0613011

Line Under Test	Results	*Comments	Appendix D Filename
P1 +28 Vdc	Under Limit		R061261TSec21CE002
P1 Return	Under Limit		R061261TSec21CE003
P2 Return	Under Limit		R061261TSec21CE004
P2 +28 Vdc	Under Limit		R061261TSec21CE005
P1 Cable	Under Limit	Shielded Cable	R061261TSec21CE006
P2 Cable	Under Limit	Shielded Cable	R061261TSec21CE007
CAM COAX	Over Limit	Shielded Cable	R061261TSec21CE008
	Under Limit	Grounded I/O Cable	R061261TSec21CE0011
NAV COAX	Over Limit	Shielded Cable	R061261TSec21CE009
	Under Limit	Grounded I/O Cable	R061261TSec21CE0010

*Conducted Emissions Passes with IFR 4000 Reduced to -101 dBm (from -68 dBm) I/O Coax Connector Grounded and Scope Probe Removed

9.6 LIST OF TEST EQUIPMENT: METHOD CONDUCTED EMISSIONS

Item	Characteristics	Manufacturer	Model No.	Serial No.	Cal Due
Spectrum Analyzer	9 kHz - 22 GHz	Hewlett Packard	8593EM	3639A00177	03-15-07
Current Probe	10 kHz - 100 MHz	Solar Electronics	6741-1	894503	07-07-06
Current Probe	10 kHz - 100 MHz	Solar Electronics	6741-1	911313	11-14-06
Current Probe	10 kHz - 400 MHz	EG&G	SCP-1(3)	25	11-16-06
RF Cable (Blue)	0.01 Hz - 18 GHz	Micro-Coax	UFA210A-0-1920	99F0430	06-09-06
RF Cable (Blue)	0.01 Hz - 18 GHz	Micro-Coax	UFA210A-0-0600	99F0435	06-09-06
5 uH LISNs	100 kHz - 1 GHz	Solar Electronics	6338-5-TS-50-N	903753 903755	03-01-07
RF Feedthrough Capacitors	10 uF High Voltage	Solar Electronics	7012-106R	C701202 C701207	No cal required
Shielded Room	16' x16' x10'	Ray proof	SR007	SL45432	No cal required
Power Supply	36 Vdc, 15 Amp	Kepco	ATE36-15DM	F69312	No cal required

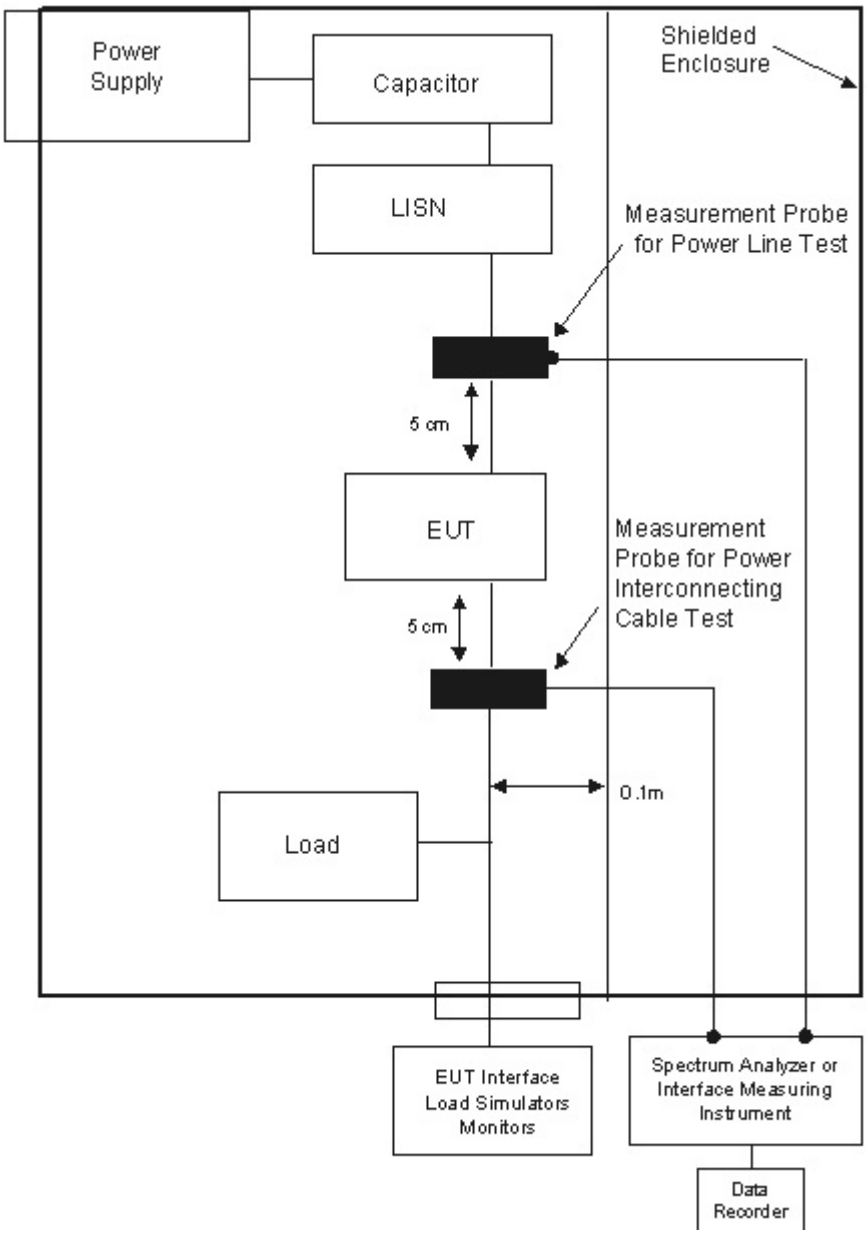


Figure 9-1
RF Conducted Emissions General Test Setup

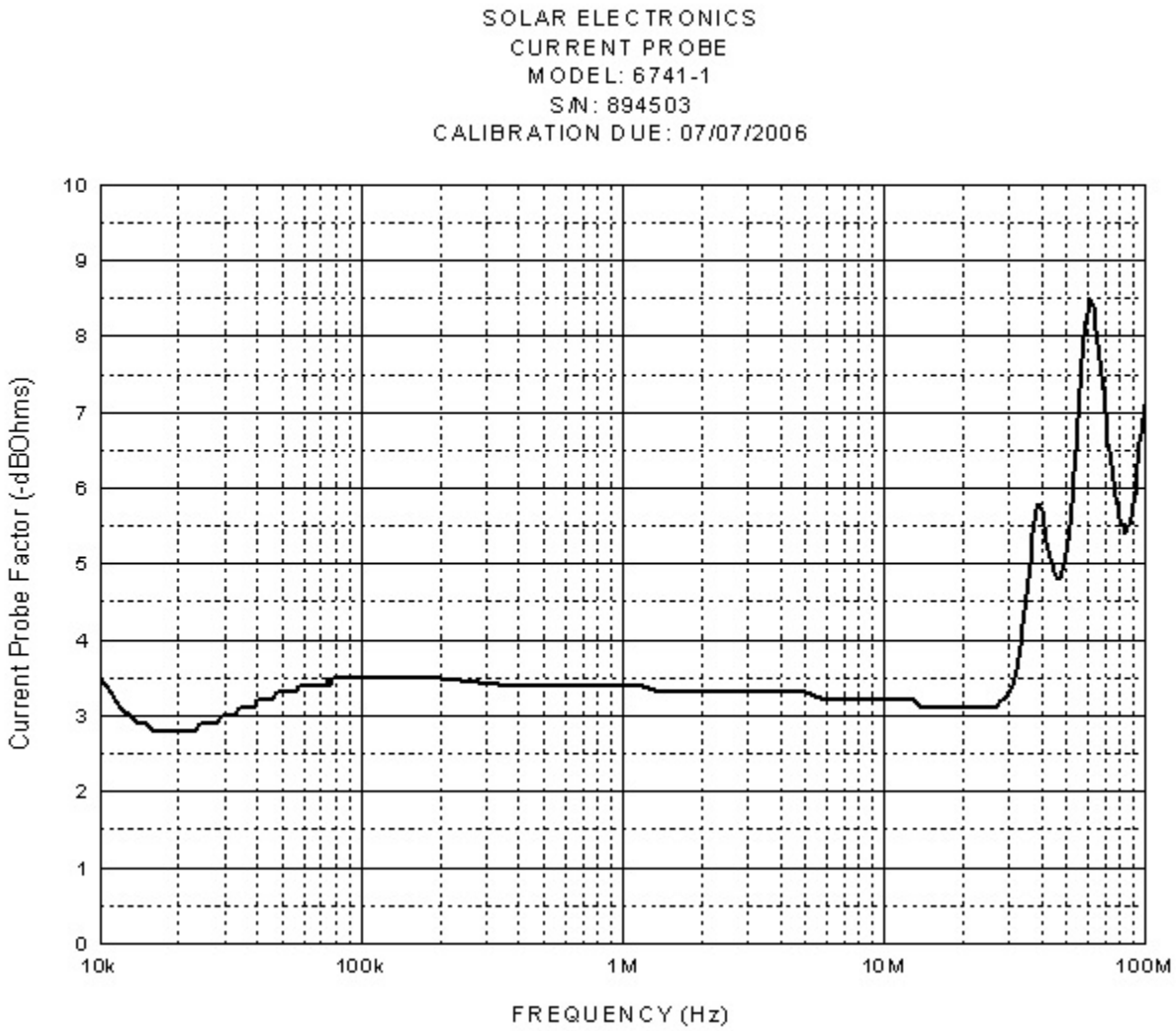


Figure 9-2
Current Probe

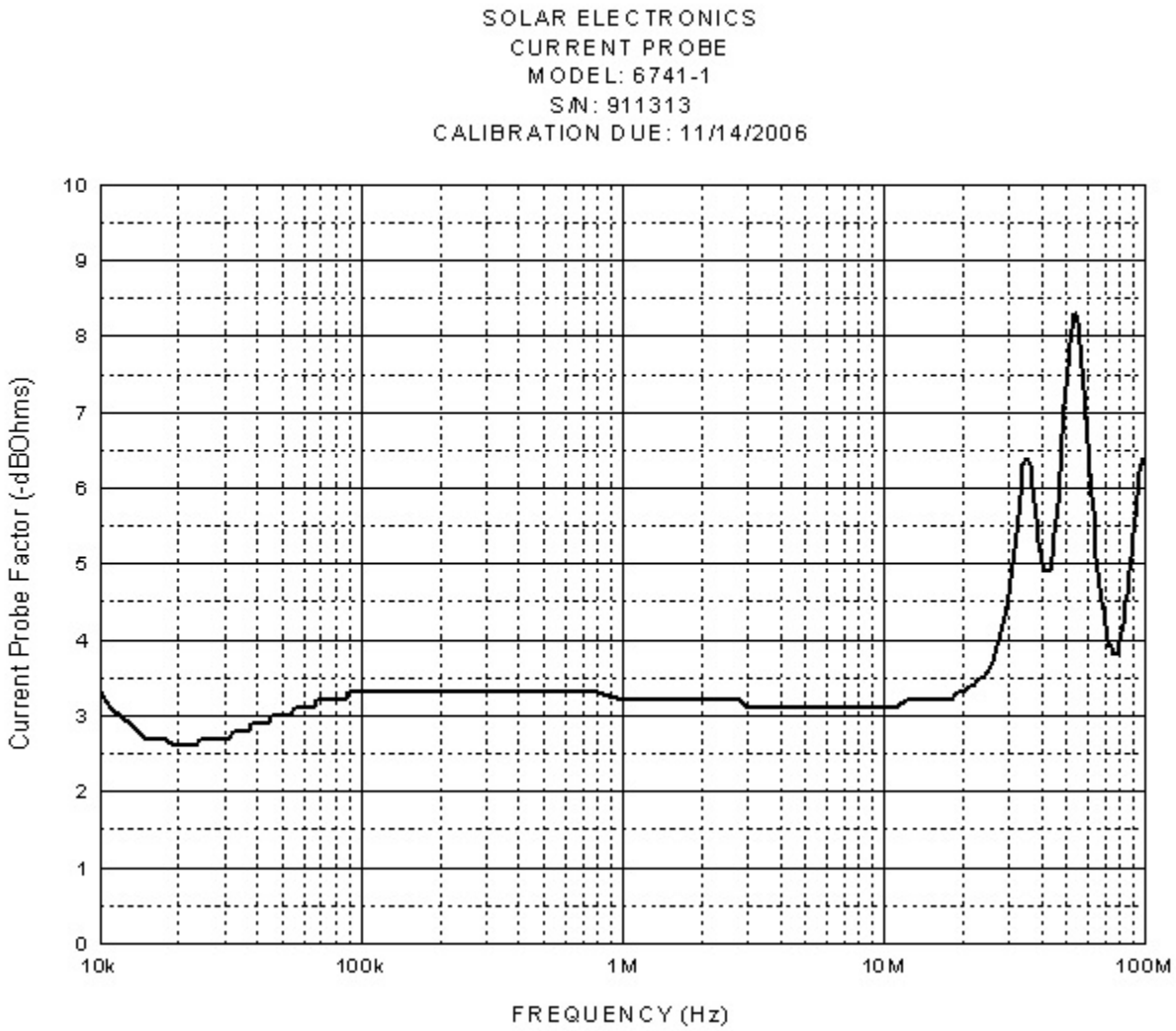


Figure 9-3
Current Probe

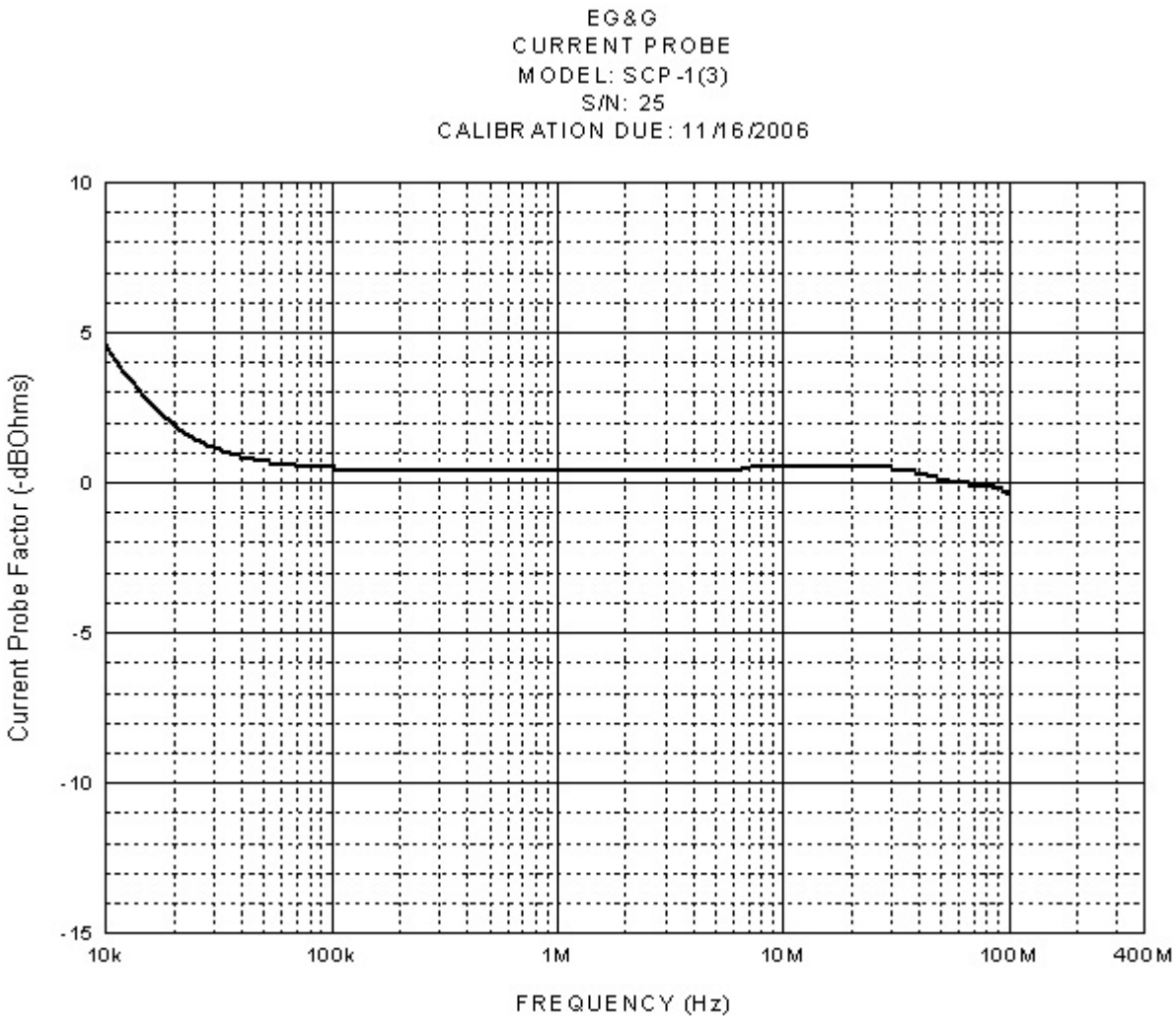
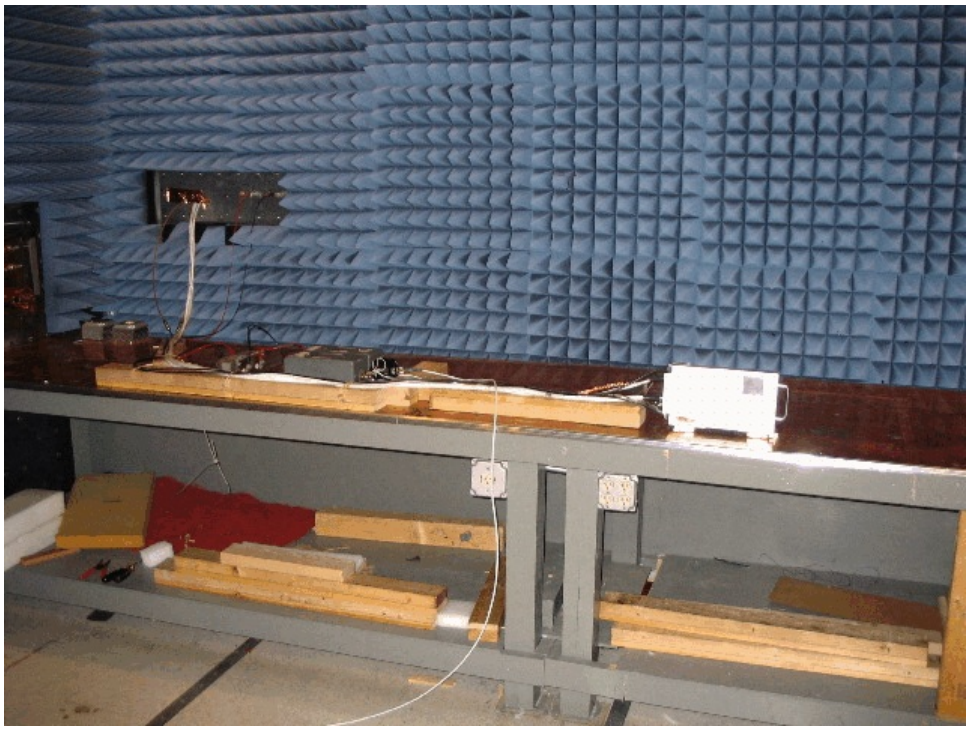


Figure 9-4
Current Probe



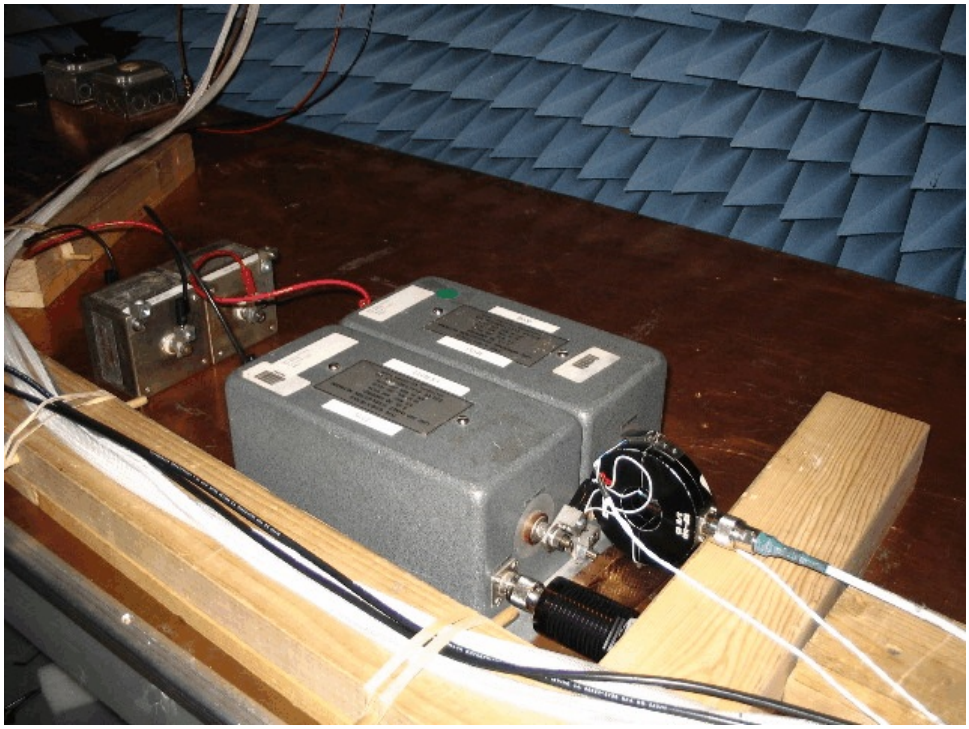


Figure 9-5
Photograph of Conducted Emissions Test Setup

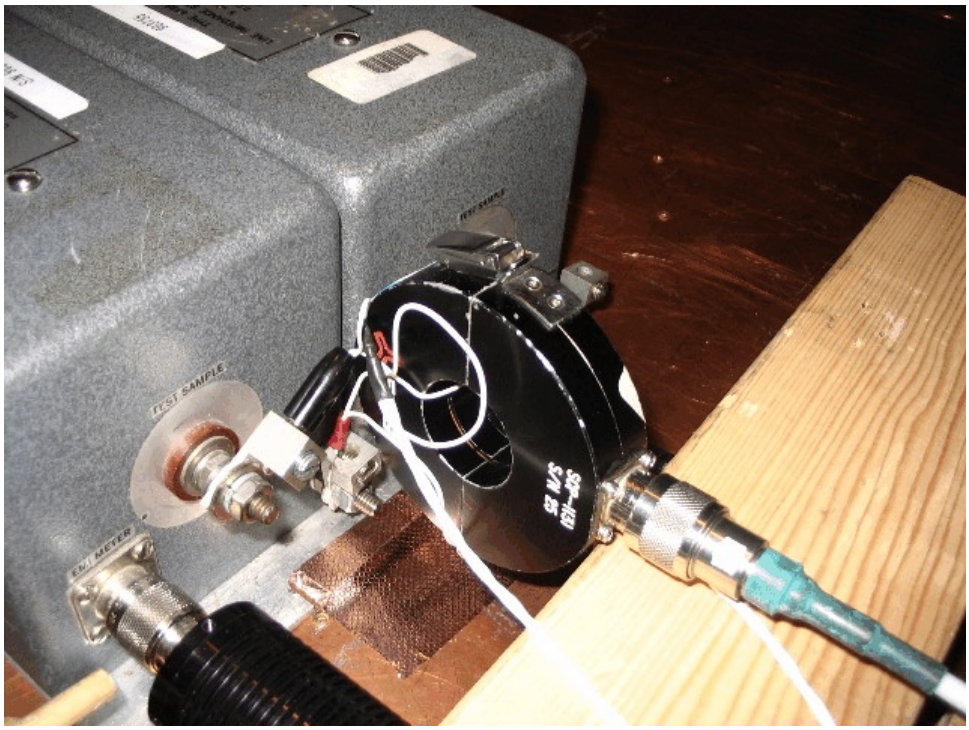


Figure 9-6
Photograph of Conducted Emissions Test Setup

SECTION 10
RADIO FREQUENCY RADIATED EMISSIONS

10.1 SCOPE

The purpose of this test was to measure the electric field emissions radiated from the EUT. Emissions were measured over the frequency range of 2 MHz to 6 GHz. The EUT was tested to the requirement of RTCA/DO-160E, Section 21, Category L.

10.2 TEST PROCEDURE

The general test setup is shown in Figure 10-1. The EUT was operated as described in Section 3 of this test report.

A 5-µH LISN was inserted into each dc power lead 1 meter from the EUT and bonded on the ground plane. All power, signal, and control leads were separated from the ground plane by 5 centimeters.

A probe was used to determine the area of maximum radiation from the EUT. This part of the unit was oriented closest to the receiving antenna during the test. Radiated emissions were measured at a distance of one meter from the EUT.

A variety of antennas was necessary to cover the required frequency range of the test. The following antennas and the corresponding frequency ranges were used to cover the specified frequency range:

Antenna	Frequency Range
Active Rod	2 MHz - 30 MHz
Biconical	30 MHz - 200 MHz
Log Periodic	200 MHz - 1000 MHz
Double Ridged Guide	1 GHz - 6 GHz

The antenna factors for the above antennas can be found in Figures 10-2 through 10-5. At frequencies above 30 MHz, emissions were measured using both horizontal and vertical antenna polarizations.

The Hewlett Packard 8593EM Spectrum Analyzer was used to measure emissions within the frequency range from 2 MHz to 6 GHz. All signals within the frequency range from 2 MHz to 6 GHz were measured and recorded, including all out-of-spec signals.

While the measurement system was scanning through the frequency range, the appropriate antenna factor was added to the reading, using the equations found in the sample calculation section. The data was then plotted against the appropriate limit.

The following data was noted on all test data sheets:

1. Receiver/analyzer and antenna used
2. Frequency and level (dBµV) of the emission signal
3. Calculated level compared to the appropriate limit level
4. All correction factors (for manual data)

10.3 SAMPLE CALCULATION

Total Level (dBµV/m) =

Reading (dBµV) + Antenna Factor (dB) + Cable Loss (dB)

- Pre Amplifier Gain (dB)

10.4 TEST RESULTS

RTCA/DO-160E	RF Radiated Emissions	Section 21	Category L
Manufacturer:	L3 Communications/GNS		
Model:	ADR7050	S/N:	0613011

Frequency Range	Polarity	Mode	Results	Appendix E Filename
2 MHz - 25 MHz	Vertical	Ambient	Under Limit	R061261TSec21RE001
25 MHz - 200 MHz	Vertical/Horizontal	Ambient	Under Limit	R061261TSec21RE001
200 MHz - 1 GHz	Vertical/Horizontal	Ambient	Under Limit	R061261TSec21RE001
1 GHz - 6 GHz	Vertical/Horizontal	Ambient	Under Limit	R061261TSec21RE003
2 MHz - 25 MHz	Vertical	Power ON	Under Limit	R061261TSec21RE002
25 MHz - 200 MHz	Vertical/Horizontal	Power ON	Under Limit	R061261TSec21RE002
200 MHz - 1 GHz	Vertical/Horizontal	Power ON	Under Limit	R061261TSec21RE002
1 GHz - 6 GHz	Vertical/Horizontal	Power ON	Under Limit	R061261TSec21RE004

10.5 LIST OF TEST EQUIPMENT: METHOD RF RADIATED EMISSIONS

Item	Characteristics	Manufacturer	Model No.	Serial No.	Cal Due
Spectrum Analyzer	9 kHz - 22 GHz	Hewlett Packard	8593EM	3639A00177	03-15-07
Active Rod Antenna	30 Hz - 50 MHz	EMCO	3301B	9808-4049	02-20-07
Biconical Antenna	20 MHz - 200 MHz	EMCO	3104C	49230	06-10-06
Double Ridged Guide Antenna	200 MHz - 2 GHz	Electro-metrics	RGA-30AT1000	2462	09-06-06
Double Ridged Guide Antenna	1 GHz - 18 GHz	Electro Metrics	3115	9907-5854	11-28-06
Preamplifier	10 kHz - 1000 MHz	Sonoma	310N	231504	11-07-06
Microwave Amplifier	45 MHz - 50 GHz	Hewlett Packard	83051A	3332A00422	03-16-07
Microwave Amplifier	500 MHz - 26.5 GHz	Hewlett Packard	83017A	3123A00514	03-16-07
RF Cable (Blue)	0.01 Hz - 18 GHz	Micro-Coax	UFA210A-0-0240	02A0872	06-09-06
RF Cable (Blue)	0.01 Hz - 18 GHz	Micro-Coax	UFA210A-0-1920	99F0430	06-09-06
RF Cable (Blue)	0.01 Hz - 18 GHz	Micro-Coax	UFA210A-0-0800	00J0378	06-09-06
5 uH LISNs	100 kHz - 1 GHz	Solar Electronics	6338-5-TS-50-N	903753 903755	03-01-07
RF Feedthrough Capacitors	10 uF High Voltage	Solar Electronics	7012-106R	C701202 C701207	No cal required
Shielded Room	16' x16' x10'	Ray proof	SR007	SL45432	No cal required
Power Supply	36 Vdc, 15 Amp	Kepco	ATE36-15DM	F69312	No cal required

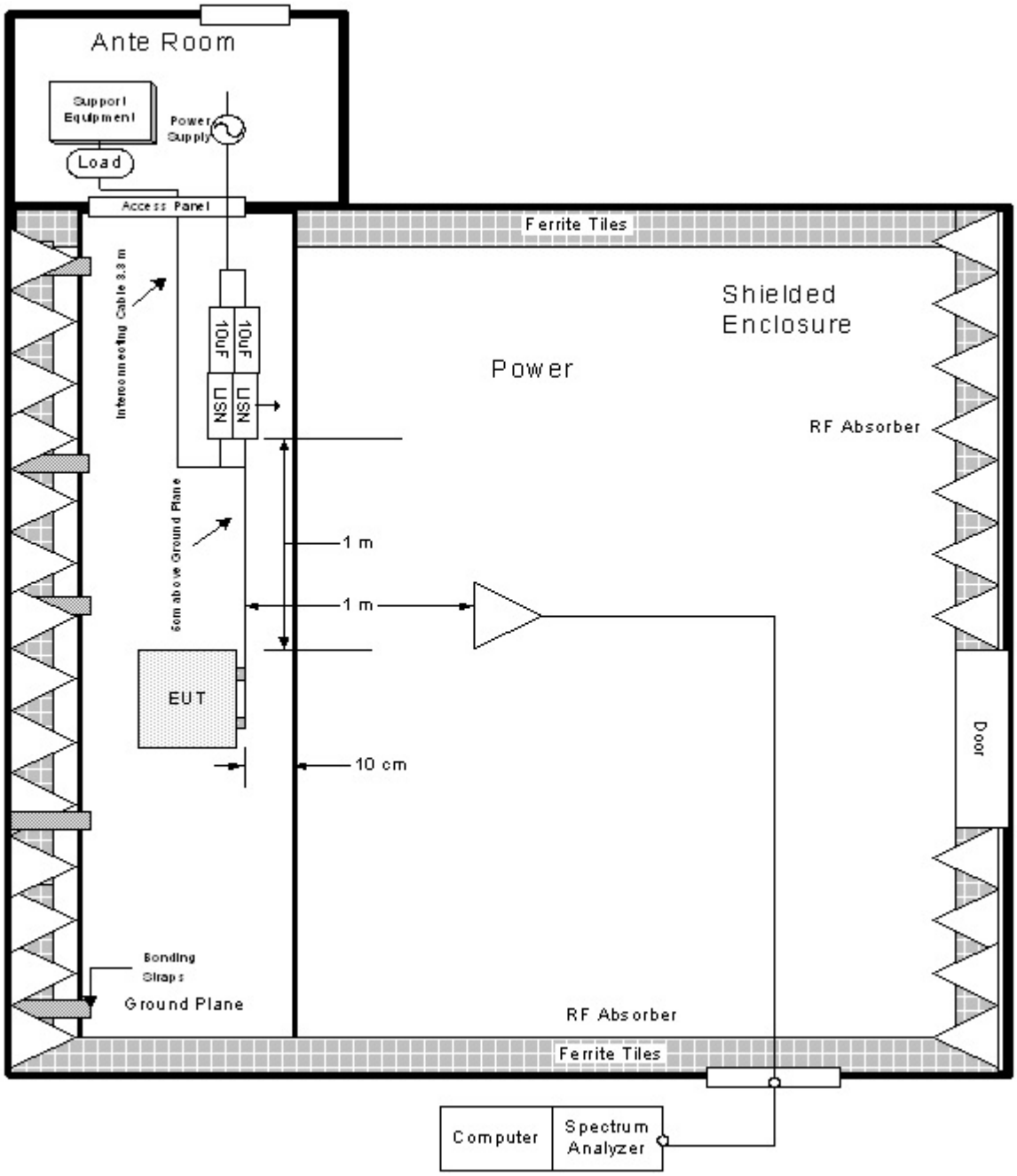


Figure 10-1
RF Radiated Emission Test General Test Setup
2 MHz to 6 GHz

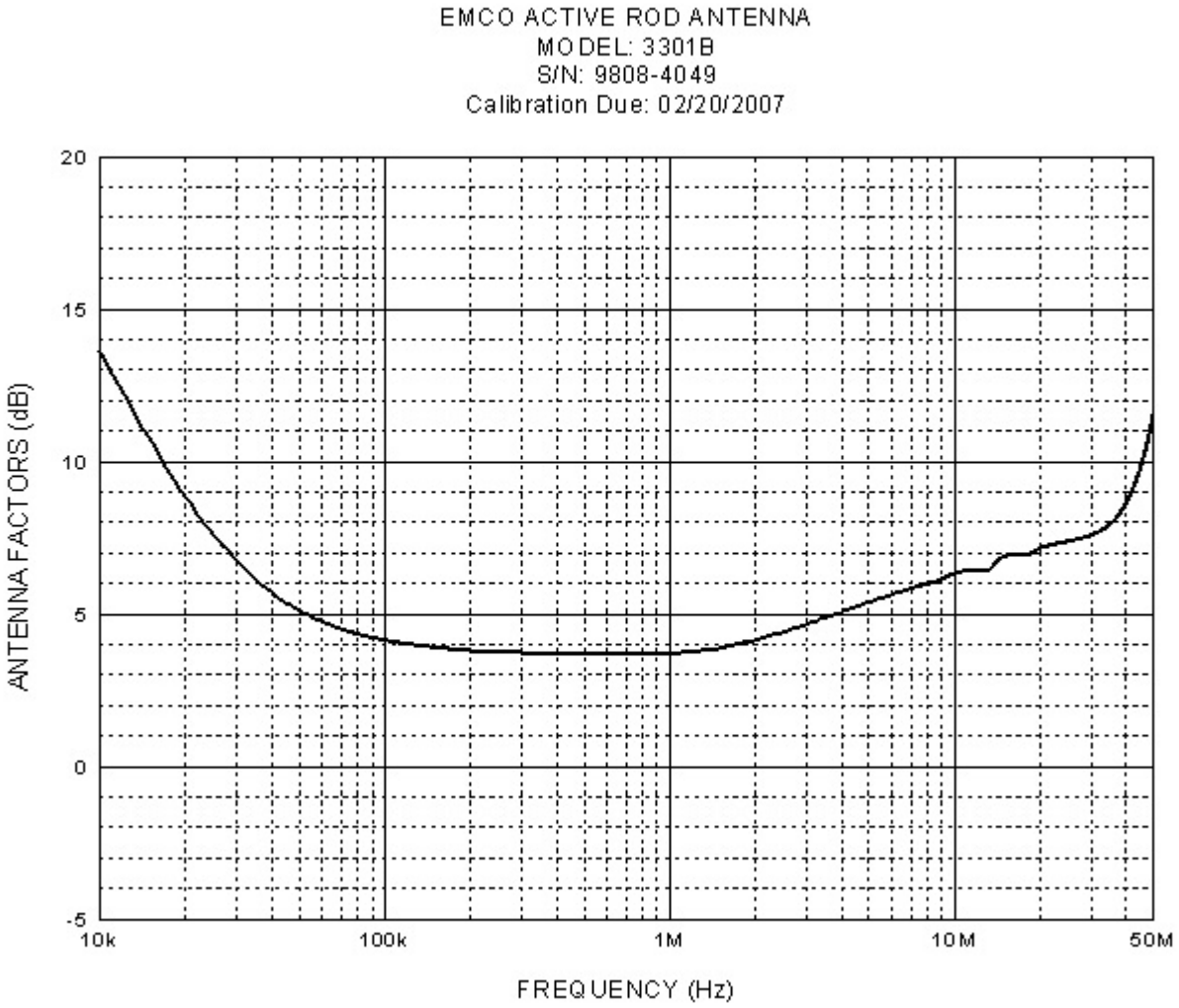


Figure 10-2
Active Rod Antenna Factor

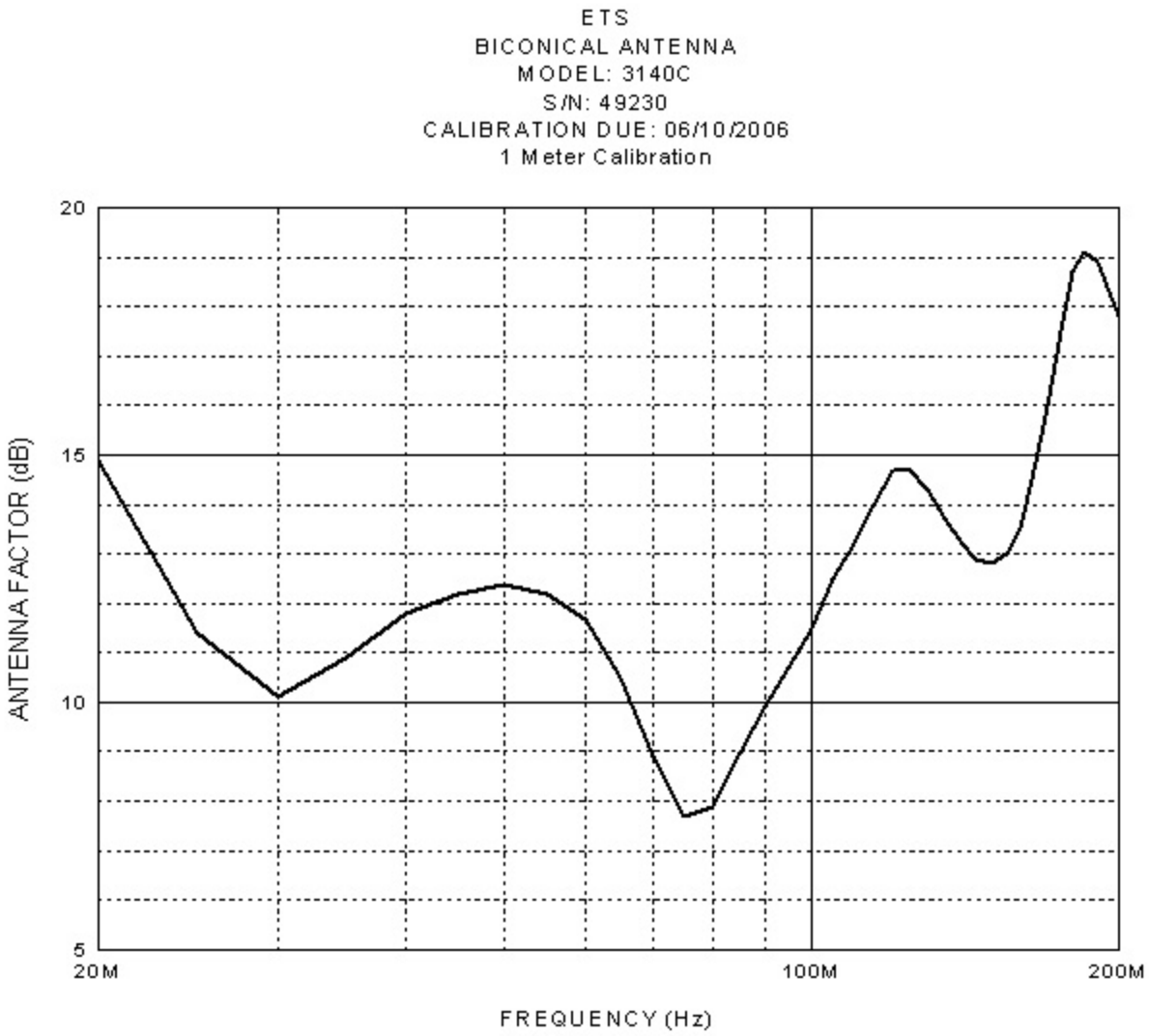


Figure 10-3
Biconical Antenna Factor

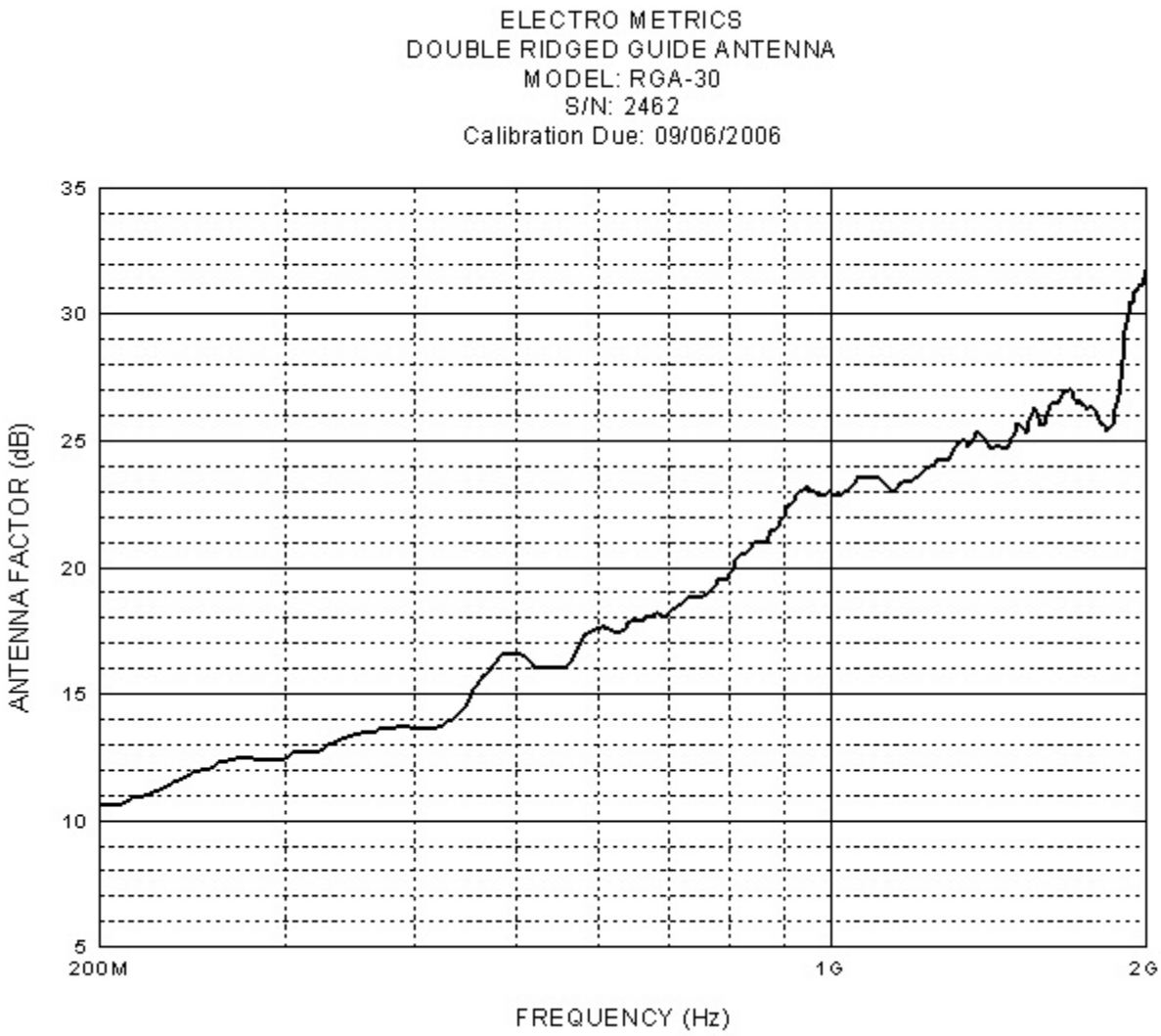


Figure 10-4
Double Ridged Guide Antenna Factor

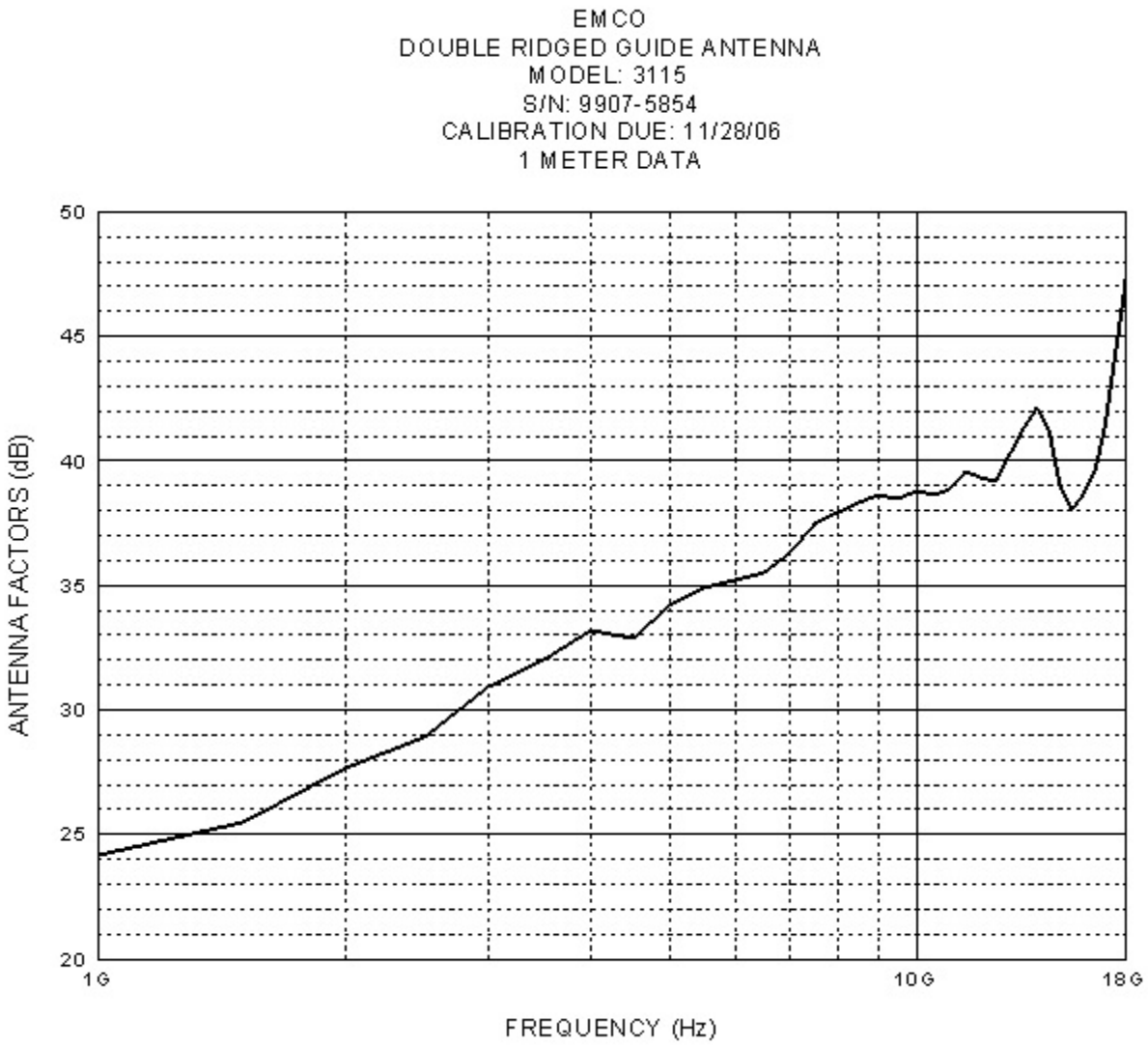


Figure 10-5
Double Ridged Guide Antenna Factor

Figure 10-6
Photograph of Radiated Emissions Test Setup
Active Rod Antenna
150 kHz to 30 MHz

Figure 10-7
Photograph of Radiated Emissions Test setup
Biconical Antenna, Vertical Polarization
30 MHz to 200 MHz

Figure 10-8
Photograph of Radiated Emissions Test Setup
Biconical Antenna, Horizontal Polarization
30 MHz to 200 MHz

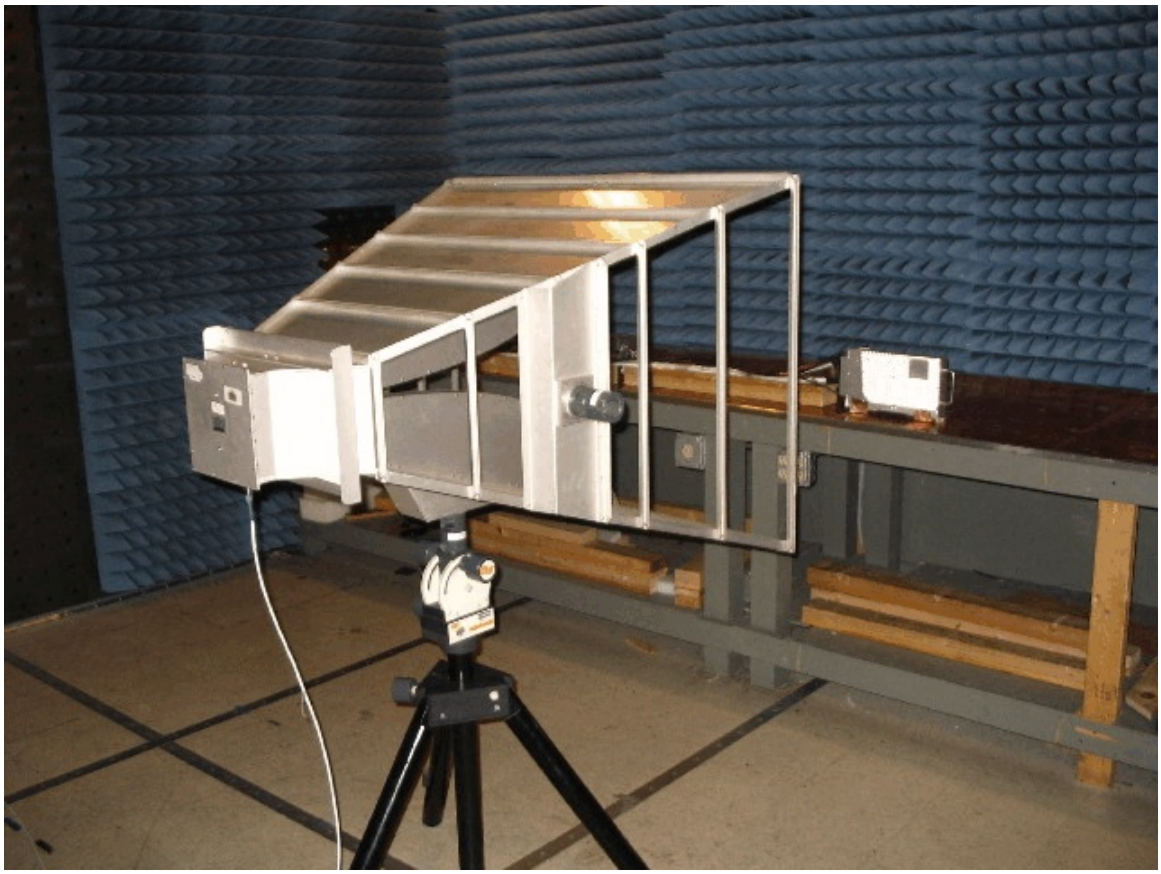


Figure 10-9
Photograph of Radiated Emissions Test Setup
Double Ridged Guide Antenna, Vertical Polarization
200 MHz to 1000 MHz

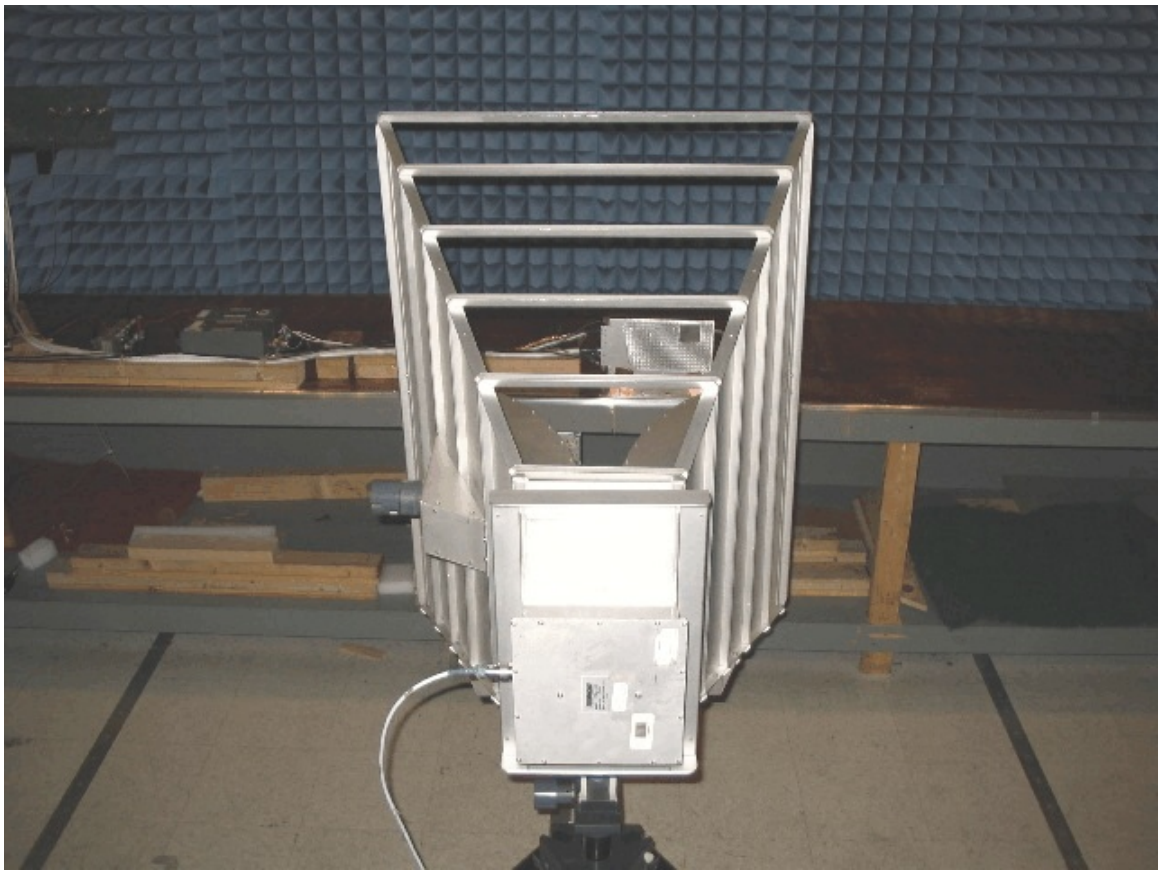


Figure 10-10
Photograph of Radiated Emissions Test Setup
Double Ridged Guide Antenna, Horizontal Polarization
200 MHz to 1000 MHz

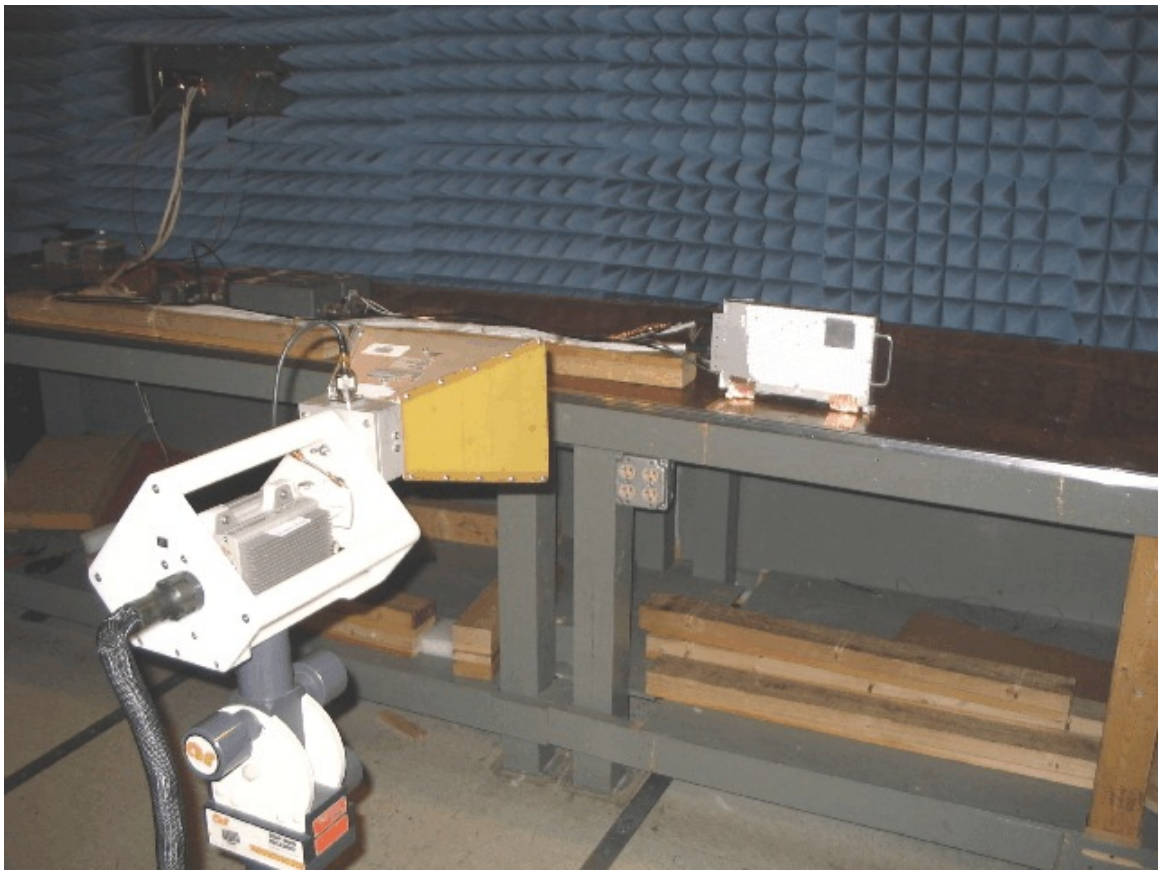


Figure 10-11
Photograph of Radiated Emissions Test Setup
Horn Antenna, Vertical Polarization
1 GHz to 6 GHz

Figure 10-12
Photograph of Radiated Emissions Test Setup
Horn Antenna, Horizontal Polarization
1 GHz to 6 GHz

APPENDIX D
DATA FOR SECTION 21, CE

RTCA/DO-160E, Section 21

150 kHz - 30 MHz, Category L, M & H, Power Leads

Conducted Emissions Scan

EUT - ADR-7050

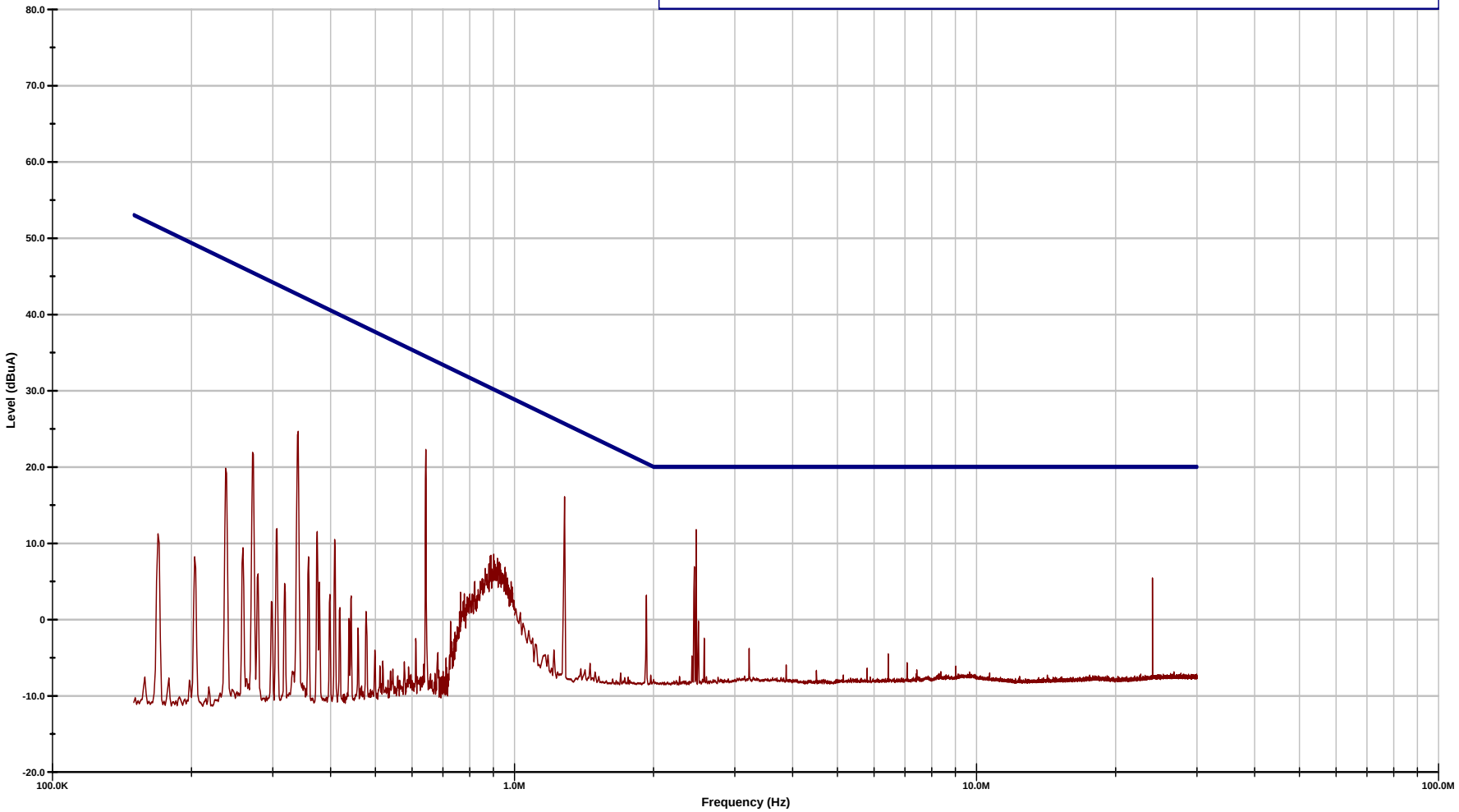
S/N - 0613011

Mode - Power on

Pin # - P1

Line - +28 VDC Line

Notes -



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APPENDIX D
SECTION 21, CE
PAGE 2

Operator: CPD

EUT: ADR-7050

H:\Test_Data\2006\JN 1261\Data\R061261TSec21CE-002.TIL

Contact: J.Q. Zheng

10:52:33 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E, Section 21

150 kHz - 30 MHz, Category L, M & H, Power Leads

Conducted Emissions Scan

EUT - ADR-7050

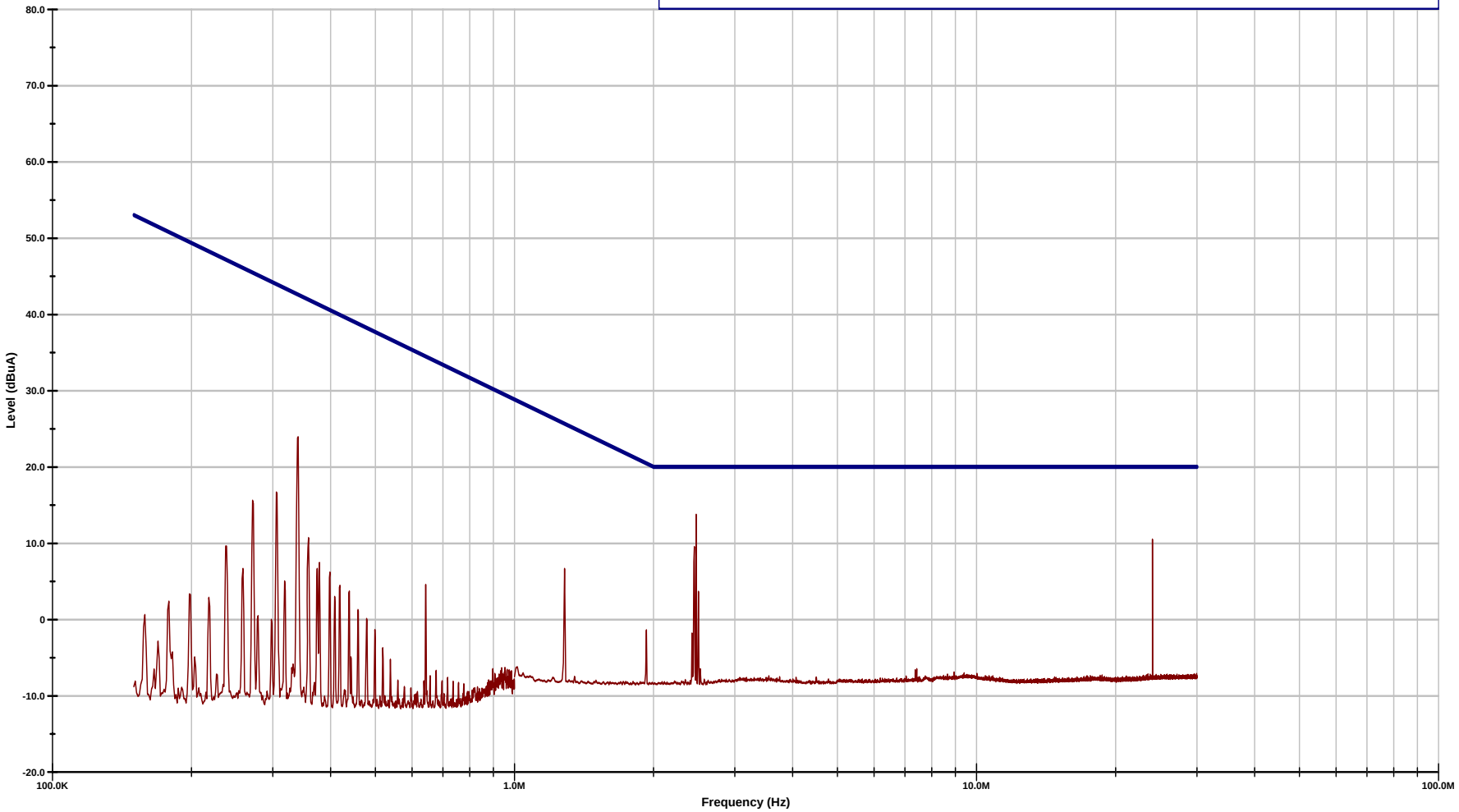
S/N - 0613011

Mode - Power on

Pin # - P1

Line - Return Line

Notes -



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SECTION 21, CE
PAGE 3

Operator: CPD

EUT: ADR-7050

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Contact: J.Q. Zheng

11:00:14 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E, Section 21

150 kHz - 30 MHz, Category L, M & H, Power Leads

Conducted Emissions Scan

EUT - ADR-7050

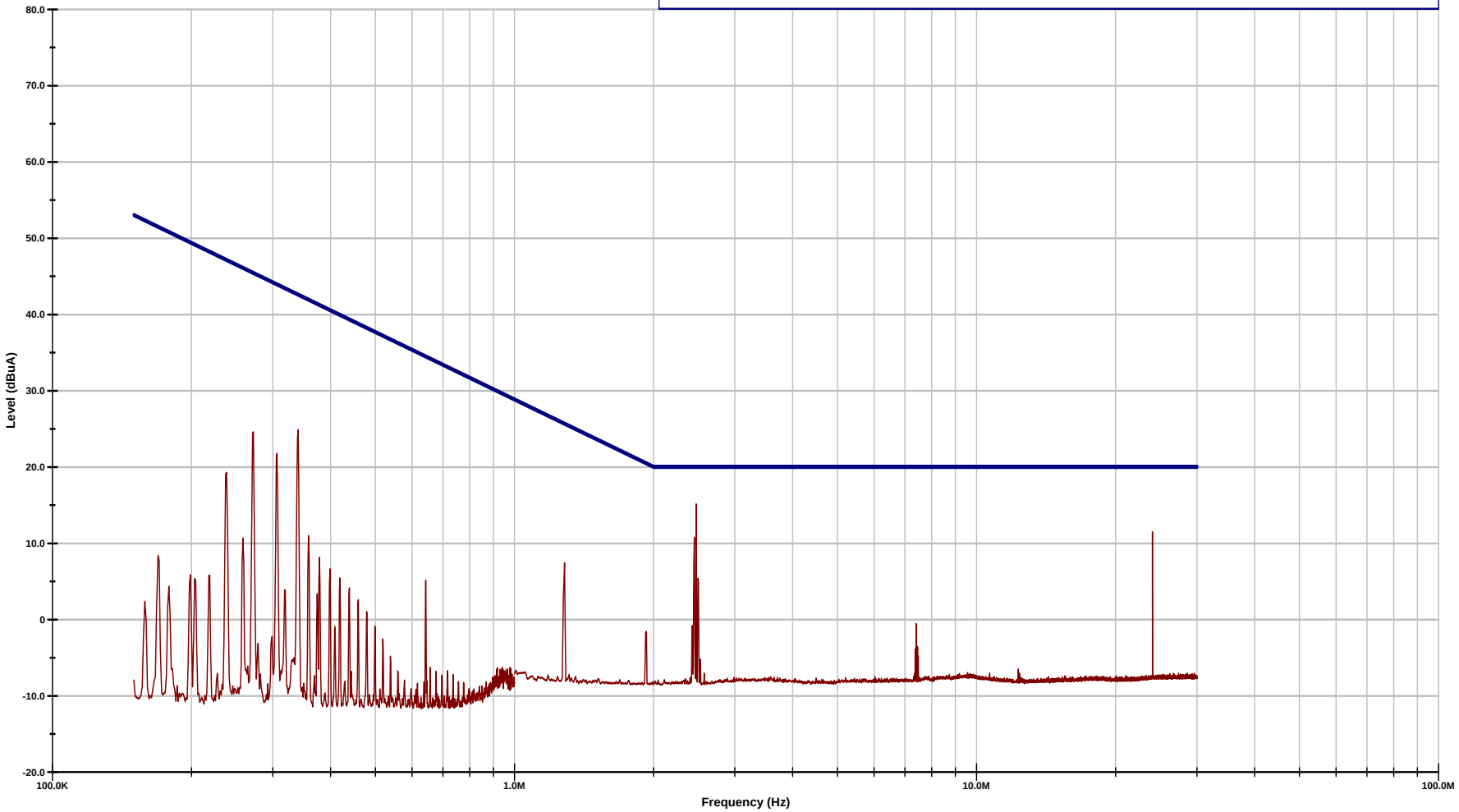
S/N - 0613011

Mode - Power on

Pin # - P2

Line - Return Line

Notes -



Operator: CPD

EUT: ADR-7050

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SECTION 21, CE
PAGE 4

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Contact: J.Q. Zheng

11:08:38 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E, Section 21

150 kHz - 30 MHz, Category L, M & H, Power Leads

Conducted Emissions Scan

EUT - ADR-7050

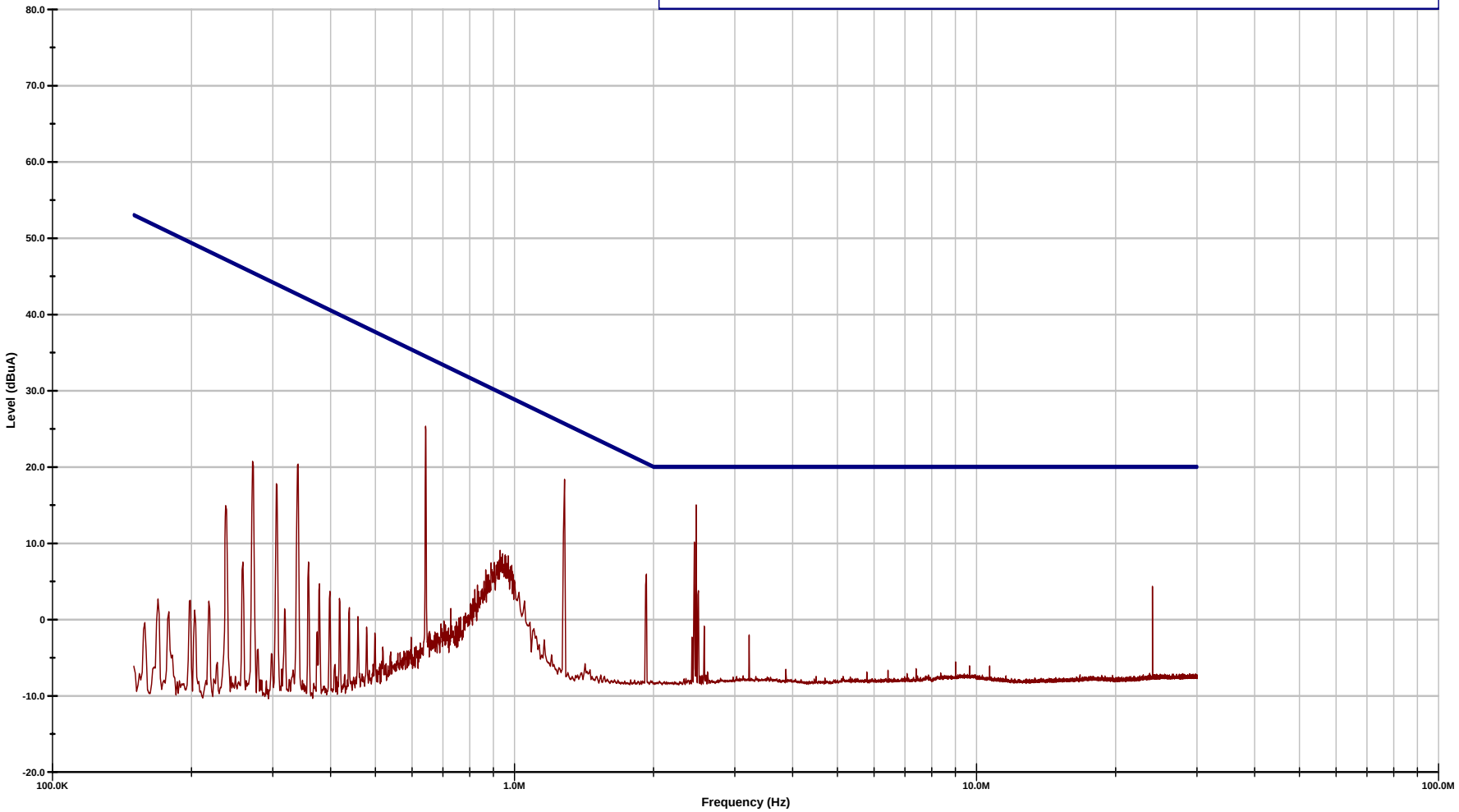
S/N - 0613011

Mode - Power on

Pin # - P2

Line - +28 VDC Line

Notes -



Operator: CPD

EUT: ADR-7050

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APPENDIX D
SECTION 21, CE
PAGE 5

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Contact: J.Q. Zheng

11:15:29 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E, Section 21

150 kHz - 30 MHz, Category L, M & H, Interconnecting Leads

Conducted Emissions Scan

EUT - ADR-7050

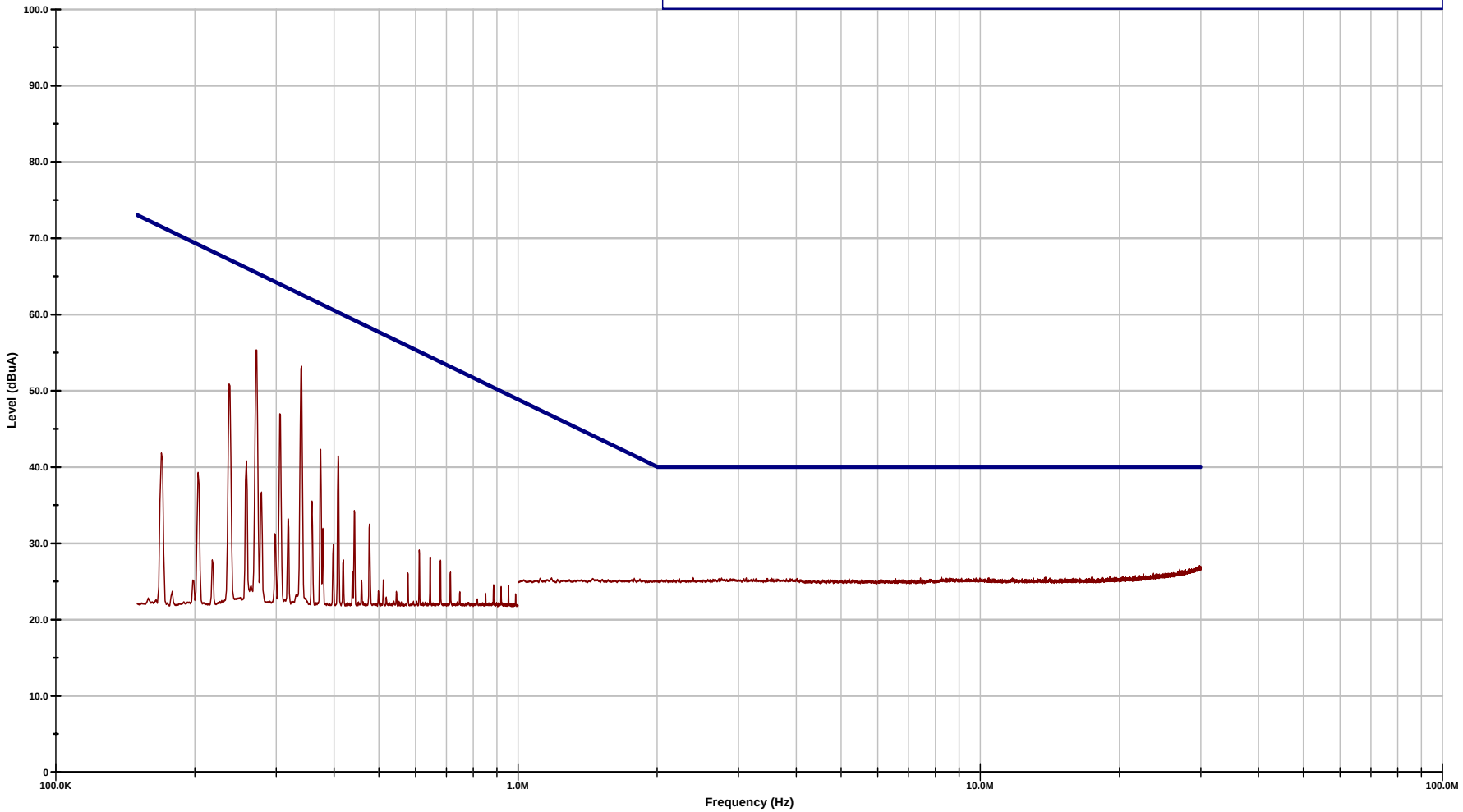
S/N - 0613011

Mode - Power on

Pin # - P1

Line - P1 Cable

Notes - No PWR Cable



Operator: CPD

EUT: ADR-7050

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SECTION 21, CE
PAGE 6

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Contact: J.Q. Zheng

11:44:25 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E, Section 21

150 kHz - 30 MHz, Category L, M & H, Interconnecting Leads

Conducted Emissions Scan

EUT - ADR-7050

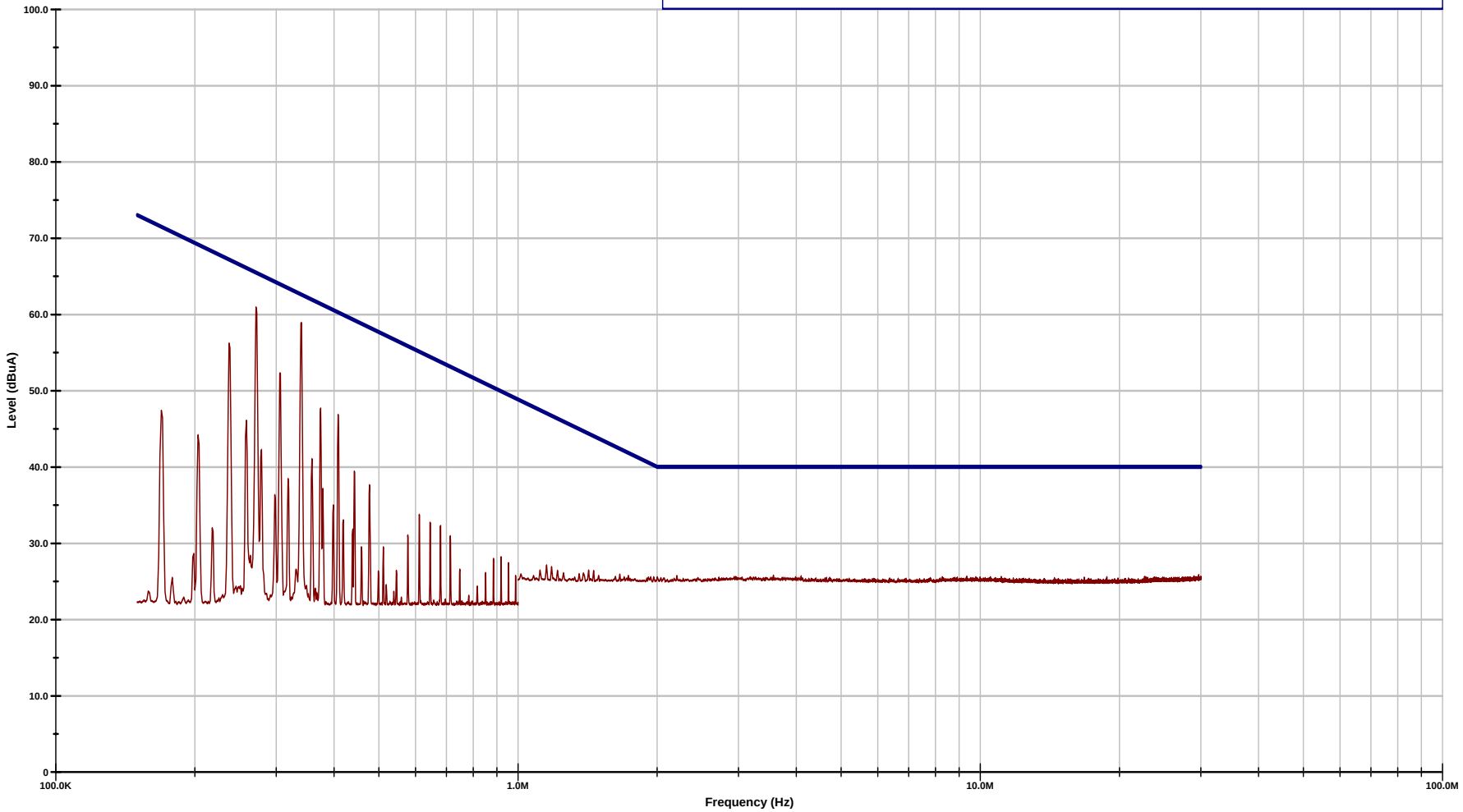
S/N - 0613011

Mode - Power on

Pin # - P2

Line - P2 Cable

Notes - No PWR Cable



Operator: CPD

EUT: ADR-7050

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SECTION 21, CE
PAGE 7

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Contact: J.Q. Zheng

11:56:48 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E, Section 21

150 kHz - 30 MHz, Category L, M & H, Interconnecting Leads

Conducted Emissions Scan

EUT - ADR-7050

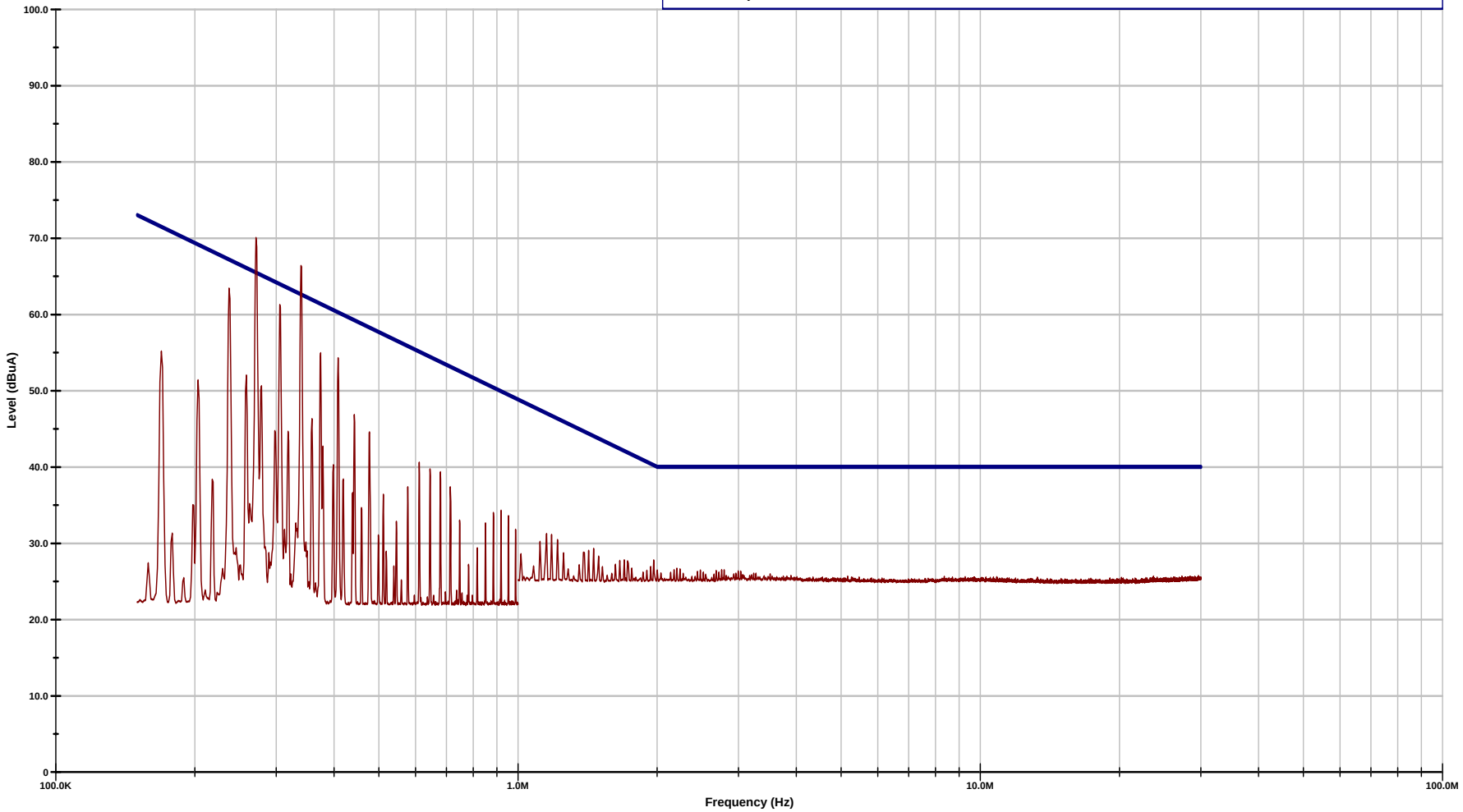
S/N - 0613011

Mode - Power on

Pin # -

Line - CAM Coax

Notes - ÿ



Operator: CPD

EUT: ADR-7050

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SECTION 21, CE
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Contact: J.Q. Zheng

12:29:16 PM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E, Section 21

150 kHz - 30 MHz, Category L, M & H, Interconnecting Leads

Conducted Emissions Scan

EUT - ADR-7050

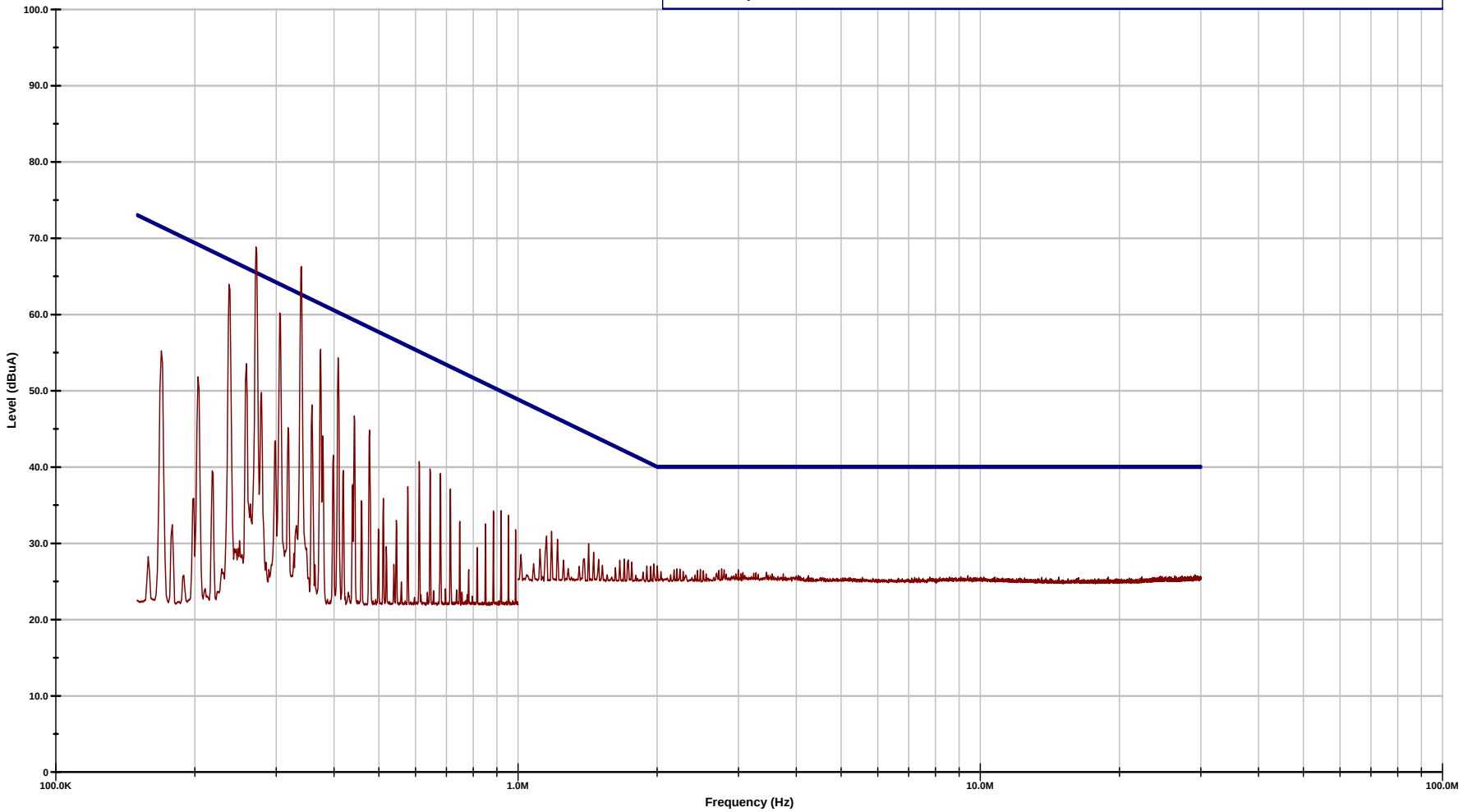
S/N - 0613011

Mode - Power on

Pin # -

Line - Nav Coax

Notes - ÿ



Operator: CPD

EUT: ADR-7050

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SECTION 21, CE
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Contact: J.Q. Zheng

12:13:03 PM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E, Section 21

150 kHz - 30 MHz, Category L, M & H, Interconnecting Leads

Conducted Emissions Scan

EUT - ADR-7050

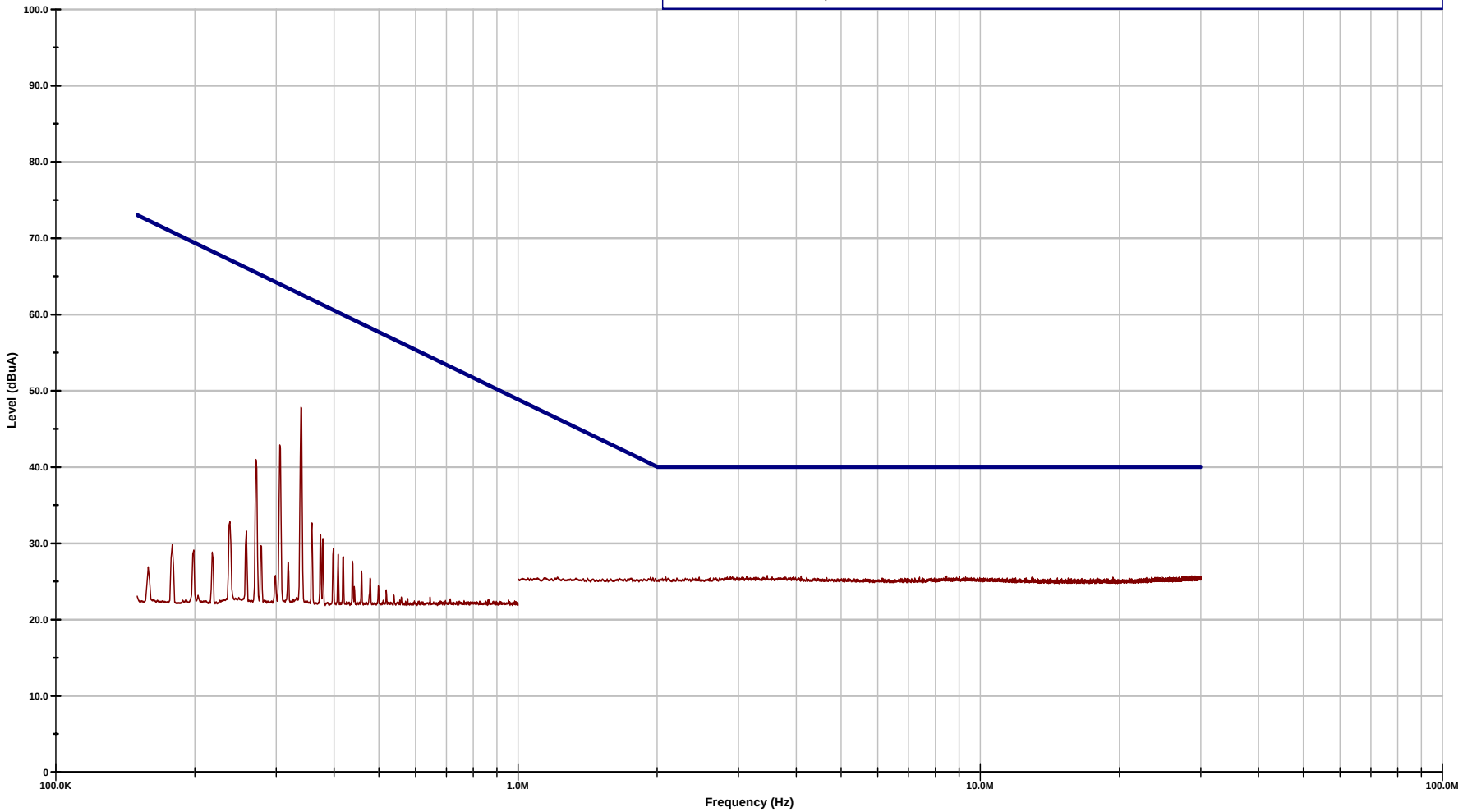
S/N - 0613011

Mode - Power on

Pin # -

Line - CAM Coax

Notes - Removed Scope Probe



Operator: CPD

EUT: ADR-7050

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SECTION 21, CE
PAGE 10

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Contact: J.Q. Zheng

01:14:43 PM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E, Section 21

150 kHz - 30 MHz, Category L, M & H, Interconnecting Leads

Conducted Emissions Scan

EUT - ADR-7050

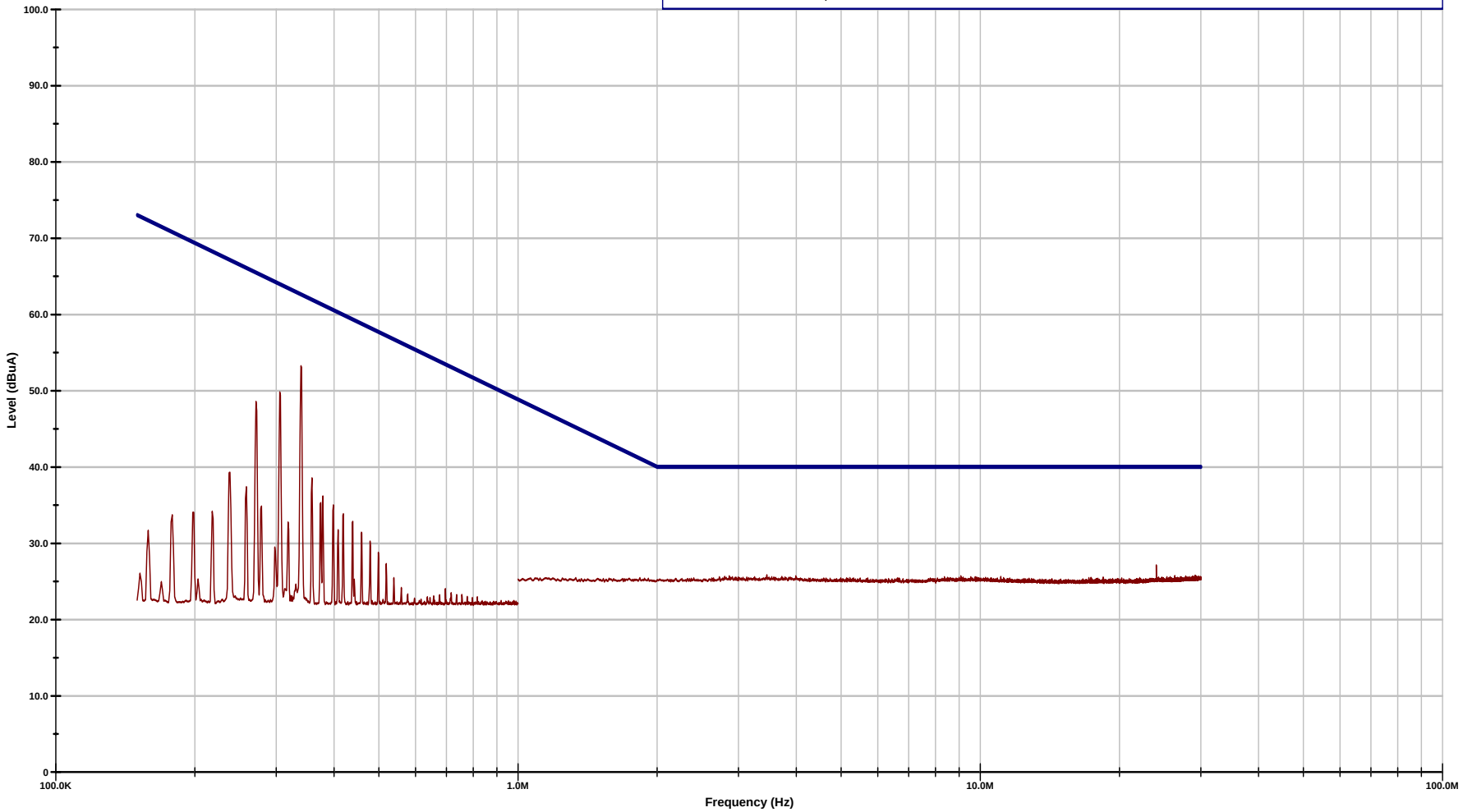
S/N - 0613011

Mode - Power on

Pin # -

Line - Nav Coax

Notes - Removed Scope Probe



Operator: CPD

EUT: ADR-7050

REPORT 06_1261
APPENDIX D
SECTION 21, CE
PAGE 11

H:\Test_Data\2006\JN 1261\Data\R061261TSec21CE-011.TIL

Contact: J.Q. Zheng

01:34:24 PM, Wednesday, April 12, 2006

Company: L3 / GNS

APPENDIX E
DATA FOR SECTION, RE

RTCA/DO-160E

Category L

2 MHz - 25 MHz, Vertical Polarity

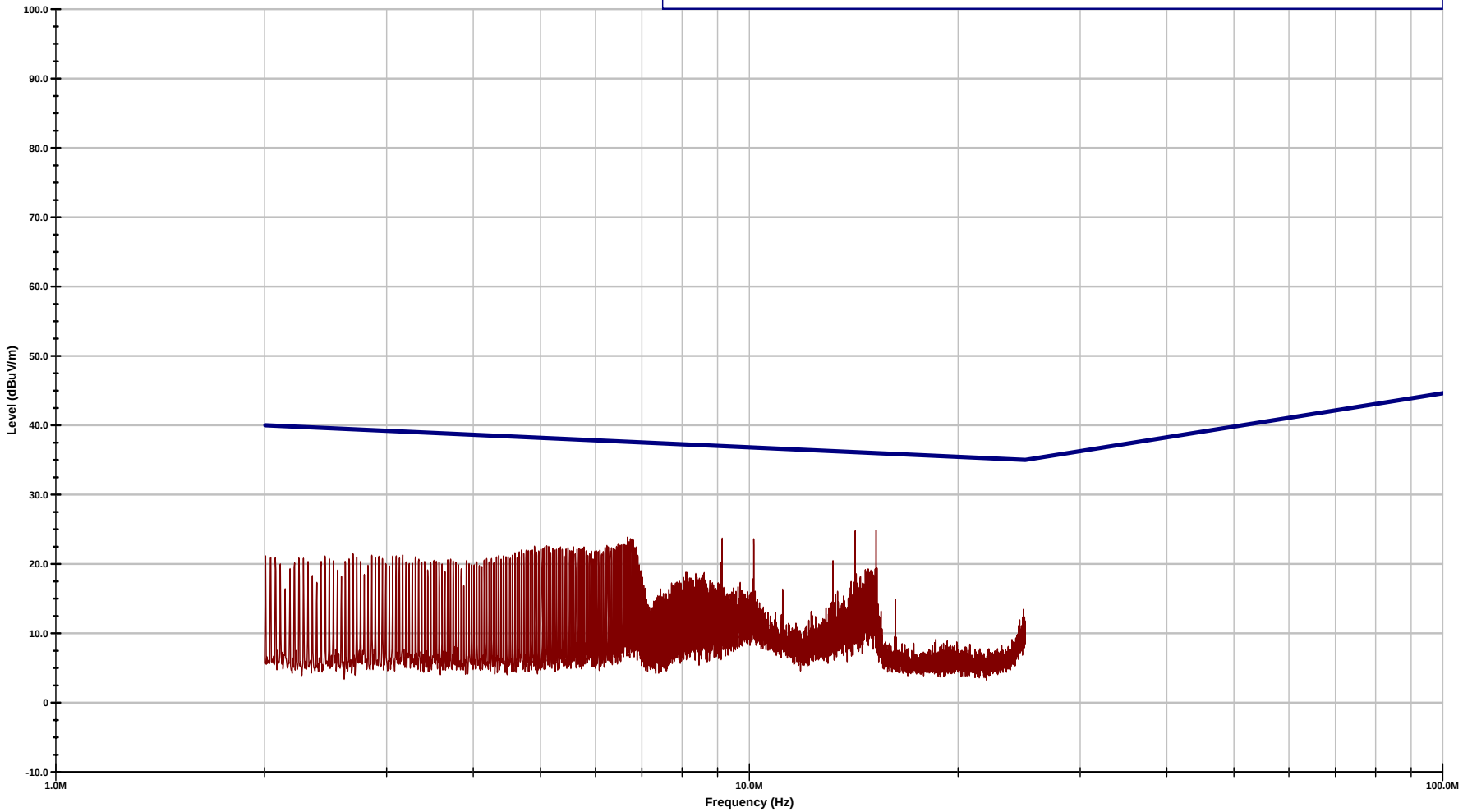
EUT - ADR-7050

S/N - 0613011

Mode - PWR off / Aux on

Position - 1 Meter

Notes - Ambient Reading



REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 2

Operator: CPD

EUT: ADR-7050

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-001.TIL

Contact: J.Q. Zheng

10:31:54 AM, Tuesday, April 11, 2006

Company: L3 / GNS

RTCA/DO-160E

Category L

25 MHz - 200 MHz, Vertical Polarity

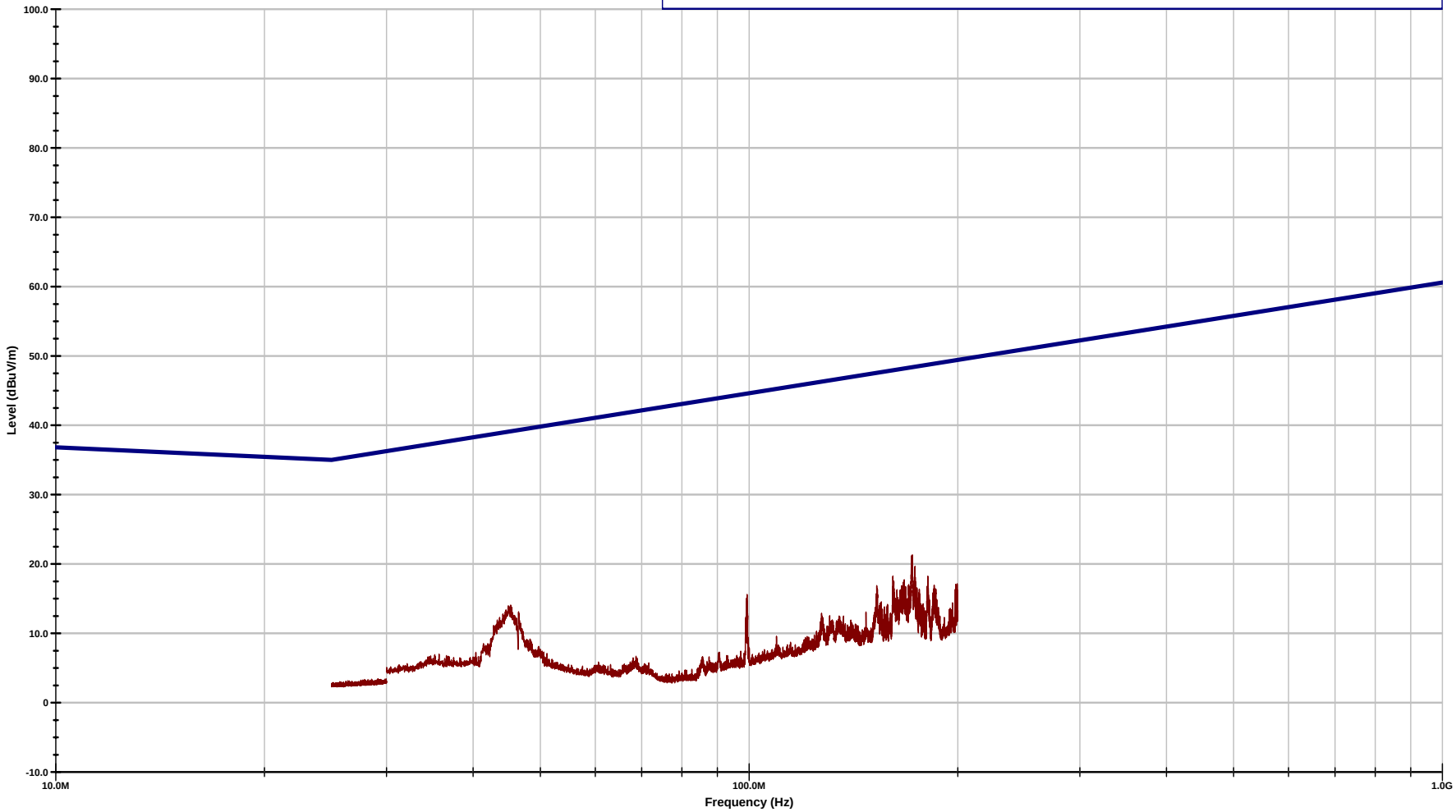
EUT - ADR-7050

S/N - 0613011

Mode - PWR off / Aux on

Position - 1 Meter

Notes - Ambient Reading



Operator: CPD

EUT: ADR-7050

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-001.TIL

Contact: J.Q. Zheng

11:45:34 AM, Tuesday, April 11, 2006

Company: L3 / GNS

RTCA/DO-160E

Category L

25 MHz - 200 MHz, Horizontal Polarity

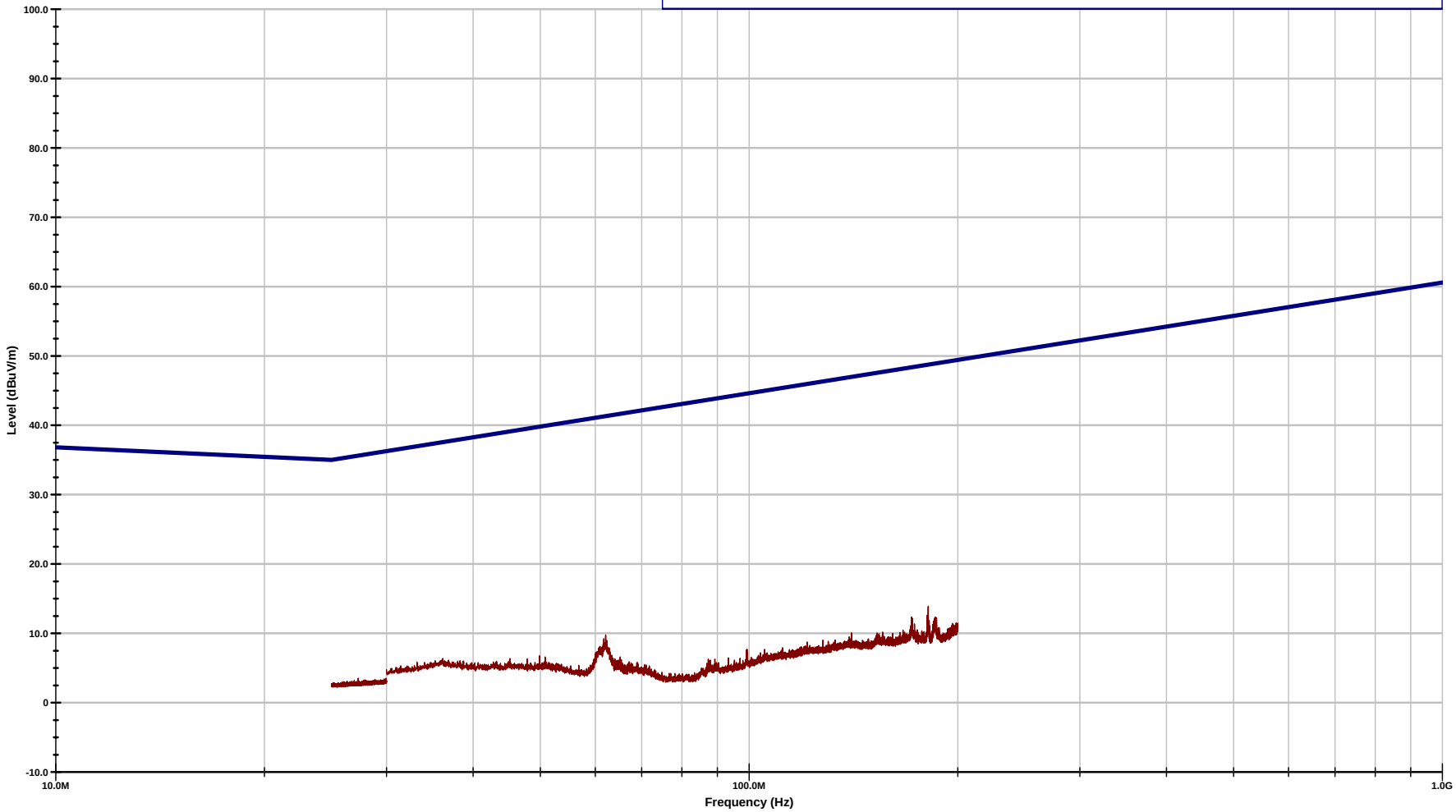
EUT - ADR-7050

S/N - 0613011

Mode - PWR off / Aux on

Position - 1 Meter

Notes - Ambient Reading



Operator: CPD

EUT: ADR-7050

REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 4

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-001.TIL

Contact: J.Q. Zheng

11:45:34 AM, Tuesday, April 11, 2006

Company: L3 / GNS

RTCA/DO-160E

Category L

200 MHz - 1 GHz, Vertical Polarity

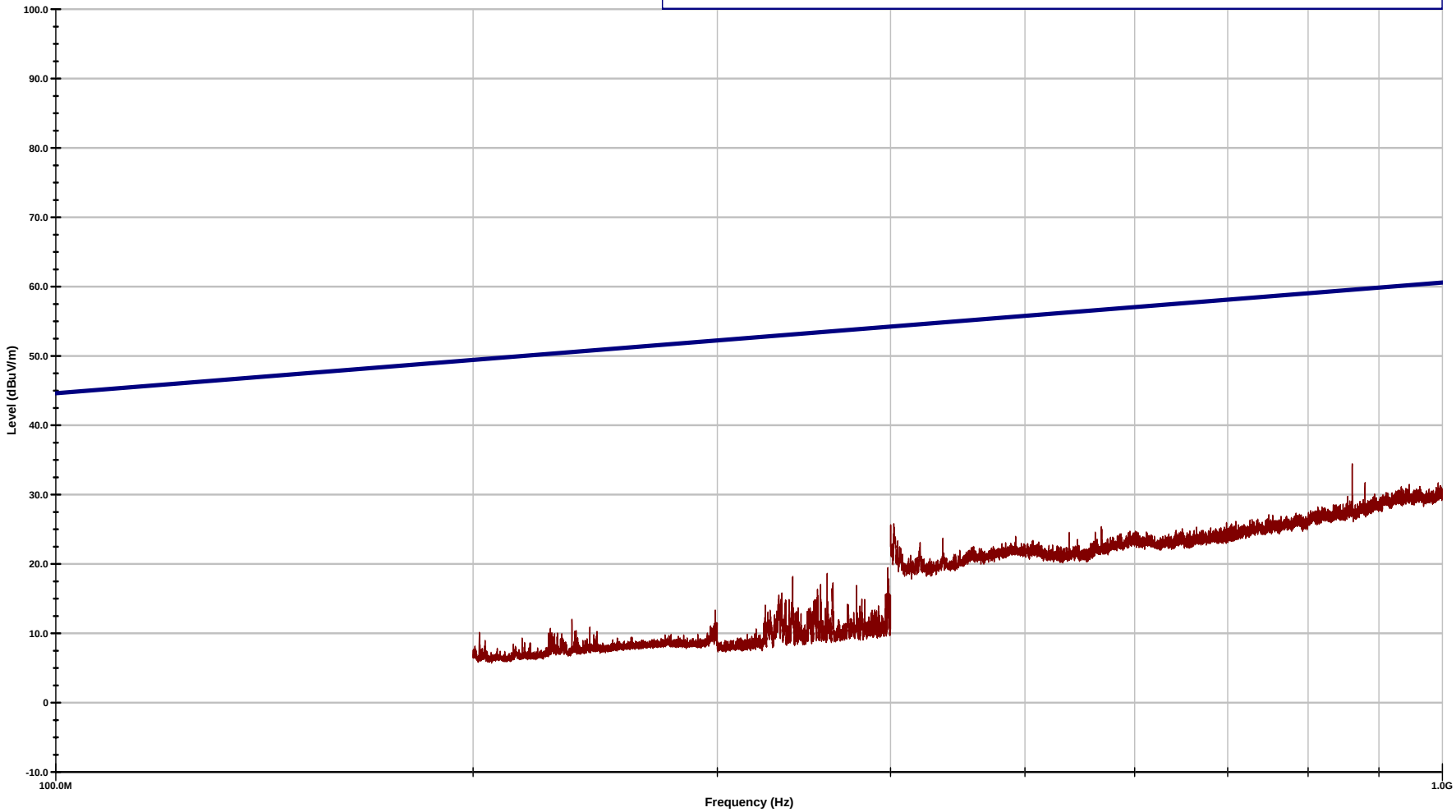
EUT - ADR-7050

S/N - 0613011

Mode - PWR off / Aux on

Position - 1 Meter

Notes - Ambient Reading



REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 5

Operator: CPD

EUT: ADR-7050

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-001.TIL

Contact: J.Q. Zheng

02:41:00 PM, Tuesday, April 11, 2006

Company: L3 / GNS

RTCA/DO-160E

Category L

200 MHz - 1 GHz, Horizontal Polarity

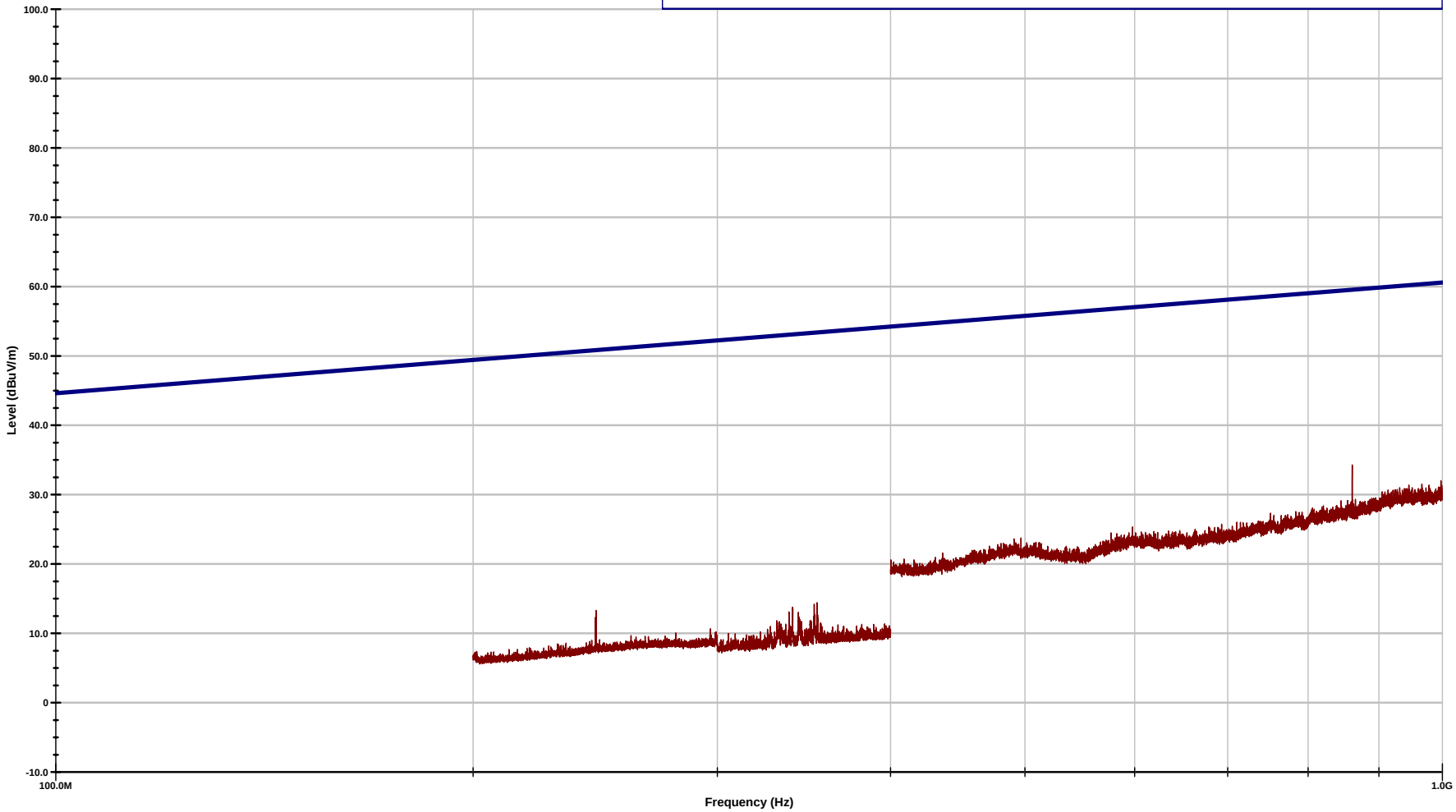
EUT - ADR-7050

S/N - 0613011

Mode - PWR off / Aux on

Position - 1 Meter

Notes - Ambient Reading



Operator: CPD

EUT: ADR-7050

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-001.TIL

Contact: J.Q. Zheng

02:41:00 PM, Tuesday, April 11, 2006

Company: L3 / GNS

RTCA/DO-160D

Category L

Vertical Polarity, 1 GHz to 6 GHz

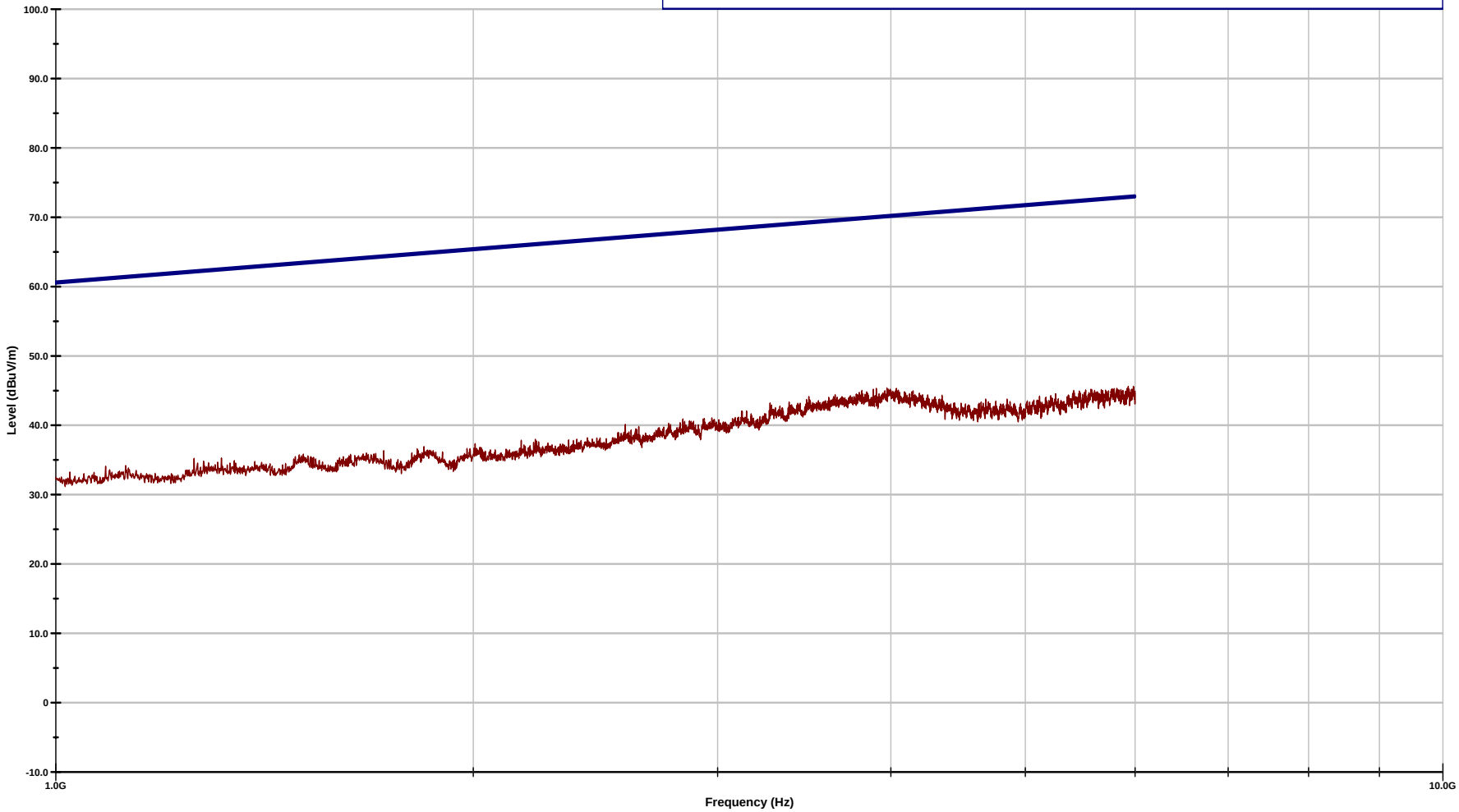
EUT - ADR-7050

S/N - 0613011

Mode - PWR off / Aux on

Position - 1 Meter

Notes - Ambient Reading



Operator: CPD

EUT: ADR-7050

REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 7

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-003.TIL

Contact: J.Q. Zheng

08:55:39 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160D

Category L

Horizontal Polarity, 1 GHz to 6 GHz

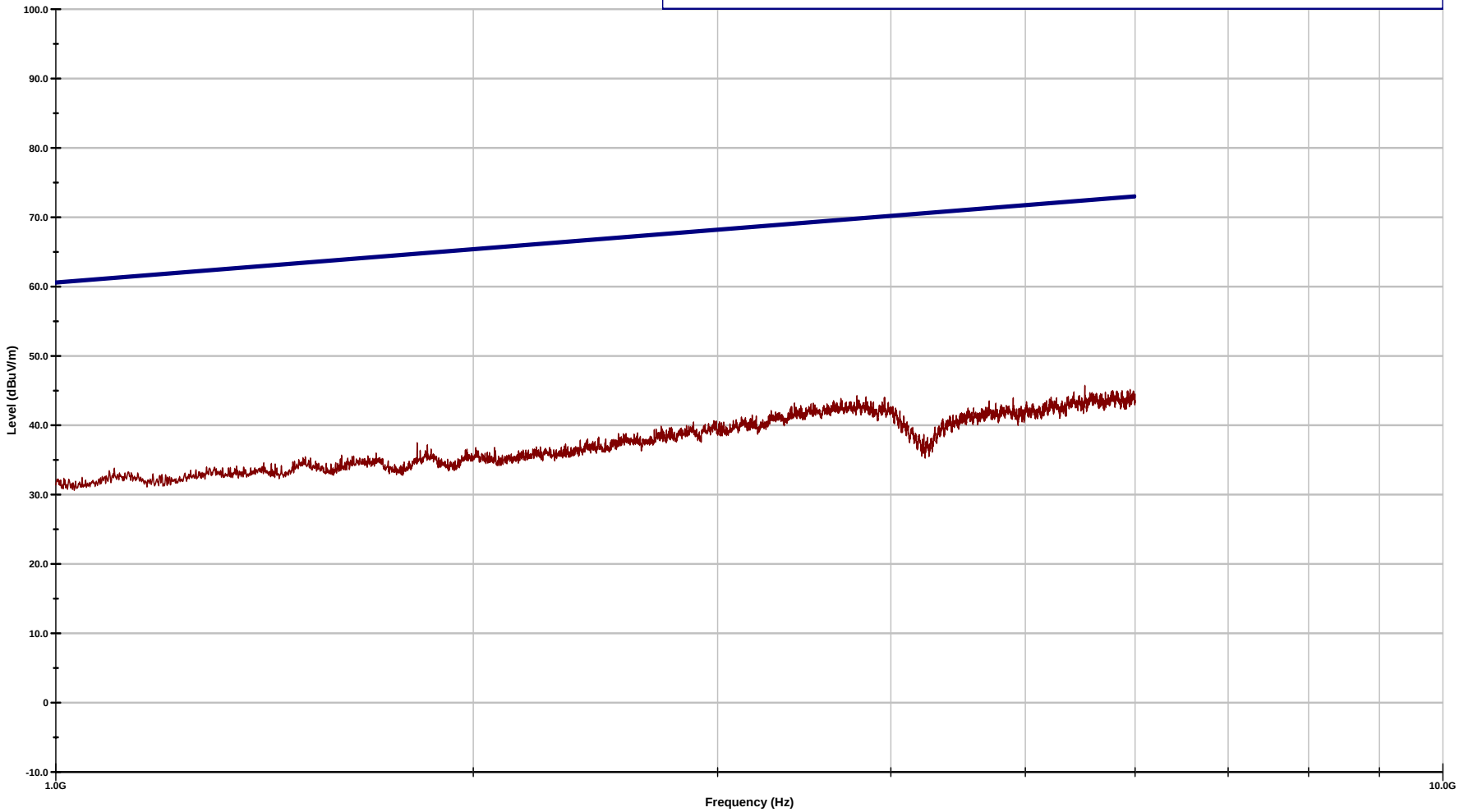
EUT - ADR-7050

S/N - 0613011

Mode - PWR off / Aux on

Position - 1 Meter

Notes - Ambient Reading



Operator: CPD

EUT: ADR-7050

REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 8

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-003.TIL

Contact: J.Q. Zheng

08:55:39 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E

Category L

2 MHz - 25 MHz, Vertical Polarity

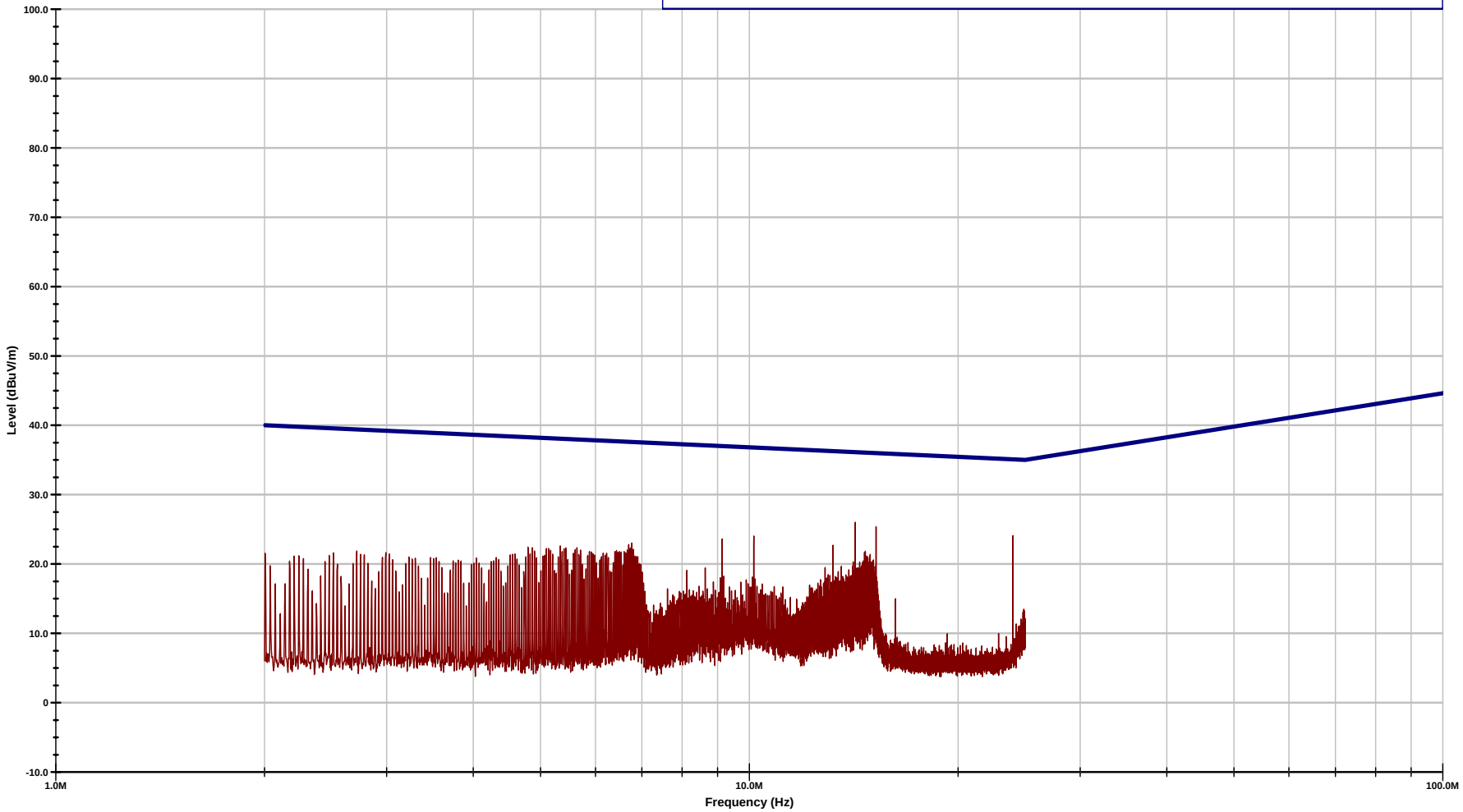
EUT - ADR-7050

S/N - 0613011

Mode - Power on

Position - 1 Meter

Notes - ÿ



Operator: CPD

EUT: ADR-7050

REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 9

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-002.TIL

Contact: J.Q. Zheng

10:51:22 AM, Tuesday, April 11, 2006

Company: L3 / GNS

RTCA/DO-160E

Category L

25 MHz - 200 MHz, Vertical Polarity

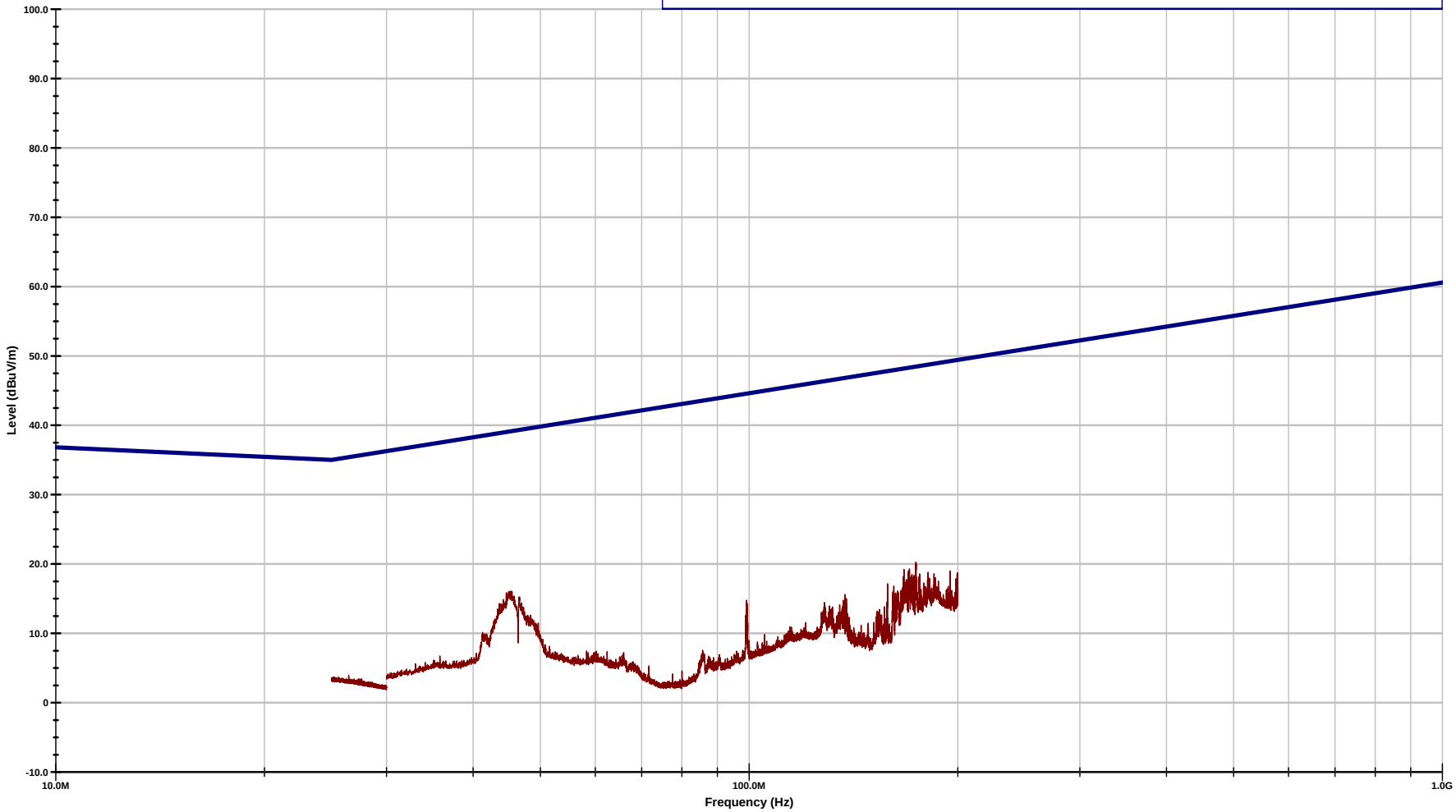
EUT - ADR-7050

S/N - 0613011

Mode - Power on

Position - 1 Meter

Notes - ÿ



Operator: CPD

EUT: ADR-7050

REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 10

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-002.TIL

Contact: J.Q. Zheng

10:19:27 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E

Category L

25 MHz - 200 MHz, Horizontal Polarity

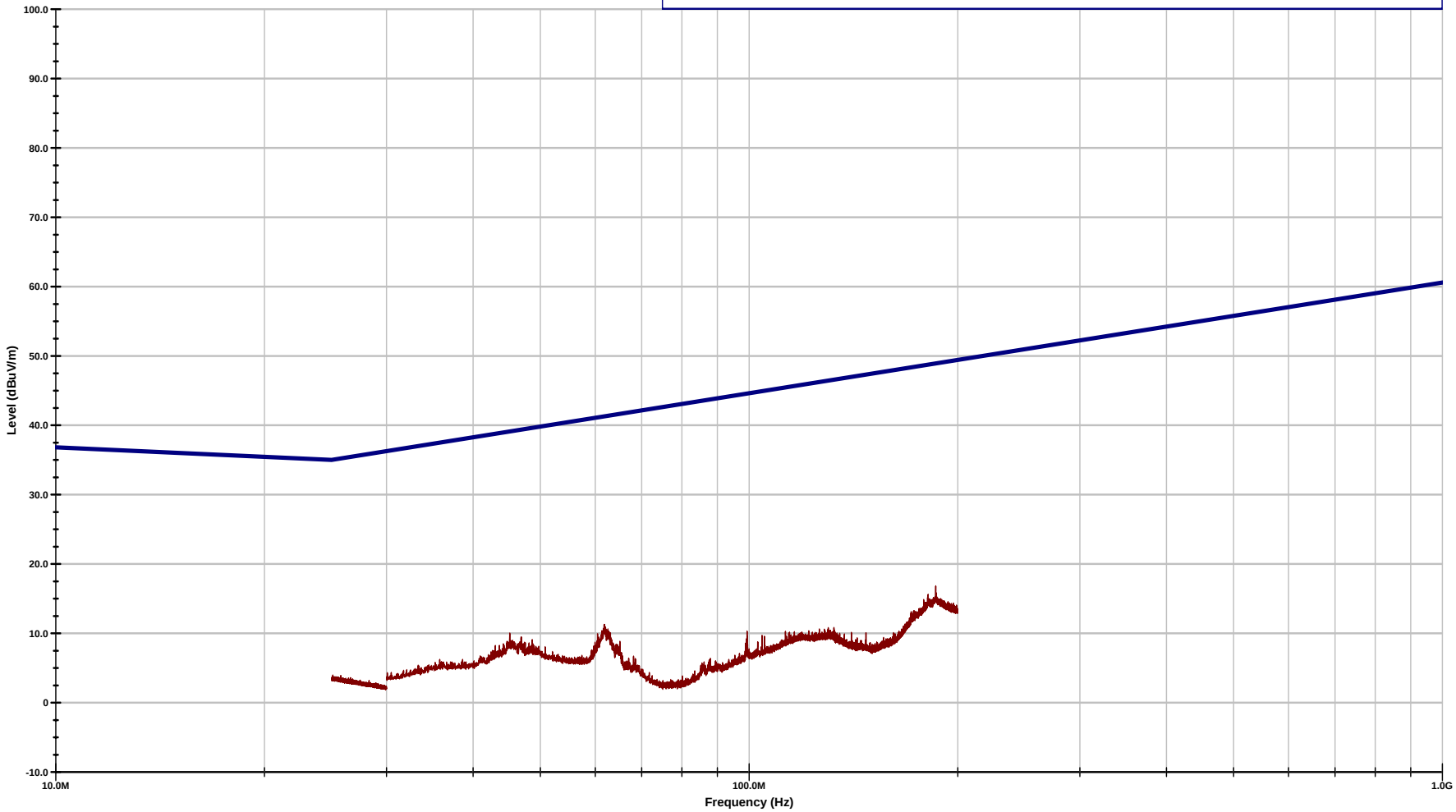
EUT - ADR-7050

S/N - 0613011

Mode - Power on

Position - 1 Meter

Notes - ÿ



Operator: CPD

EUT: ADR-7050

REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 11

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-002.TIL

Contact: J.Q. Zheng

10:19:27 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160E

Category L

200 MHz - 1 GHz, Vertical Polarity

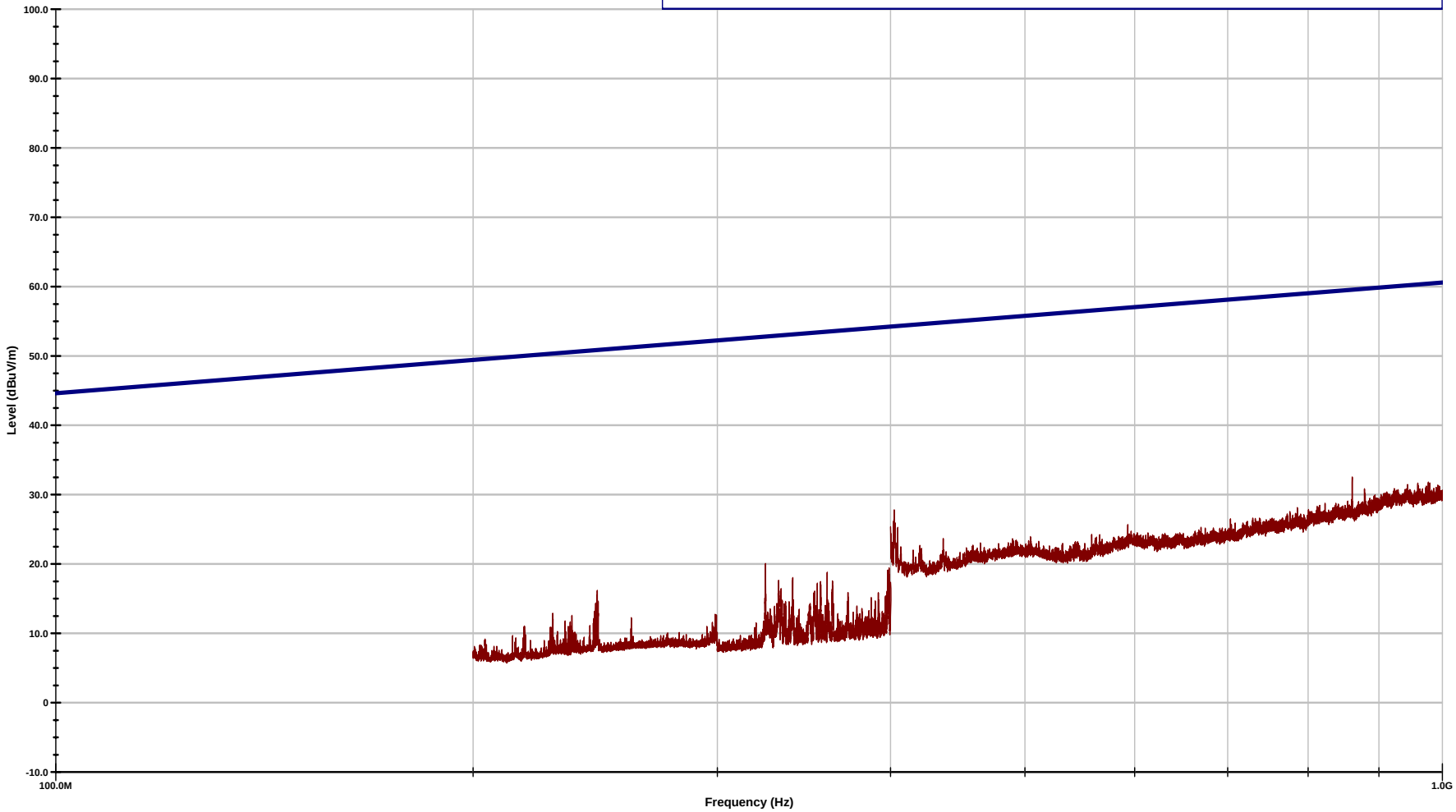
EUT - ADR-7050

S/N - 0613011

Mode - Power on

Position - 1 Meter

Notes - ÿ



Operator: CPD

EUT: ADR-7050

REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 12

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-002.TIL

Contact: J.Q. Zheng

03:58:10 PM, Tuesday, April 11, 2006

Company: L3 / GNS

RTCA/DO-160E

Category L

200 MHz - 1 GHz, Horizontal Polarity

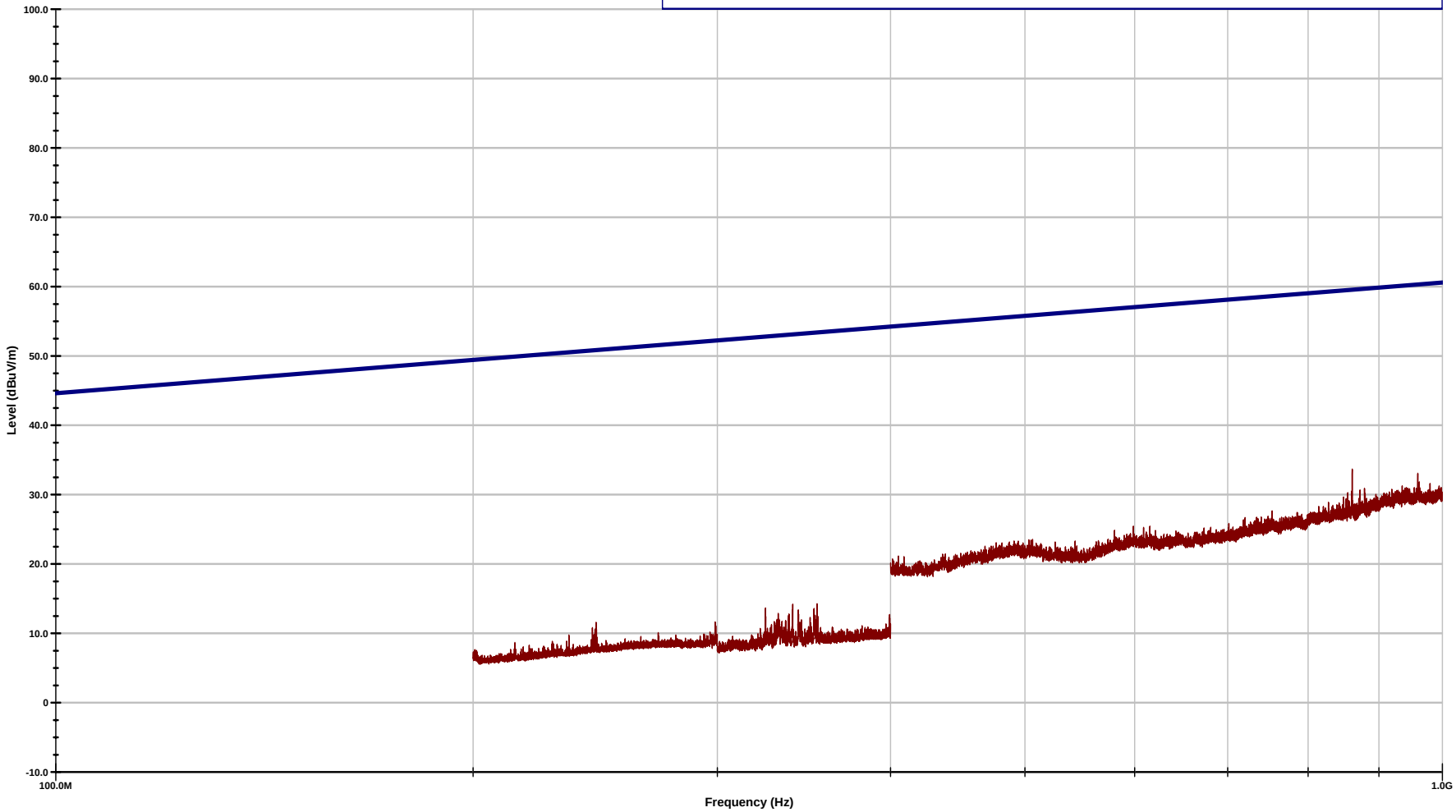
EUT - ADR-7050

S/N - 0613011

Mode - Power on

Position - 1 Meter

Notes - ÿ



Operator: CPD

EUT: ADR-7050

REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 13

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-002.TIL

Contact: J.Q. Zheng

03:58:10 PM, Tuesday, April 11, 2006

Company: L3 / GNS

RTCA/DO-160D

Category L

Vertical Polarity, 1 GHz to 6 GHz

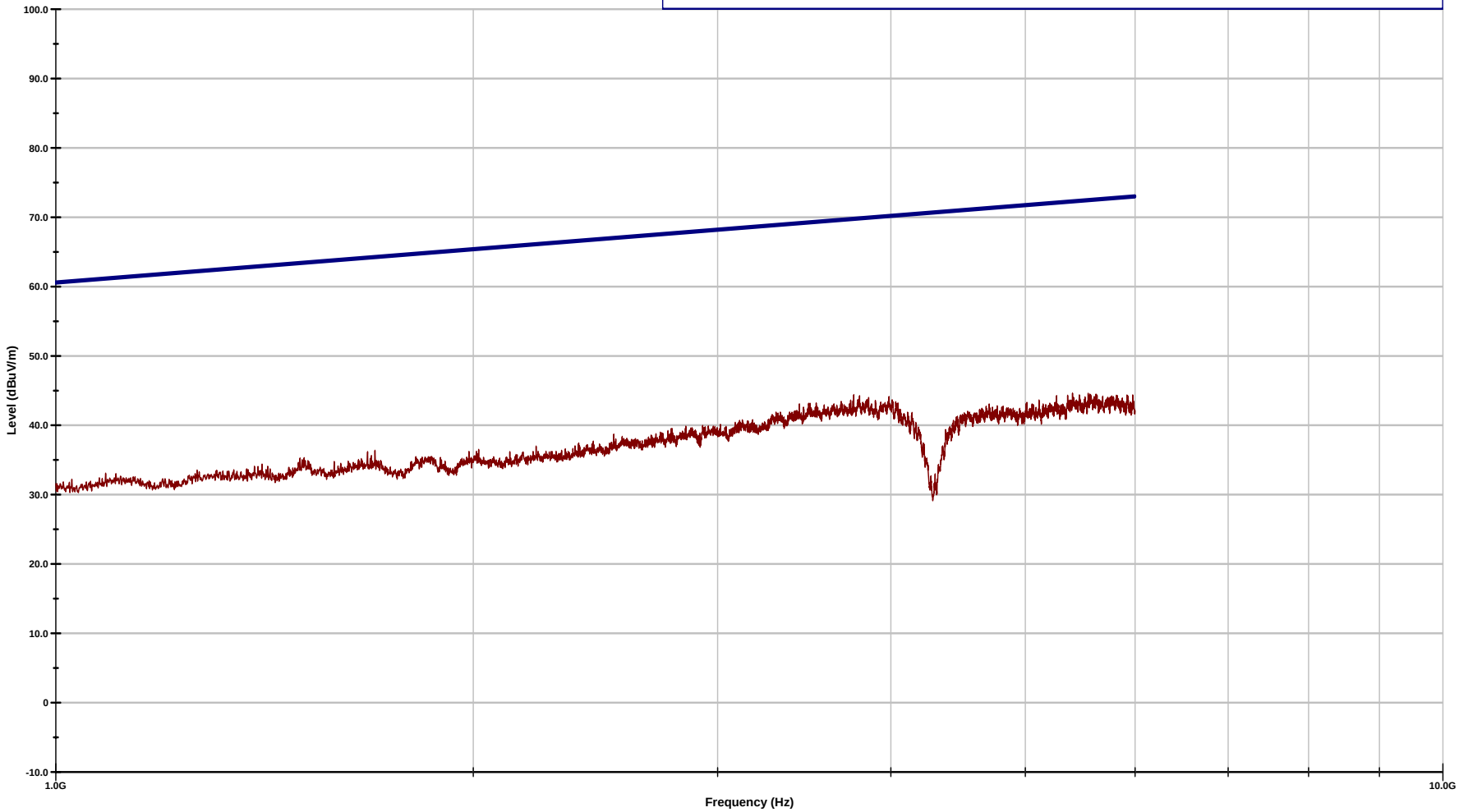
EUT - ADR-7050

S/N - 0613011

Mode - Power on

Position - 1 Meter

Notes - EUT Operating



Operator: CPD

EUT: ADR-7050

REPORT 06_1261
APPENDIX E
SECTION 21, RE
PAGE 14

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-004.TIL

Contact: J.Q. Zheng

09:26:40 AM, Wednesday, April 12, 2006

Company: L3 / GNS

RTCA/DO-160D

Category L

Horizontal Polarity, 1 GHz to 6 GHz

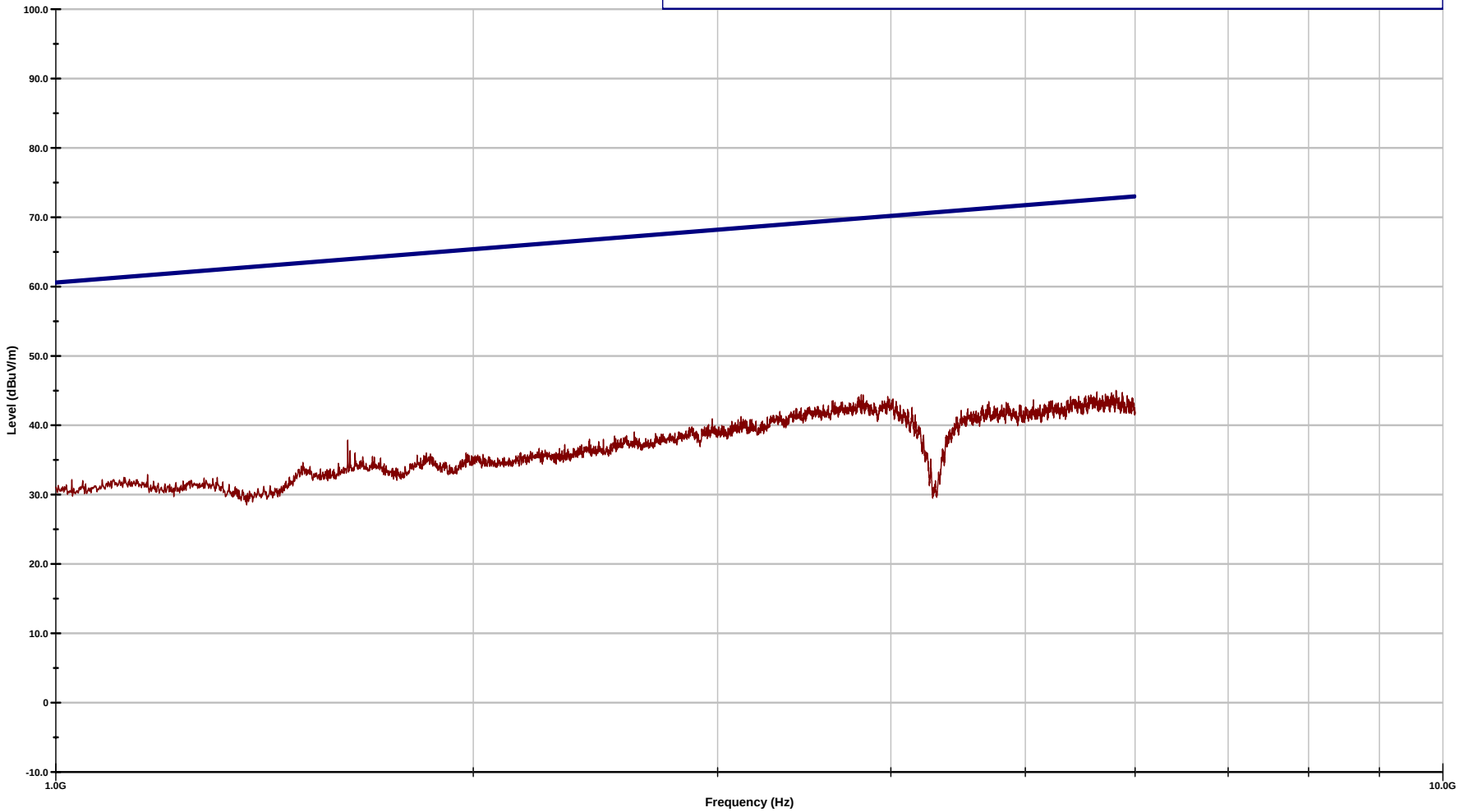
EUT - ADR-7050

S/N - 0613011

Mode - Power on

Position - 1 Meter

Notes - EUT Operating



Operator: CPD

EUT: ADR-7050

H:\Test_Data\2006\JN 1261\Data\R061261TSec21RE-004.TIL

Contact: J.Q. Zheng

09:26:40 AM, Wednesday, April 12, 2006

Company: L3 / GNS