CETECOM ICT Services GmbH

Radio Satellite Communication
Untertürkheimer Straße 6–10, D-66117 Saarbrücken, Telephone +49 (0) 681 598 - 0 , Fax +49 (0) 681 598 – 9075

Recognized by the
Federal Communications Commission and Industry Canada
Anechoic chamber registration No.: 90462 (FCC)
Anechoic chamber registration No.: 3463 (IC)
TCB ID: DE0001

Federal Communications Commission

Accredited by the
German Accreditation Council
DAR–Registration Number
DAT–P–176/94-D1

Deutscher Akkreditierungs Rat DAR

Accredited Bluetooth® Test Facility (BQTF)

Test report No.	2-4837-2-2/07
Applicant:	BERTHOLD TECHNOLOGIES GmbH & Co KG
Type:	Micro-Polar (Brix) ++ LB 565-11 / LB 565-12 LB 566-11 / LB 566-12
Test standard:	FCC Part 15.245
FCC ID:	R9ZFCC01X12
IC ID:	4777A-IC01X12

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1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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Tester:

Date	Name	Signature
2009-04-23	Nicolas Stamber	

Technical responsibility for area of testing:

Date	Name	Signature
2009-04-23	Karsten Geraldy	

1.2 Testing laboratory

CETECOM ICT Services GmbH
Untertürkheimerstraße 6–10
D-66117 Saarbrücken
Germany

CETECOM ICT Services GmbH
P.O. Box 10 04 45
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Accredited testing laboratory
Accredited by : Regulierungsbehörde für Telekommunikation und Post (RegTP)
Listed by : Federal Communications Commission (FCC)
Industry Canada (IC)

Authority	Identification/Registration No.
RegTP	DAT-P-176/94-D1
FCC	90462
IC	3463

Testing location, if different from CETECOM ICT Services GmbH: (Not applicable)

1.3 Details of applicant

Name : BERTHOLD TECHNOLOGIES GmbH & Co KG
Street : Calmbacher Strasse 22
Town : 75323 Bad Wildbad
Country : Germany
Phone : +49 (0) 7081 177-0
Fax : +49 (0) 7081 177-100

Contact person
Name : Mr. Hayattin Yilmaz
Phone : +49 (0) 7081 177-274
Fax : +49 (0) 7081 177-527
E–Mail : Hayattin.Yilmaz@Berthold.com

1.4 Application details

Date of receipt of application : 2008-06-09
Date of receipt of test item : 2008-08-21, 2009-04-20
Date of test : 2008-08-21, 2009-04-21
Person(s) who have been present during the test : Mr. Ulrich Klute
: Mr. Hayattin Yilmaz

1.5 Test item (EUT)

Description	:	Field disturbance sensor; Humidity Sensor
Type:		Micro-Polar (Brix) ++ LB 565-11, LB 565-12 LB 566-11, LB 566-12
Manufacturer	:	BERTHOLD TECHNOLOGIES GmbH & Co KG Calmbacher Strasse 22 75323 Bad Wildbad Germany

1.6 Technical data

Frequency range	:	2.435 000 GHz to 2.465 000 GHz
Operational frequency	:	2.440 000 GHz
Field strength	:	100.31 dBµV/m
Type of modulation	:	N0N (unmodulated)
Antennas	:	In tank sensor (Gain « 0 dBi), Flow cell sensor (Gain < 0 dBi), Horn antenna (Gain = 8.5 dBi), Spiral antenna (Gain = 8.5 dBi),

AC-Version:

Normal power supply	(U nom)	:	230.0 V AC
Extreme power supply	(U min)	:	90.0 V AC
	(U max)	:	265.0 V AC
Nominal AC frequency			45 Hz to 65 Hz

DC-Version:

Normal power supply	(U nom)	:	24.0 V DC
Extreme power supply	(U min)	:	18.0 V DC
	(U max)	:	36.0 V DC

1.6.1 Operation conditions

Operation	:	As soon as the equipment is powered up, TX and RX start operating
Purpose of operation	:	Humidity measurement

1.6.2 Equipment under test

Type: Micro-Polar (Brix) ++, LB 565-11 (id-No 51832-01) with all antennas / sensors mentioned above
Micro-Polar (Brix) ++, LB 565-12 (id-No. 51832-02)

The tests were performed with the two models mentioned above. The difference between those two versions is the power supply.
The model LB 565-11 is AC-powered.
The model LB 565-12 is DC-powered.
The test report also covers the model versions LB 566-11 and LB 566-12 which are equipped with different software for the data evaluation. This has no influence on the RF-parameters.

1.7 Test standards

	Code of Federal Regulations (CFR 47) Federal Communications Commission (FCC)
FCC Part 15	Radio Frequency Devices (07/2008) Section 15.245 Operation within the band 2435 MHz to 2465 MHz. Section 15.209 Radiation emission limits, general requirements Section 15.205 Restricted bands of operation.
RSS 210	Issue 7, Annex 7 - Field Disturbance Sensors Operating in the Bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10.5-10.55 GHz and 24.075-24.175 GHz

2 Technical test

2.1 Summary of test results

[X] No deviations from the technical specification (s) were ascertained in the course of the performed tests.

[ ] The deviations as specified in 2.5 were ascertained in the course of the performed tests.

This test report :

[X] describes the first test

[ ] describes an additional test

[ ] is a verification of documents

[ ]

2.2 Test environment

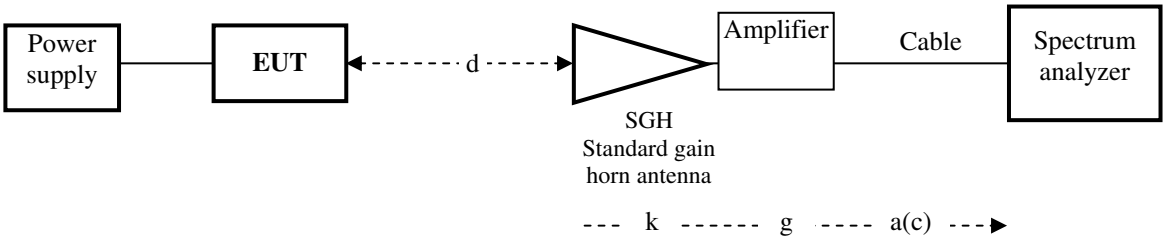
The environmental conditions are documented especially for each test.

2.3 Measurement and test set-up

The measurement and test set-up is defined in the technical specification.

2.4 Test equipment utilized and test set-up

2.4.1 Field strength measurement of spurious radiation in the frequency range 12 GHz to 26 GHz



Frequency f [GHz]	Distance d [m]	Antenna factor k [dB(1/m)]	Dist. Corr. dc (3 m/Xm) [dB]	Amp.gain g [dB]	Cable loss a(c) [dB]
12.0 … 18.0	0.25	33.97	**21.60**	35.0	3.1
18.0 … 26.0	0.25	40.22	**21.60**	33.0	3.3

Calculation :

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor – dist. Corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)] – dc [dB]

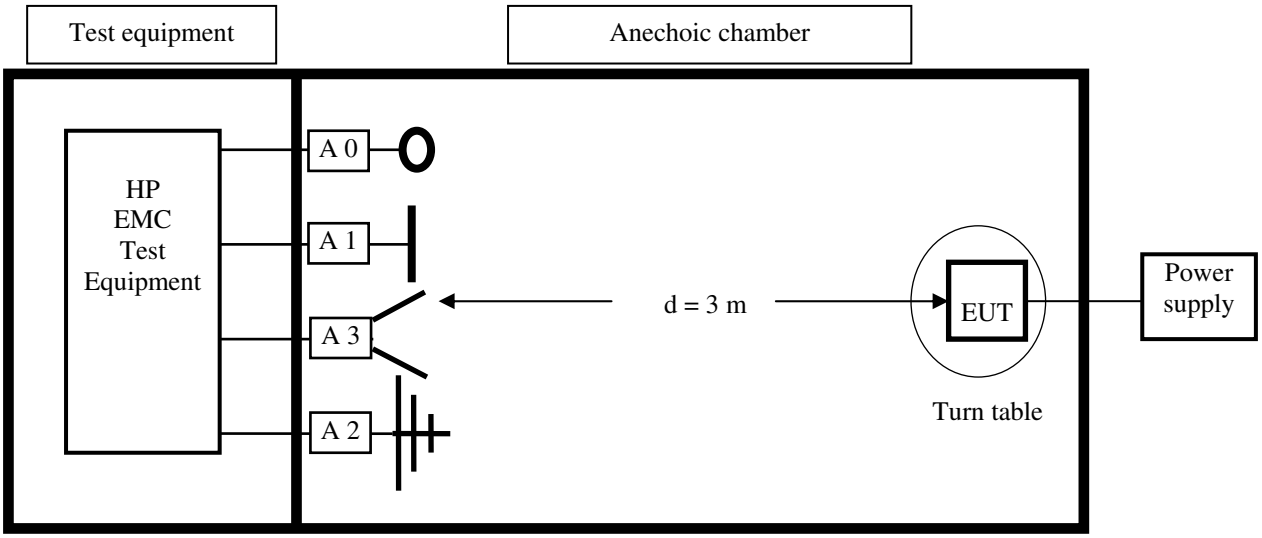
Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	Rohde & Schwarz	FSU 50	300003443
SGH 12.0 to 18.0 GHz	narda	639	300000787
SGH 18.0 to 26.0 GHz	narda	V637	300000487
Amplifier 0.1 ... 26 GHz	HP	HP 83017A	300002267
RF-cable	Huber + Suhner	Diverse	-/-

Measurement uncertainties

Test parameter	Measurement uncertainty
AC Power supply	±0.5 V
Temperature	±0.2 °C
Frequency	±0.01 ppm
eirp	±1.5 dB

2.4.2 Field strength of fundamental and spurious radiation in the frequency range 9 kHz to 12 GHz

Set-up for radiated measurements



Test equipment	Manufacturer	Type	Serial No.
Spectrum analyser	HP	HP 85660B	2478A05306
Spectrum analyser	Rohde & Schwarz	FSU 50	300003443
Analyser display	HP	HP 85662A	2816A16541
Quasi peak adapter	HP	HP 85650A	2811A01131
RF-preselector	HP	HP 85685A	2833A00768
Loop Antenna A 0	R&S	HFH 2–Z2	881 058/42
Biconical antenna A 1	Emco	3104	3758
Log.-per.-antenna A 2	Emco	3146	2304
Double ridge horn ant. A 3	Emco	3115	3007
Relay switch	R&S	RSU	375 339/002
High pass filter	FSY Microwave	HM 985955	001
Amplifier	Tron-Tech	P42-GA29	B2302
AC Power supply	Grundig	RT 5 A	300001263
RF-cable	HP	5061-5359	P36303

Measurement uncertainties

Performance	Measurement uncertainty
Input power (AC)	±0.5 V
Temperature	±0.2 °C
Frequency	±0.01 ppm
RF-power	±1.5 dB

2.5 Test results

2.5.1 Test results overview

This test was performed :

☐

Verification of EUT :

☒ EUT is in accordance with the technical description

☐ EUT is not in accordance with the technical description

☒ The equipment is compliant to FCC requirement

2.5.2 Remarks on methods of measurements

The EUT Micro-Polar Brix ++ is designed to measure humidity of heaped or flowing material by means of microwave transmission. It has a separate TX port and an RX port. These ports can be equipped with various customized sensor antennas. The four different kinds of antennas tested are used for different applications. Field strength measurements are done with all kinds of antennas available.

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 26 GHz in a semi-anechoic chamber. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test set–ups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers.

1. Measurements of ERP/EIRP at fundamental and spurious frequencies

Spurious frequencies are produced by transmitter and receiver when the EUT is active. According to FCC requirements 15.209, spurious emissions have to be investigated as maximum field strength values in the frequency range from 9 kHz to 960 MHz. Where possible, the measurement distance shall be 3 m.

In the low frequency range (9 kHz to 30 MHz), the receiving antenna is an active loop antenna which is positioned at 3 m distance in a shielded, anechoic chamber (see page 10). In case of required measuring distances > 3 m, a distance correction factor is used to calculate the received field strength.

Spurious EIRP measurements in the frequency range 960 MHz to 12 GHz are carried out in a shielded semi-anechoic test chamber. The measurement distance is 3.0 m. In this frequency range a broadband amplifier with different rectangular horn antennas is used.

In the frequency range 12.0 GHz to 26 GHz, spurious EIRP measurements are performed in a shielded fully anechoic chamber with rectangular SGH´s. The measurement distances are indicated underneath each plot, and a calculation for EIRP is added, where all relevant factors like cable losses, antenna factors, etc are taken into account.

2. Measurements of conducted spurious frequencies onto the AC power supply network

The measurements are performed in the frequency range 150 kHz to 30 MHz via a 50 µH/50 Ohms LISN. The test receiver is a Rohde & Schwarz EMI selective voltmeter ESH 3 operated controlled and displayed with a specially designed PC software.

2.5.3 Test results in details

Equipment under test (EUT) : see page 5
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS SECTION 15.245
RSS 210 Issue 7, Annex 7

FUNDAMENTAL FREQUENCY

Operation : EUT operating in CW mode f = 2.441 GHz, AC Version (115V)

Antenna /Sensor type	Transmitter frequency / field strength		
	F [GHz]	Field strength (AV) [dBµV/m]	See plot
In tank sensor	2.441	83.14	1
Flow cell sensor	2.441	65.80	2
Horn antenna	2.441	100.31	3
Spiral antenna	2.441	94.06	4

REFERENCE OF TEST EQUIPMENT USED : see test set-up on page 9

LIMITS: Section 15.245 b
RSS 210 Issue 7, Annex 7

Frequency range [MHz]	Field strength E [mV/m]	Field strength e [dB(µV/m)]
2435 to 2465	500	114

Verdict :	Field strength limit is kept

Equipment under test (EUT) : see Page 5
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS SECTION 15.245

SPURIOUS FREQUENCIES SECTION 15.209
In the frequency range 9 kHz to 26 GHz RSS 210 Issue 7, Annex 7.3

Operation : TX on; RX on EUT operating in CW mode, AC Version (115V)
Antenna assembly: **In tank sensor g < 0 dBi**

Test condition t = 23.0 ° C AC Power supply 115V	Field strength of Fundamental and spurious			
Frequency range [MHz]	Spurious frequencies [MHz]	S A e [dBµV/m]	E [µV/m]	See plot
0.009 – 30 (h + v) horizontal and vertical plane	-/-	< limit	< limit	5
30 – 1000 (h + v.)	See table below plot 6	< limit	< limit	6
1000 – 4000 (h + v.) (sensor surrounded by water)	-/-	< limit	< limit	7
1000 – 4000 (h + v.) (standalone sensor)	-/-	< limit	< limit	8
4000 – 12000 (h + v.)	-/-	< limit	< limit	9
12000 – 18000 (h + v.)	14.644	20.45	10.53	10
18000 – 26000 (h + v.)	-/-	< limit	< limit	11

REFERENCE OF TEST EQUIPMENT USED : see test set-up on pages 8, and 9

LIMITS: SECTION 15.205 / 15.209
RSS 210 Issue 7, Annex 7.3

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBµV/m] @ 3 m	Field strength E [µV/m]
0.009 – 0.490	300	88.5 ... 53.8	2400/F(kHz)
0.490 – 1.705	30	53.8 ... 43.0	24000/F(kHz)
1.705 – 30.0	30	49.5	30
30.0 – 88.0	3	40.0	100
88.0 – 216.0	3	43.5	150
216.0 – 960.0	3	46.0	200
Above 960.0	3	53.9	500
2435 - 2465	3	113.9	500 mV/m
Harmonics	3	64.1	1 600

Verdict : Spurious limits are kept

Equipment under test (EUT) : see Page 5
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS SECTION 15.245

SPURIOUS FREQUENCIES SECTION 15.209
In the frequency range 9 kHz to 26 GHz RSS 210 Issue 7, Annex 7.3

Operation : TX on; RX on EUT operating in CW mode, AC Version (115V)
Antenna assembly: **flow cell sensor g < 0 dBi**

Test condition t = 23.0 ° C AC Power supply 115V	Field strength of Fundamental and spurious			
Frequency range [MHz]	Spurious frequencies [GHz]	S A e [dBµV/m]	E [µV/m]	See plot
0.009 – 30 (h + v) horizontal and vertical plane	-/-	< limit	< limit	12
30 – 1000 (h + v.)	See table below plot 13	< limit	< limit	13
1001 – 4000 (h + v.) (sensor surrounded by water)	-/-	< limit	< limit	14
1001 – 4000 (h + v.) (standalone sensor)	-/-	< limit	< limit	15
4000 – 12000 (h + v.)	-/-	< limit	< limit	16
12000 – 18000 (h + v.)	14.644	22.52	13.37	17
18000 – 26000 (h + v.)	-/-	< limit	< limit	18

REFERENCE OF TEST EQUIPMENT USED : see test set-up on pages 8, and 9

LIMITS: SECTION 15.205 / 15.209
RSS 210 Issue 7, Annex 7.3

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBµV/m] @ 3 m	Field strength E [µV/m]
0.009 – 0.490	300	88.5 ... 53.8	2400/F(kHz)
0.490 – 1.705	30	53.8 ... 43.0	24000/F(kHz)
1.705 – 30.0	30	49.5	30
30.0 – 88.0	3	40.0	100
88.0 – 216.0	3	43.5	150
216.0 – 960.0	3	46.0	200
Above 960.0	3	53.9	500
2435 - 2465	3	113.9	500 mV/m
Harmonics	3	64.1	1 600

Verdict : Spurious limits are kept

Equipment under test (EUT) : see Page 5
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS SECTION 15.245

SPURIOUS FREQUENCIES SECTION 15.209
In the frequency range 9 kHz to 26 GHz RSS 210 Issue 7, Annex 7.3

Operation : TX on; RX on EUT operating in CW mode, DC Version (24V)
Antenna assembly: **horn antenna g = 8.5 dBi**

Test condition t = 23.0 ° C DC Power supply 24V	Field strength of Fundamental and spurious			
Frequency range [MHz]	Spurious frequencies [GHz]	S A e [dBµV/m]	E [µV/m]	See plot
0.009 – 30 (h + v) horizontal and vertical plane	-/-	< limit	< limit	19
30 – 1000 (h + v.)	See table below plot 20	< limit	< limit	20
1000 – 4000 (h + v.)	-/-	< limit	< limit	21
4000 – 12000 (h + v.)	4.891	35.40	58.88	22
12000 – 18000 (h + v.)	12.202	22.52	13.37	23
18000 – 26000 (h + v.)	-/-	< limit	< limit	24

REFERENCE OF TEST EQUIPMENT USED : see test set-up on pages 8, and 9

LIMITS: SECTION 15.205 / 15.209
RSS 210 Issue 7, Annex 7.3

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBµV/m] @ 3 m	Field strength E [µV/m]
0.009 – 0.490	300	88.5 ... 53.8	2400/F(kHz)
0.490 – 1.705	30	53.8 ... 43.0	24000/F(kHz)
1.705 – 30.0	30	49.5	30
30.0 – 88.0	3	40.0	100
88.0 – 216.0	3	43.5	150
216.0 – 960.0	3	46.0	200
Above 960.0	3	53.9	500
2435 - 2465	3	113.9	500 mV/m
Harmonics	3	64.1	1 600

Verdict :	Spurious limits are kept

Equipment under test (EUT) : see Page 5
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS SECTION 15.245

SPURIOUS FREQUENCIES SECTION 15.209
In the frequency range 9 kHz to 26 GHz RSS 210 Issue 7, Annex 7.3

Operation : TX on; RX on EUT operating in CW mode, AC Version (115V)
Antenna assembly: **spiral antenna g = 8.5 dBi**

Test condition t = 23.0 ° C AC Power supply 115V	Field strength of Fundamental and spurious			
Frequency range [MHz]	Spurious frequencies [MHz]	S A e [dBµV/m]	E [µV/m]	See plot
0.009 – 30 (h + v) horizontal and vertical plane	-/-	< limit	< limit	25
30 – 1000 (h + v.)	See table below plot 26	< limit	< limit	26
1000 – 4000 (h + v.)	-/-	< limit	< limit	27
4000 – 12000 (h + v.)	-/-	< limit	< limit	28
12000 – 18000 (h + v.)	14.644	20.97	11.18	29
18000 – 26000 (h + v.)	-/-	< limit	< limit	30

REFERENCE OF TEST EQUIPMENT USED : see test set-up on pages 8, and 9

LIMITS: SECTION 15.205 / 15.209
RSS 210 Issue 7, Annex 7.3

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBµV/m] @ 3 m	Field strength E [µV/m]
0.009 – 0.490	300	88.5 ... 53.8	2400/F(kHz)
0.490 – 1.705	30	53.8 ... 43.0	24000/F(kHz)
1.705 – 30.0	30	49.5	30
30.0 – 88.0	3	40.0	100
88.0 – 216.0	3	43.5	150
216.0 – 960.0	3	46.0	200
Above 960.0	3	53.9	500
2435 - 2465	3	113.9	500 mV/m
Harmonics	3	64.1	1 600

Verdict :	Spurious limits are kept

Equipment under test (EUT) : see page 5
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS SECTION 15.207

AC-CONDUCTED LINE

Operation : EUT operating in CW mode f = 2.441 GHz

Line type	Version	Verdict	See plot
Phase	DC (external power supply)	Pass	31
Neutral	DC (external power supply)	Pass	32
Phase	AC (internal power supply)	Pass	33
Neutral	AC (internal power supply)	Pass	34

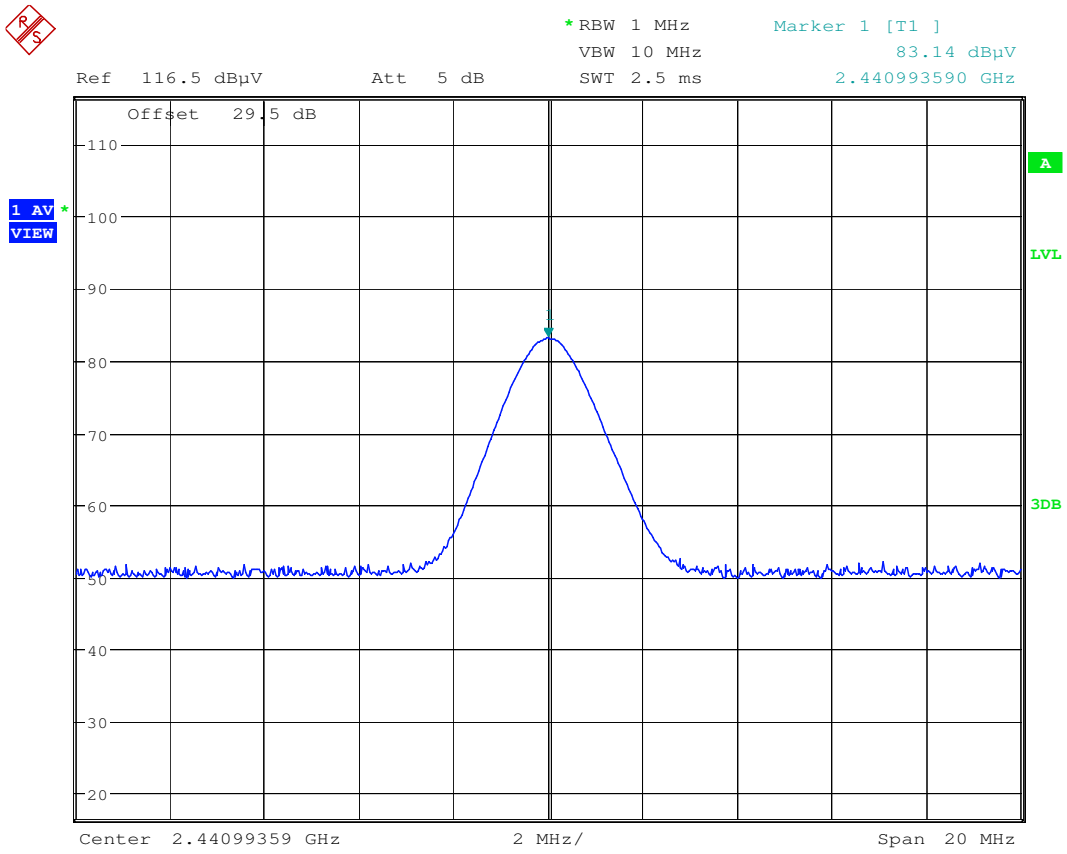
LIMITS: Section 15.207

Frequency of Emission [MHz]	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5	56	46
5 – 30	60	50

Verdict :	AC-conducted line limits passed

3 Plots, graphs and data sheets

Plot 1



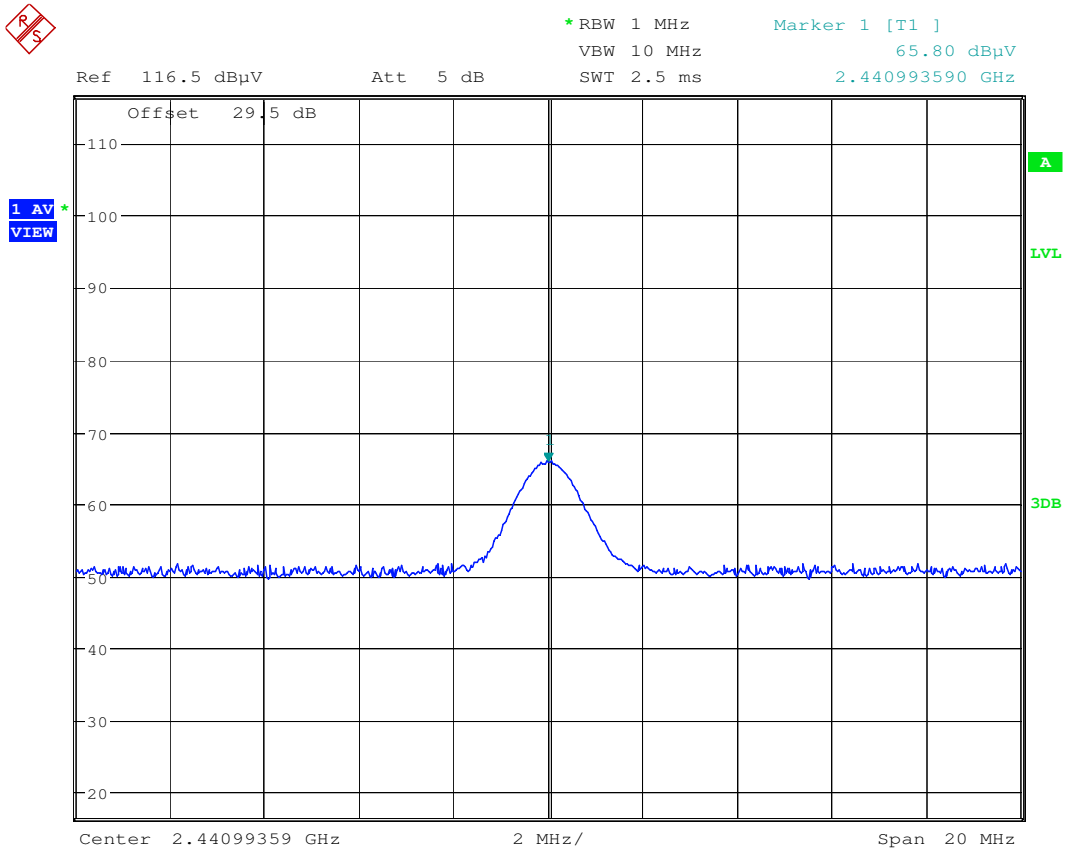
Date: 21.AUG.2008 19:06:31

Measurement distance d = 3.0 m

The system attenuation is calculated in the analyzer reading as a reference level offset.

Offset	=	cable loss	+	antenna factor
	=	a [dB]	+	k [dB(1/m)]
	=	1.1	+	28.4
	=	29.5 dB @ 3m distance		

Plot 2

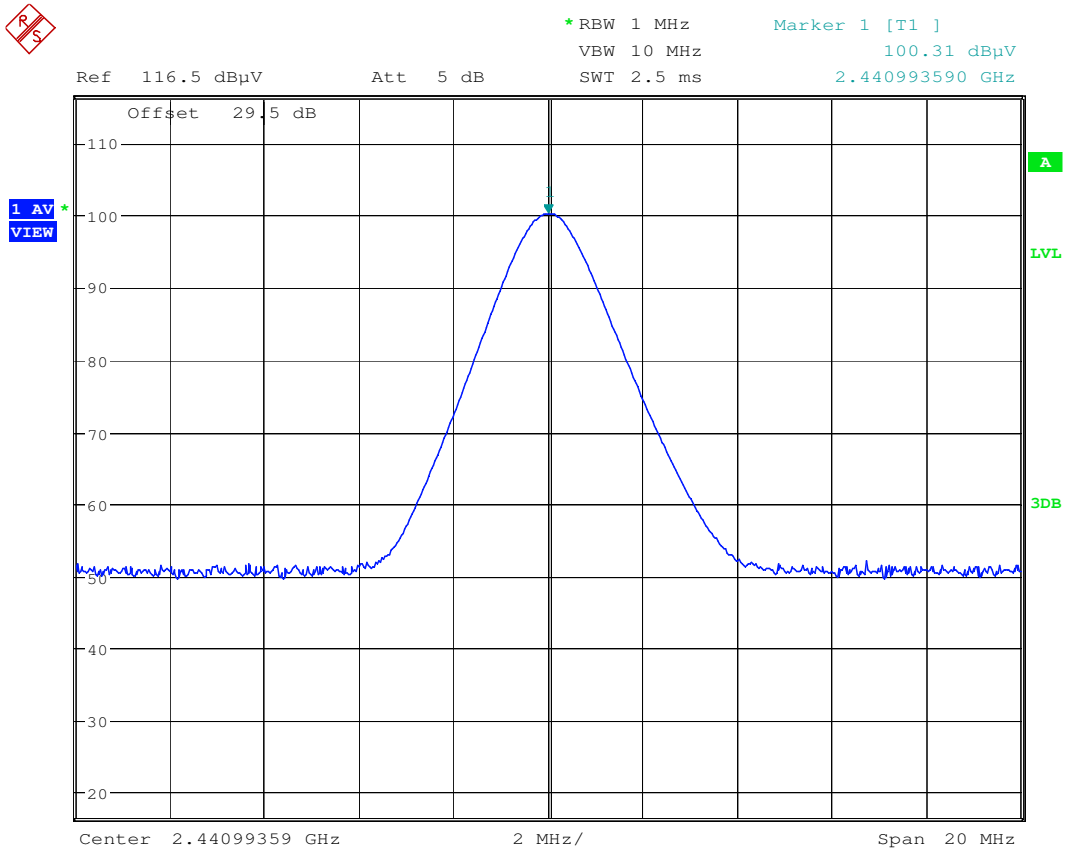


Measurement distance d = 3.0 m

The system attenuation is calculated in the analyzer reading as a reference level offset.

Offset	=	cable loss	+	antenna factor
	=	a [dB]	+	k [dB(1/m)]
	=	1.1	+	28.4
	=	29.5 dB @ 3m distance		

Plot 3

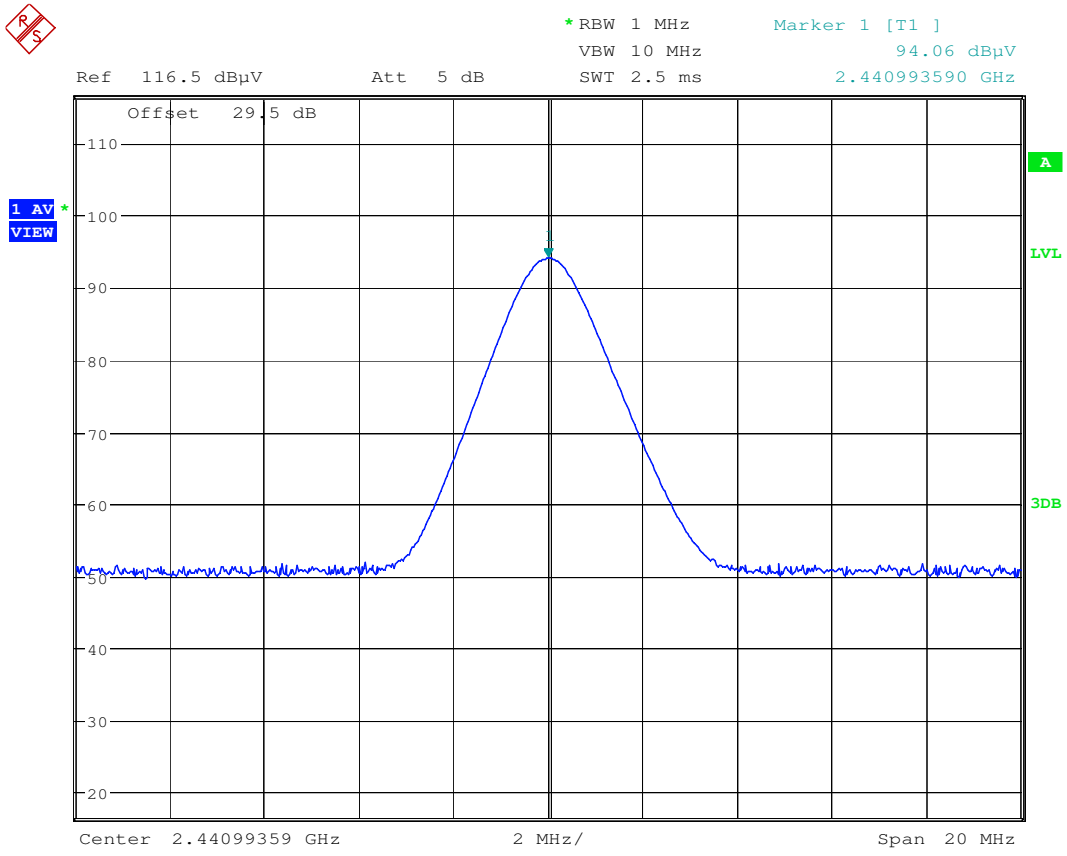


Measurement distance d = 3.0 m

The system attenuation is calculated in the analyzer reading as a reference level offset.

Offset	=	cable loss	+	antenna factor
	=	a [dB]	+	k [dB(1/m)]
	=	1.1	+	28.4
	=	29.5 dB @ 3m distance		

Plot 4



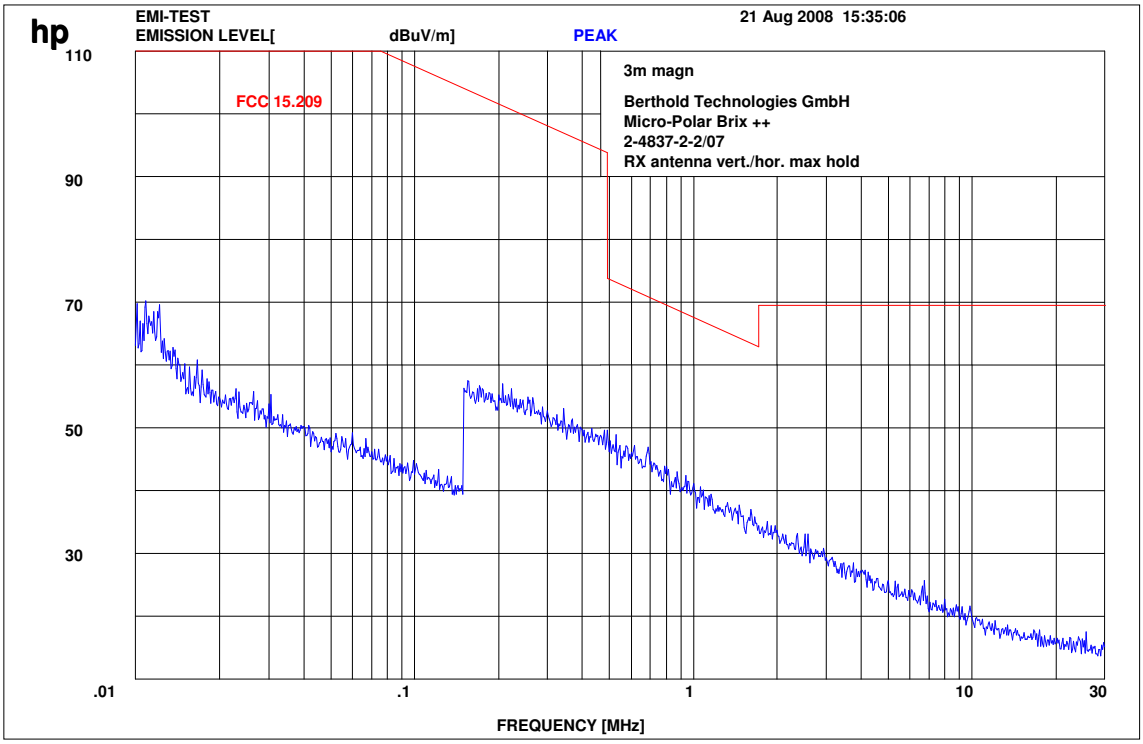
Date: 21.AUG.2008 19:20:59

Measurement distance d = 3.0 m

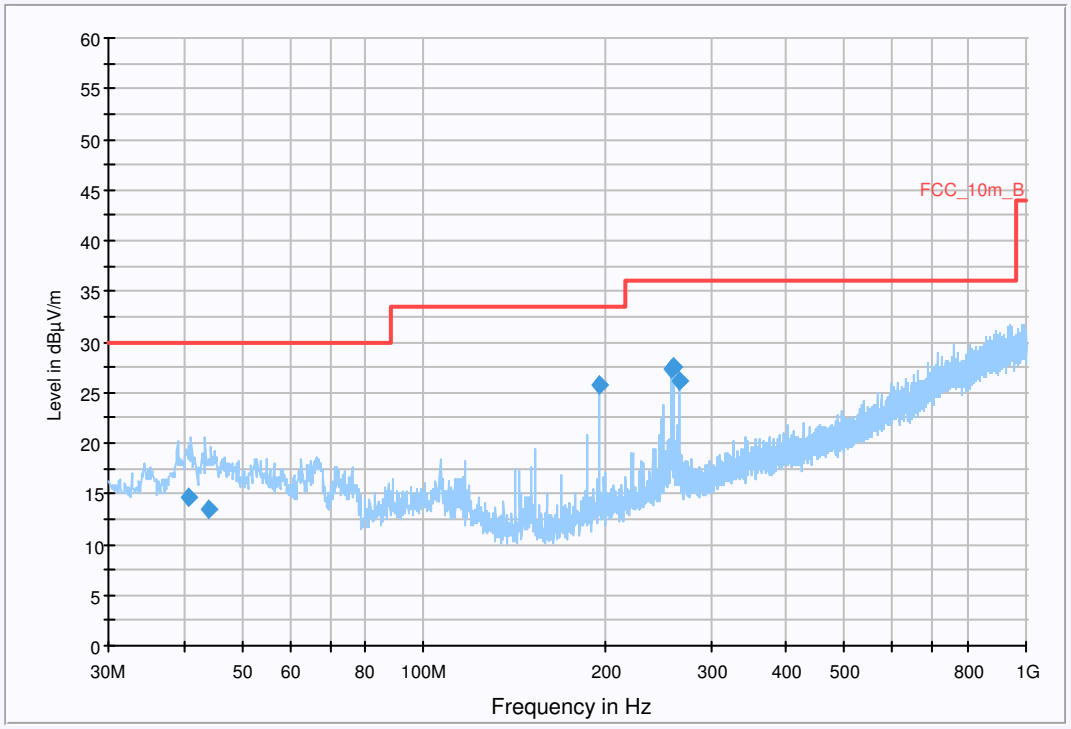
The system attenuation is calculated in the analyzer reading as a reference level offset.

Offset	=	cable loss	+	antenna factor
	=	a [dB]	+	k [dB(1/m)]
	=	1.1	+	28.4
	=	29.5 dB @ 3m distance		

Plot 5


hp
EMI-TEST
EMISSION LEVEL[dBuV/m]
PEAK
21 Aug 2008 15:35:06
3m magn
Berthold Technologies GmbH
Micro-Polar Brix ++
2-4837-2-2/07
RX antenna vert./hor. max hold
FCC 15.209
110
90
70
50
30
.01
.1
1
10
30
FREQUENCY [MHz]

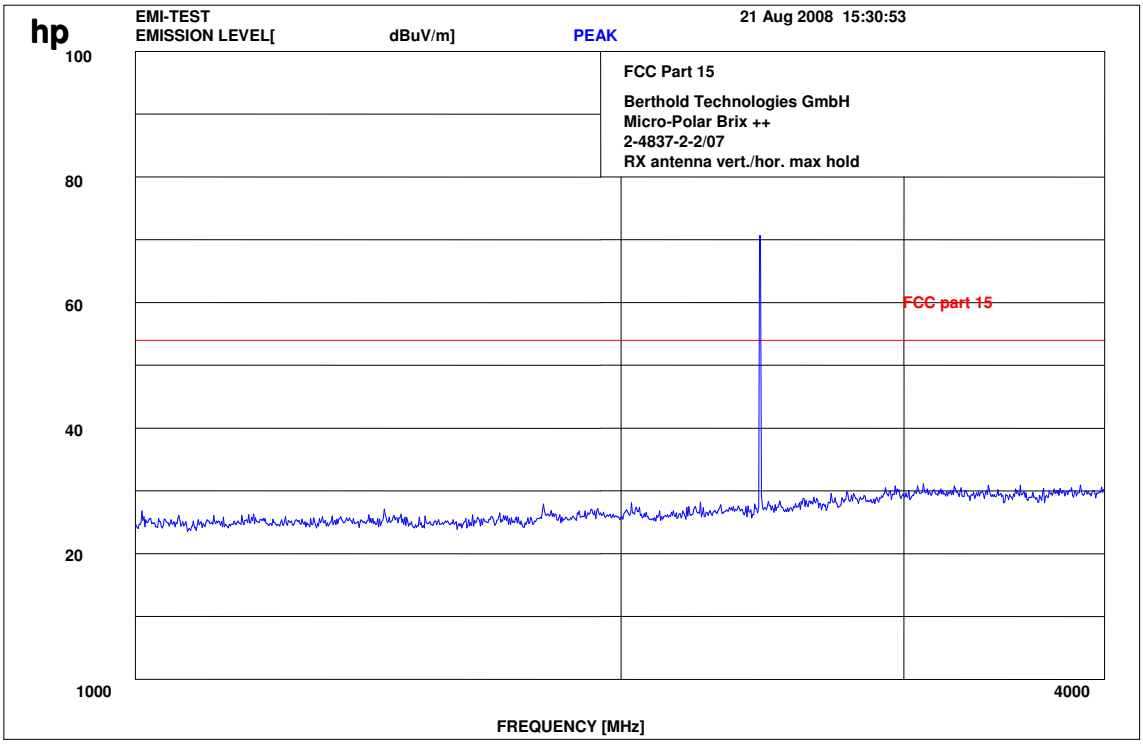
Plot 6



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
40.615900	14.6	15000.000	120.000	179.0	V	123.0	13.6	15.4	30.0	
43.963350	13.5	15000.000	120.000	126.0	V	243.0	13.5	16.5	30.0	
195.557700	25.8	15000.000	120.000	200.0	V	116.0	11.6	7.7	33.5	
257.793950	27.4	15000.000	120.000	338.0	H	170.0	13.7	8.6	36.0	
259.267850	27.6	15000.000	120.000	400.0	H	179.0	13.7	8.4	36.0	
266.663050	26.1	15000.000	120.000	165.0	V	104.0	13.9	9.9	36.0	

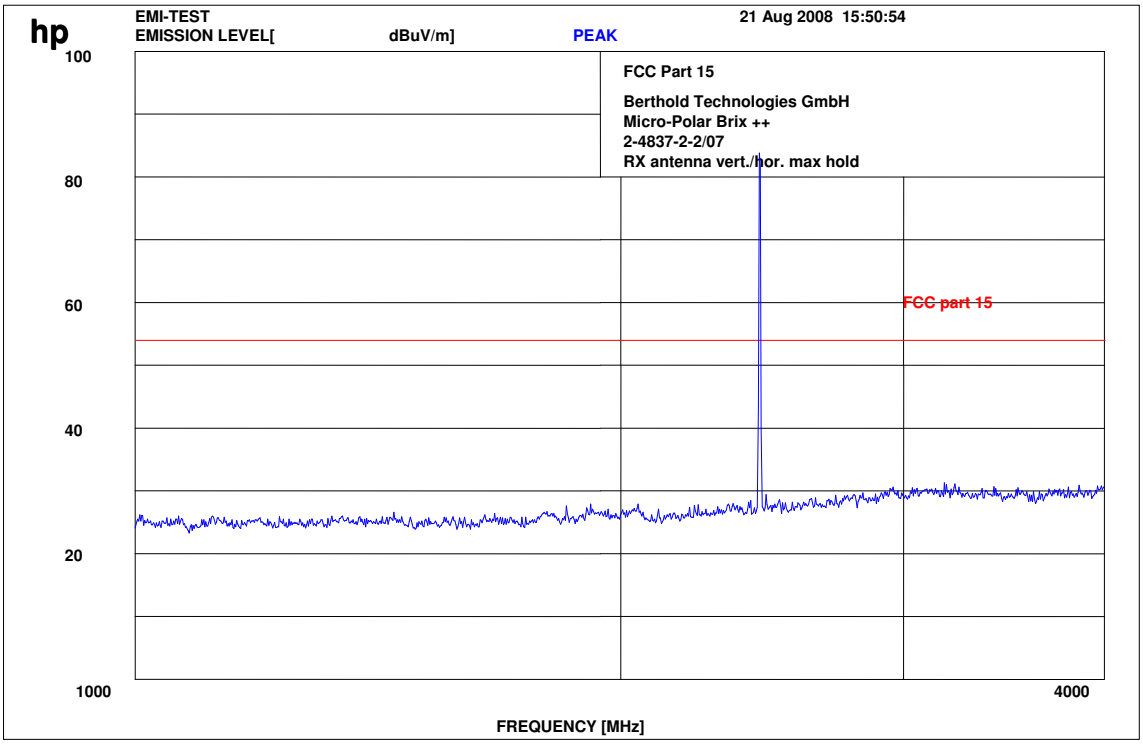
EUT:	51832-01 + 41975
Serial Number:	50009141-P001 + 6345
Test Description:	FCC @ 10 m
Operating Conditions:	CW, measuring continuouse
Operator Name:	Folz
Comment:	Powered with AC 115V/ 60 Hz

Plot 7



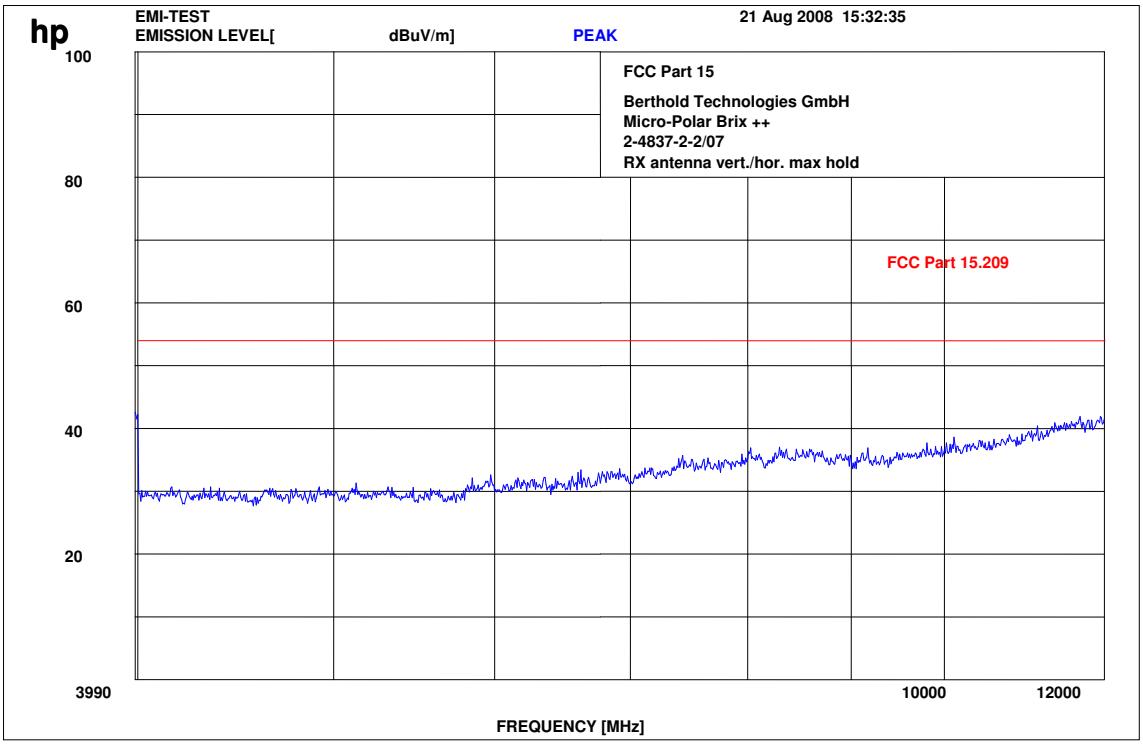
In tank sensor surrounded by water

Plot 8

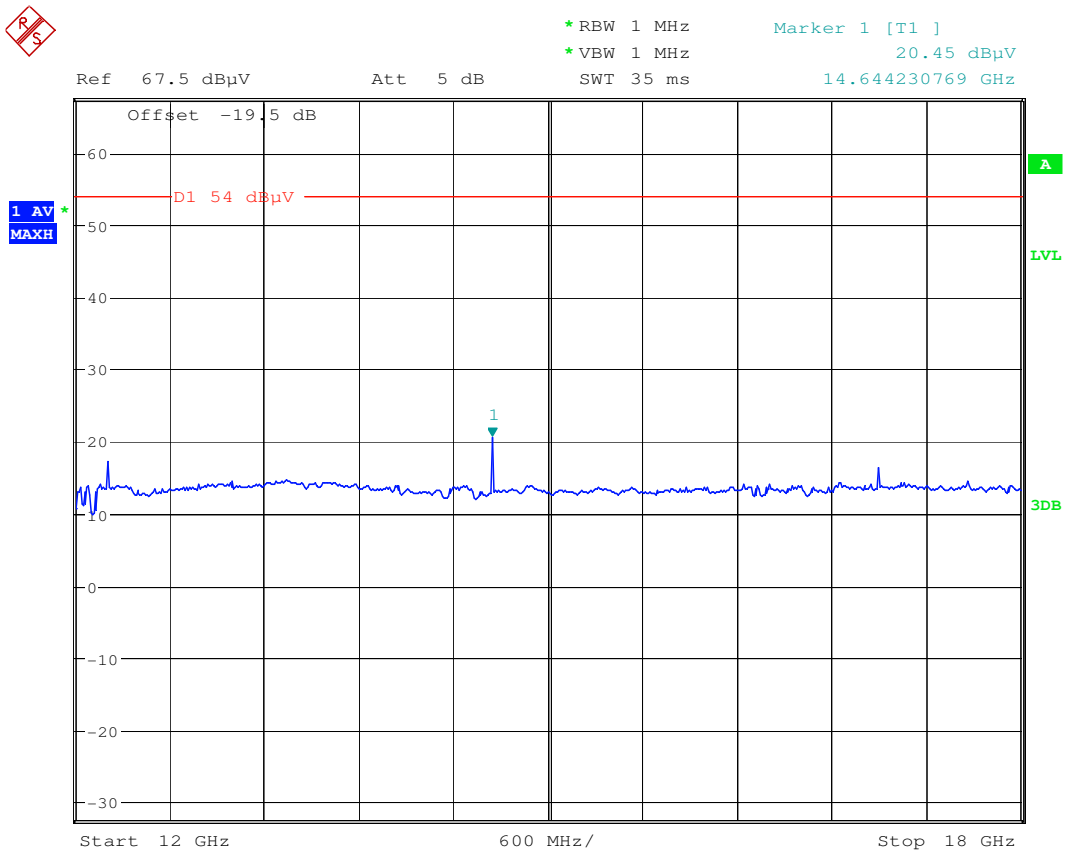


In tank sensor standalone

Plot 9

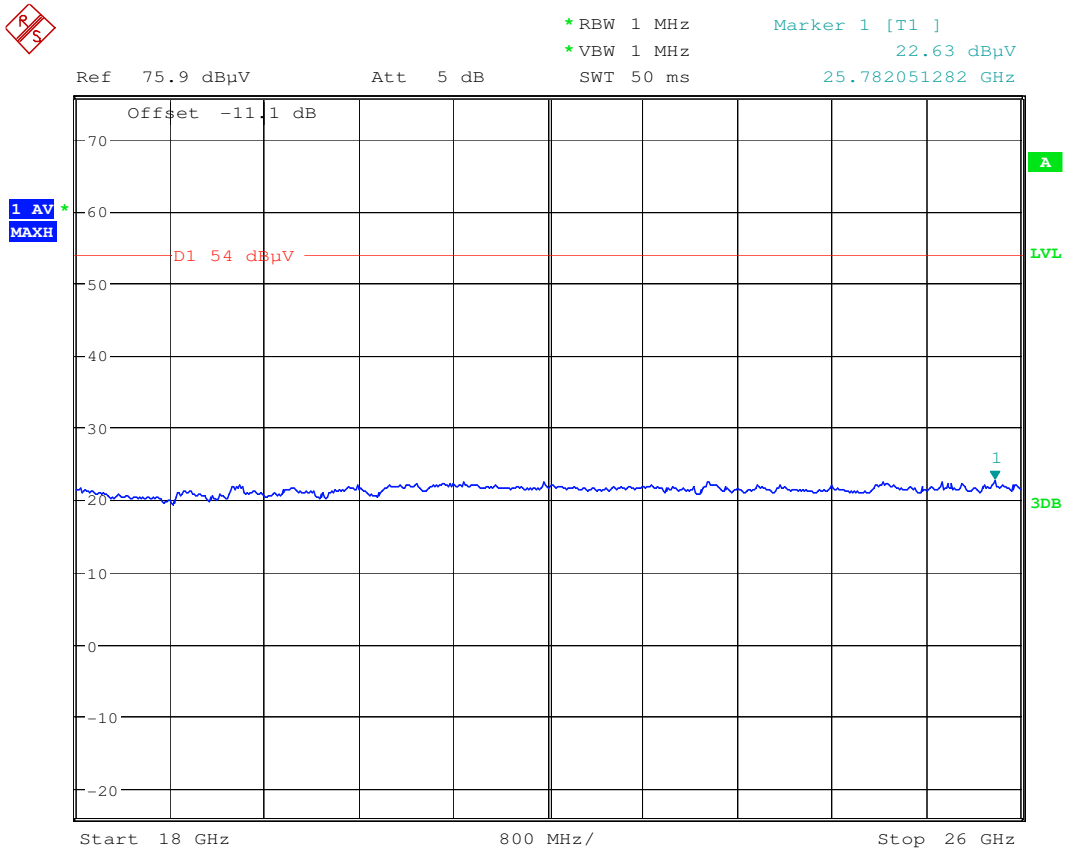

hp
EMI-TEST
21 Aug 2008 15:32:35
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15
Berthold Technologies GmbH
Micro-Polar Brix ++
2-4837-2-2/07
RX antenna vert./hor. max hold
FCC Part 15.209
100
80
60
40
20
3990
10000
12000
FREQUENCY [MHz]

Plot 10



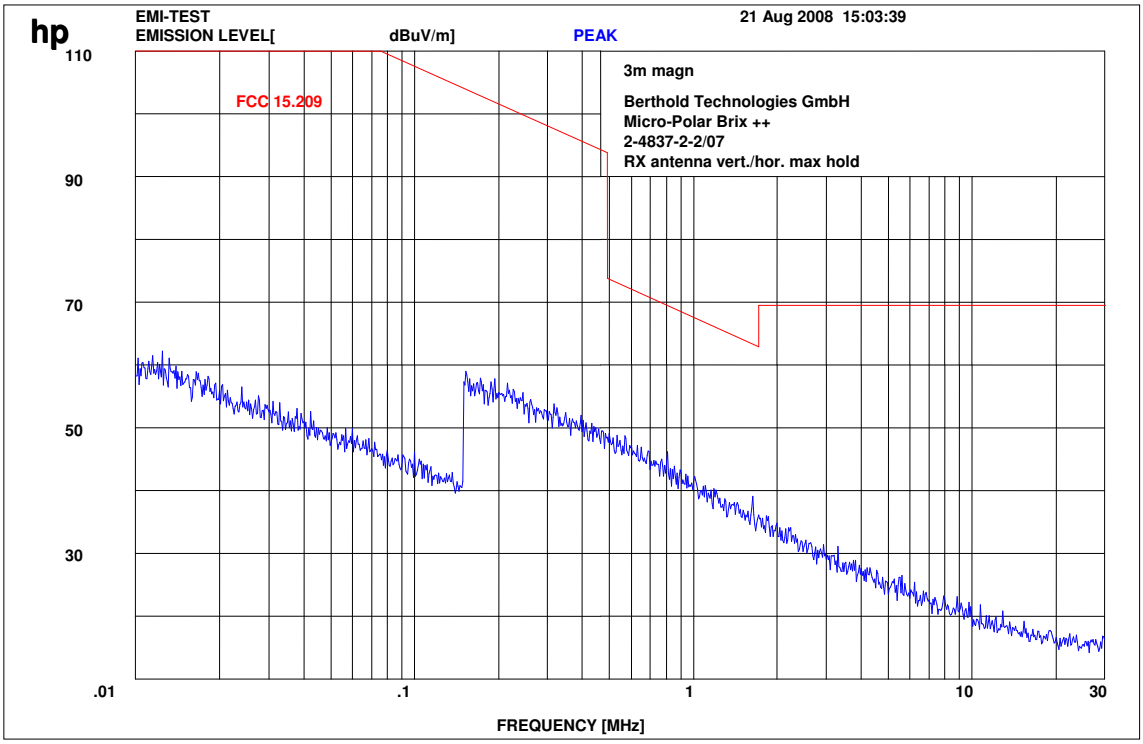
Date: 21.AUG.2008 17:18:19

Plot 11

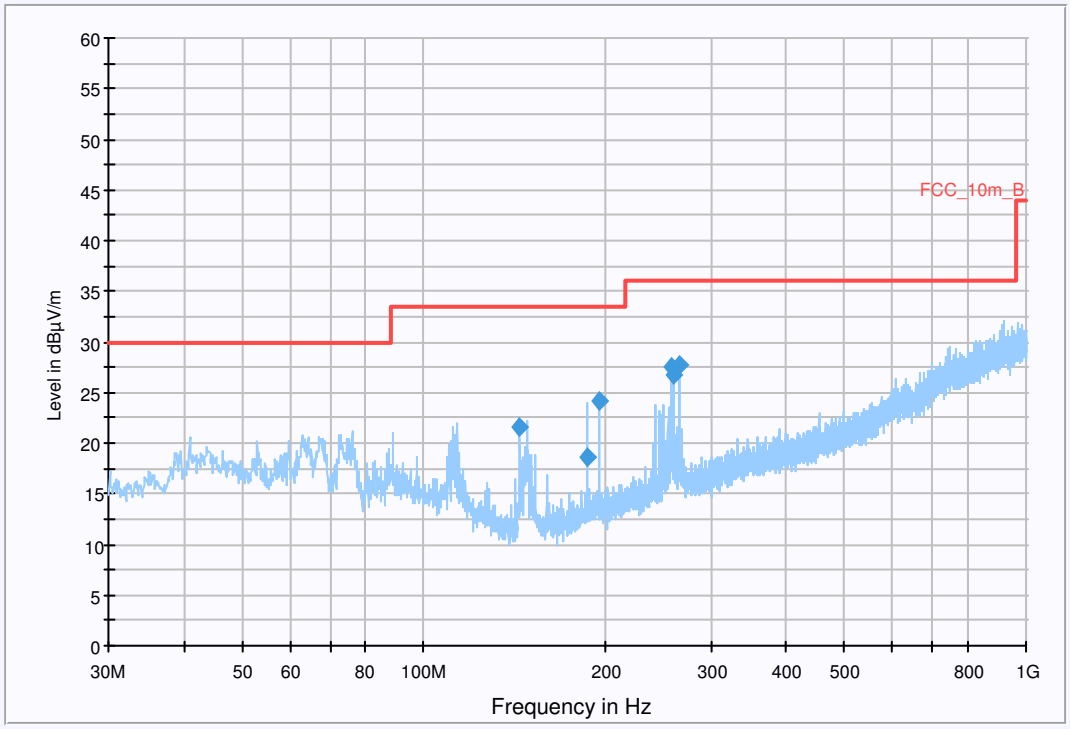


Date: 21.AUG.2008 17:23:23

Plot 12


hp
EMI-TEST
21 Aug 2008 15:03:39
EMISSION LEVEL[dBuV/m]
PEAK
110
90
70
50
30
FCC 15.209
3m magn
Berthold Technologies GmbH
Micro-Polar Brix ++
2-4837-2-2/07
RX antenna vert./hor. max hold
.01
.1
1
10
30
FREQUENCY [MHz]

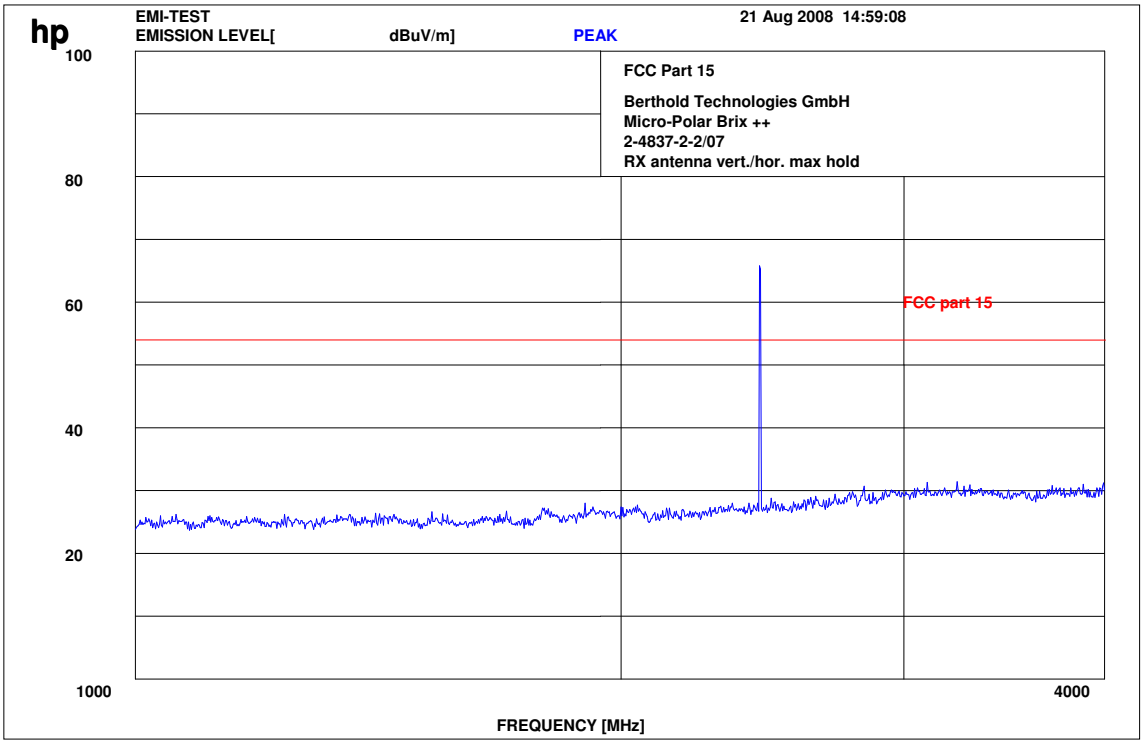
Plot 13



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
144.498250	21.7	15000.000	120.000	100.0	V	90.0	9.1	11.8	33.5	
186.649750	18.5	15000.000	120.000	114.0	V	298.0	11.1	15.0	33.5	
195.560550	24.2	15000.000	120.000	317.0	H	227.0	11.6	9.3	33.5	
257.775650	27.5	15000.000	120.000	384.0	H	24.0	13.7	8.5	36.0	
259.254800	26.7	15000.000	120.000	296.0	H	8.0	13.7	9.3	36.0	
266.670700	27.7	15000.000	120.000	400.0	H	307.0	13.9	8.3	36.0	

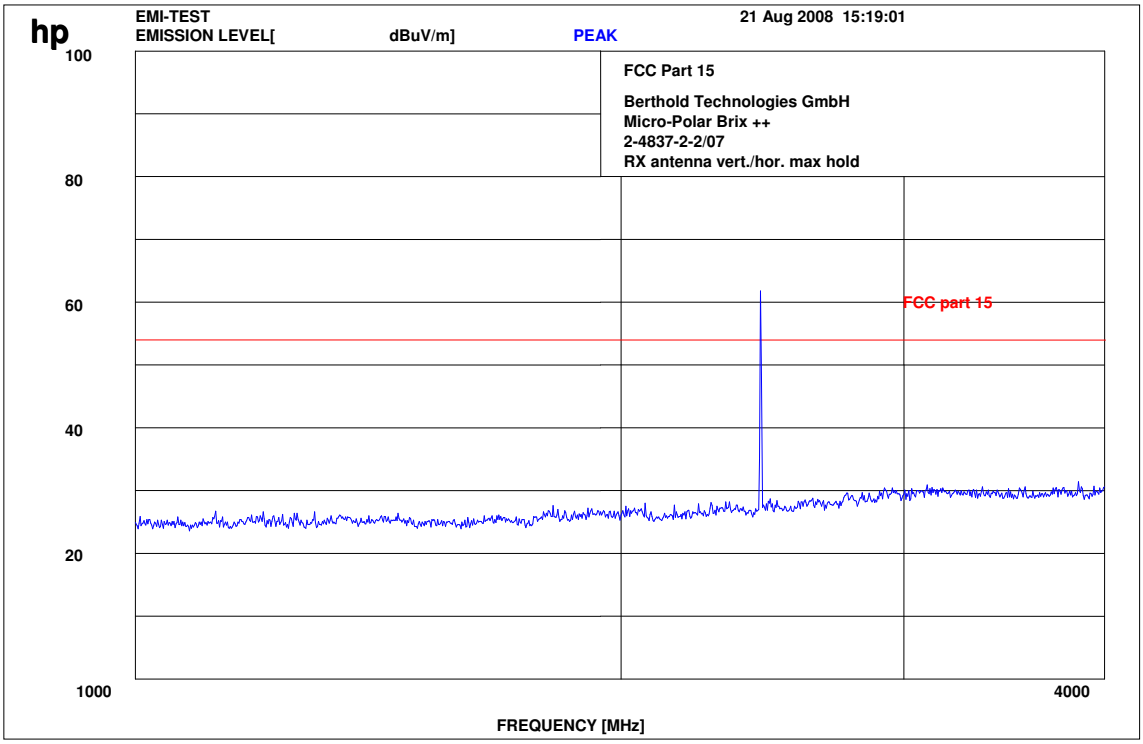
EUT:	51832-01 + 43617
Serial Number:	50009141-P001 + 6009
Test Description:	FCC @ 10 m
Operating Conditions:	CW, measuring continuous
Operator Name:	Folz
Comment:	Powered with AC 115V/ 60 Hz

Plot 14



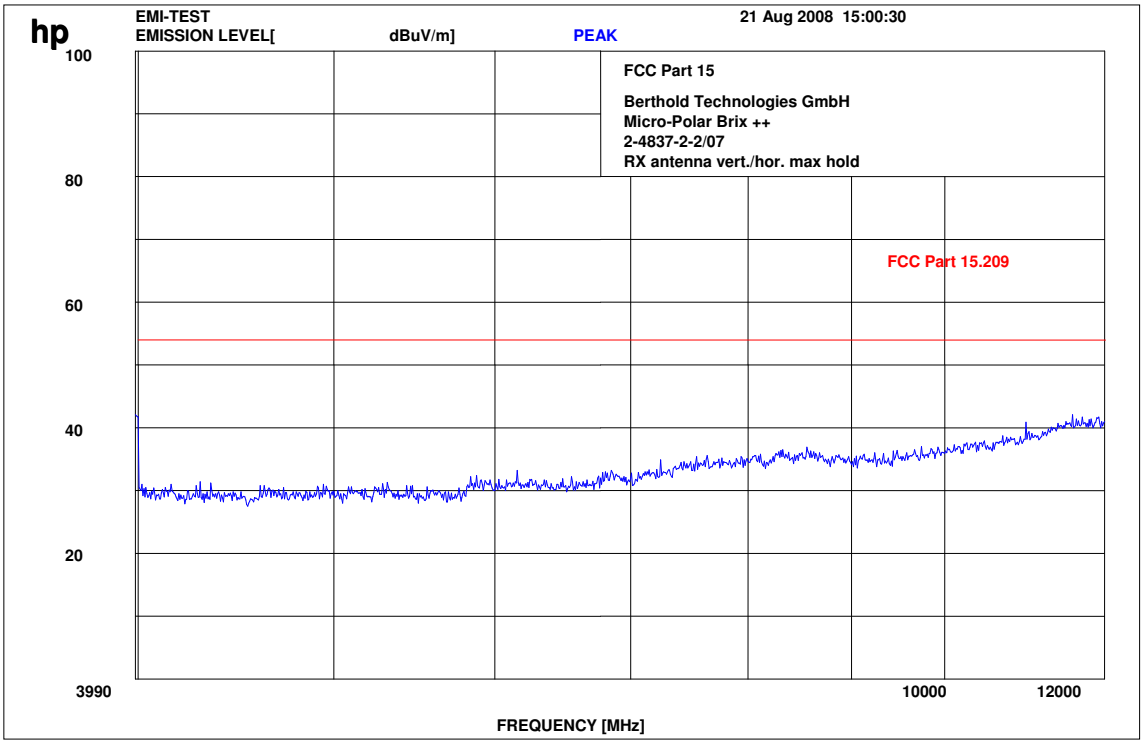
Flow cell sensor surrounded by water

Plot 15

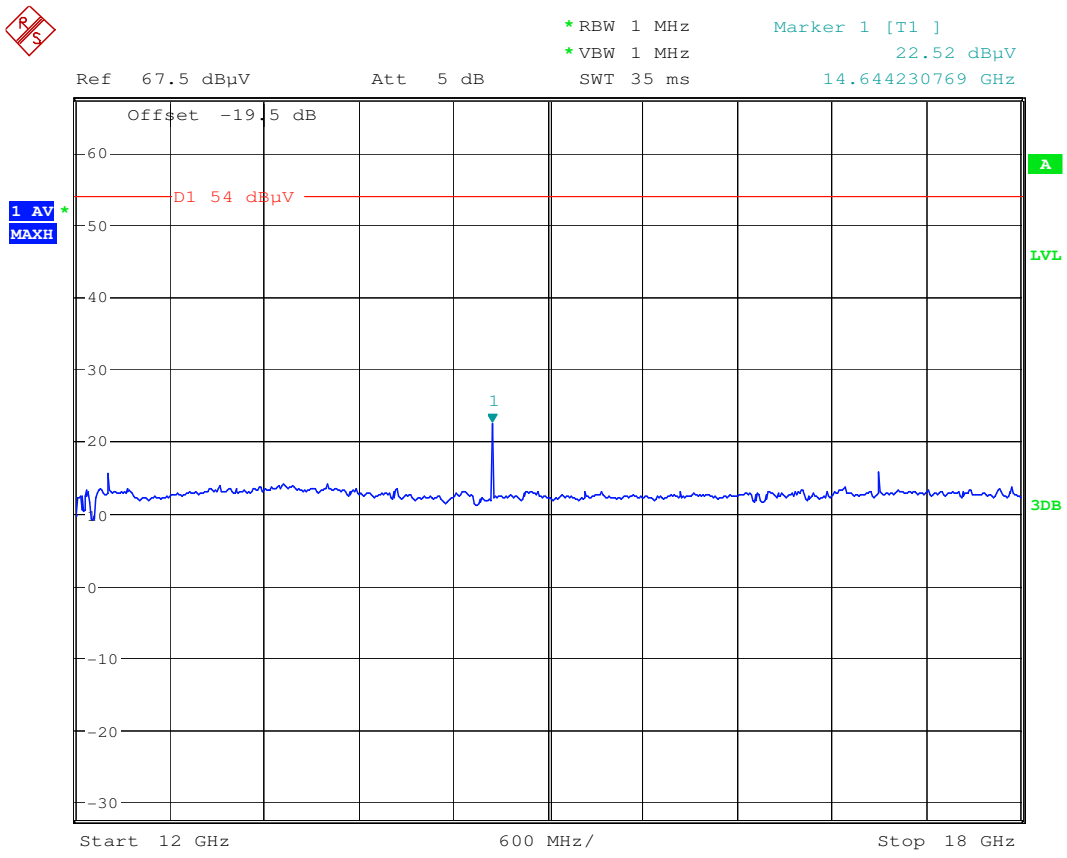


Flow cell sensor without water

Plot 16

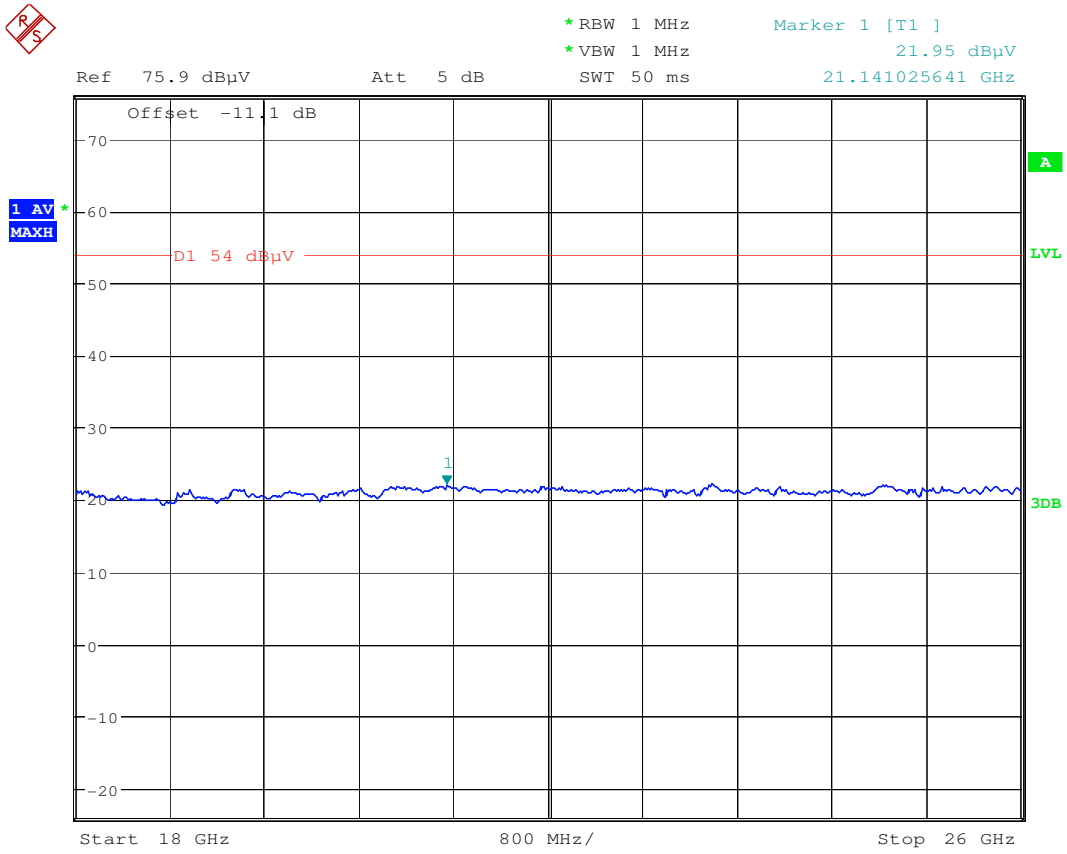

hp
EMI-TEST
21 Aug 2008 15:00:30
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15
Berthold Technologies GmbH
Micro-Polar Brix ++
2-4837-2-2/07
RX antenna vert./hor. max hold
FCC Part 15.209
100
80
60
40
20
3990
10000
12000
FREQUENCY [MHz]

Plot 17



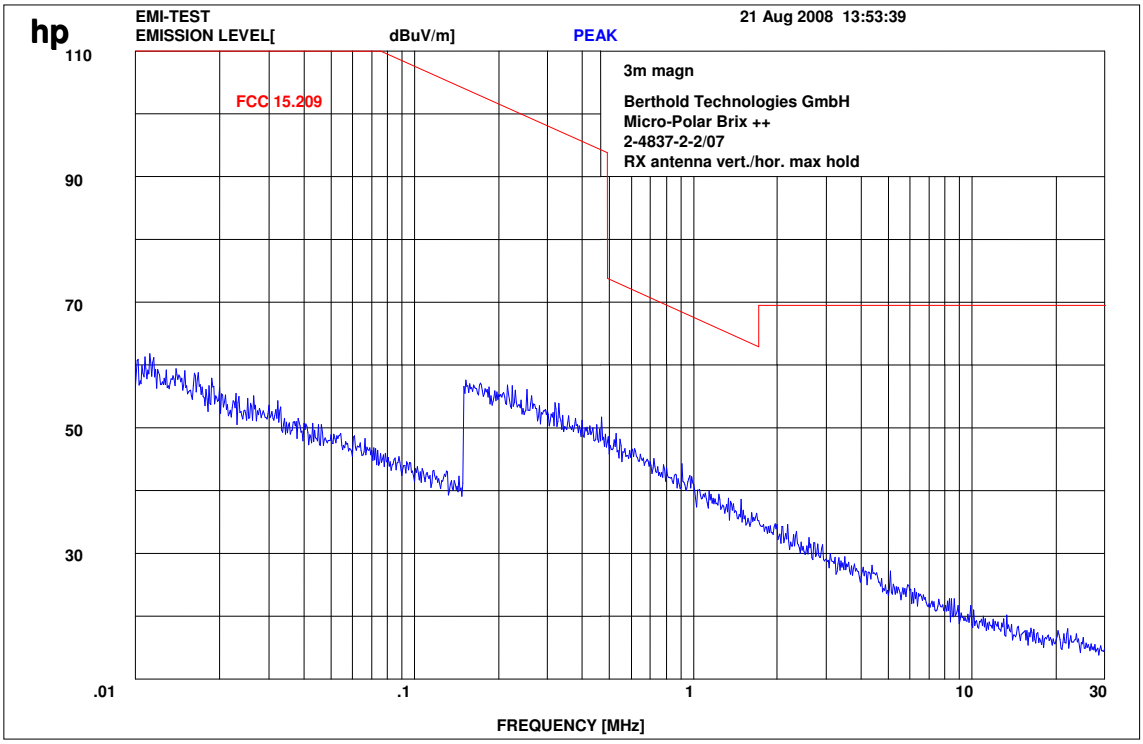
Date: 21.AUG.2008 17:47:51

Plot 18

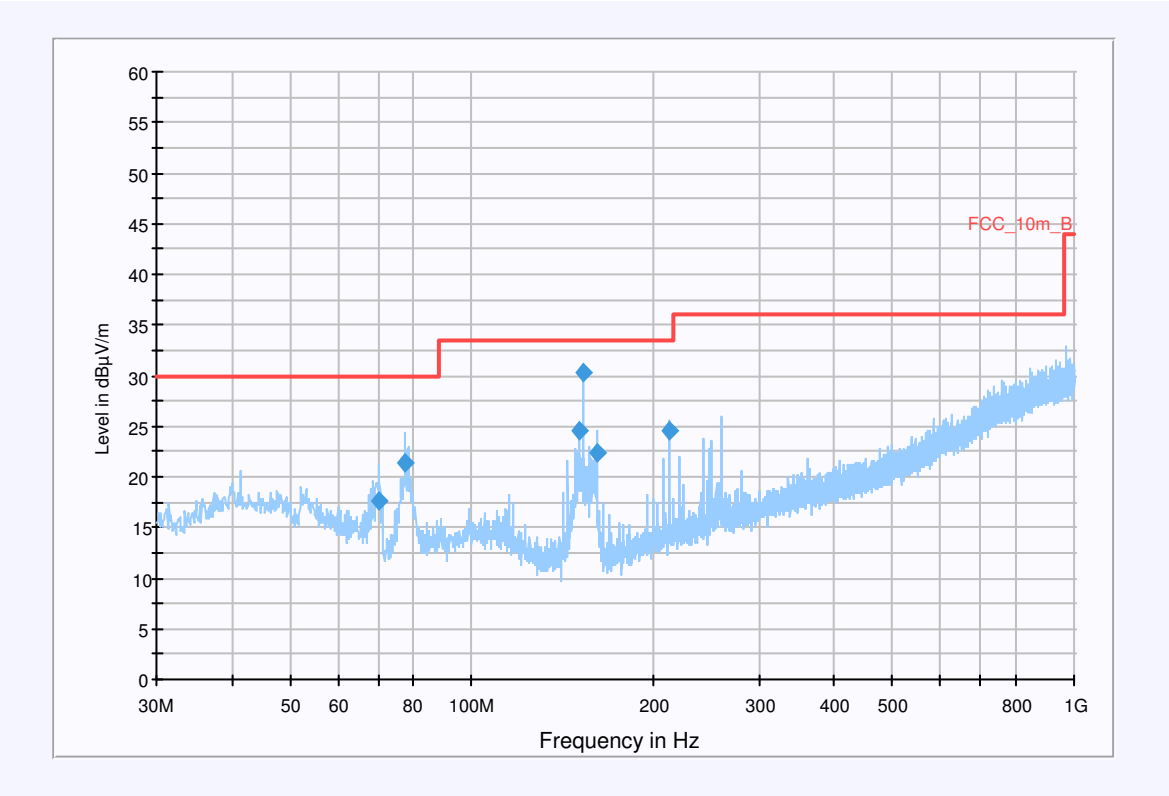


Date: 21.AUG.2008 17:52:06

Plot 19


hp
EMI-TEST
EMISSION LEVEL[dBuV/m]
PEAK
21 Aug 2008 13:53:39
3m magn
Berthold Technologies GmbH
Micro-Polar Brix ++
2-4837-2-2/07
RX antenna vert./hor. max hold
FCC 15.209
110
90
70
50
30
.01
.1
1
10
30
FREQUENCY [MHz]

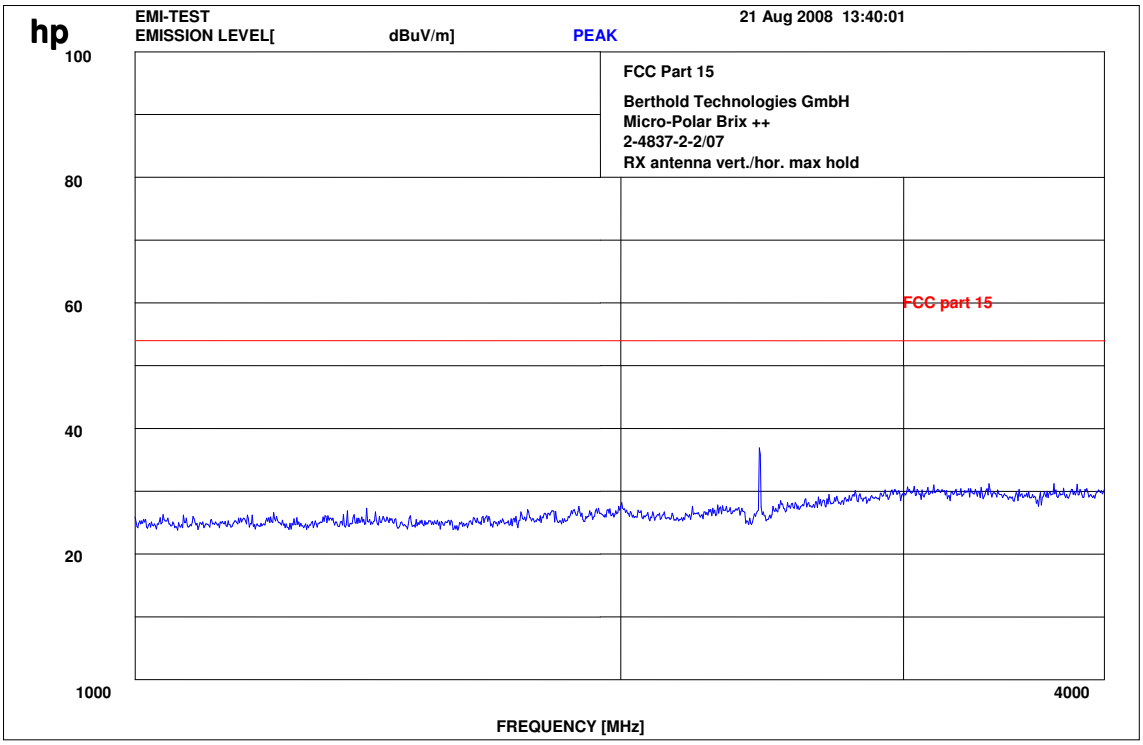
Plot 20



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
70.037500	17.7	15000.000	120.000	360.0	V	41.0	9.6	12.3	30.0	
77.452700	21.5	15000.000	120.000	320.0	V	65.0	9.5	8.5	30.0	
151.114950	24.6	15000.000	120.000	123.0	V	-1.0	9.3	8.9	33.5	
153.000450	30.3	15000.000	120.000	100.0	V	-1.0	9.3	3.2	33.5	
161.493250	22.4	15000.000	120.000	100.0	V	80.0	9.6	11.1	33.5	
212.491150	24.5	15000.000	120.000	100.0	V	312.0	12.3	9.0	33.5	

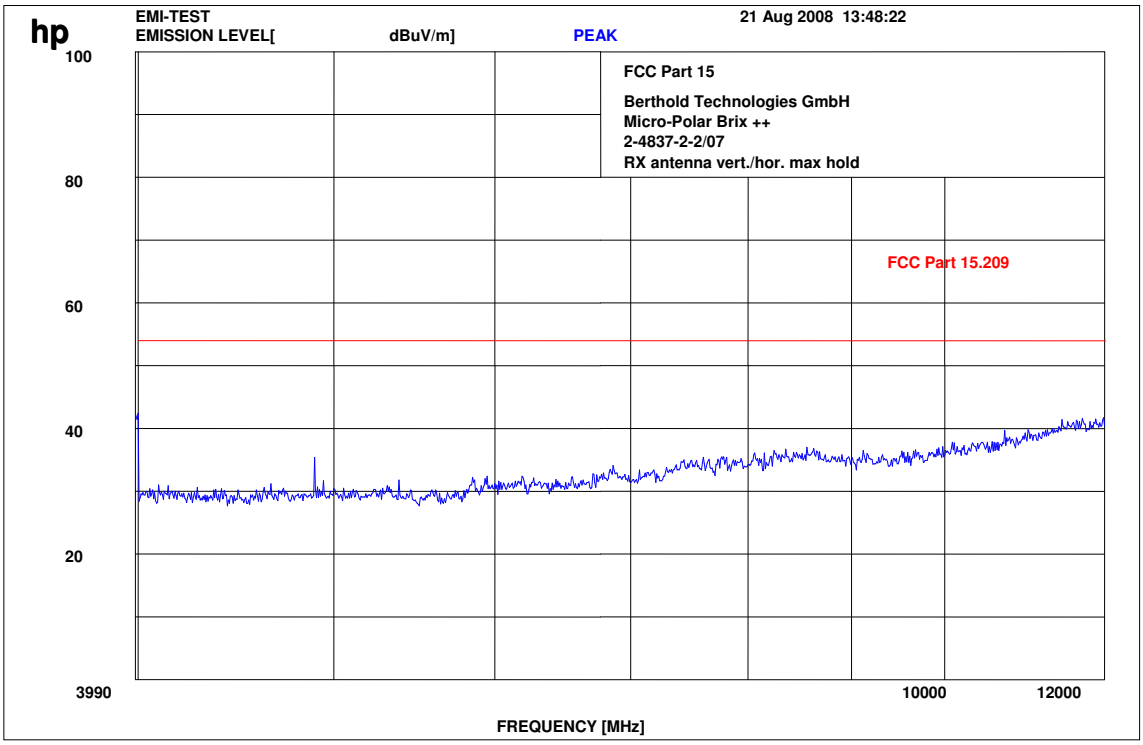
EUT:	51832-02 + 10806
Serial Number:	60028616-6001 + none
Test Description:	FCC @ 10 m
Operating Conditions:	CW, measuring continuouse
Operator Name:	Folz
Comment:	Powered with DC 24V

Plot 21

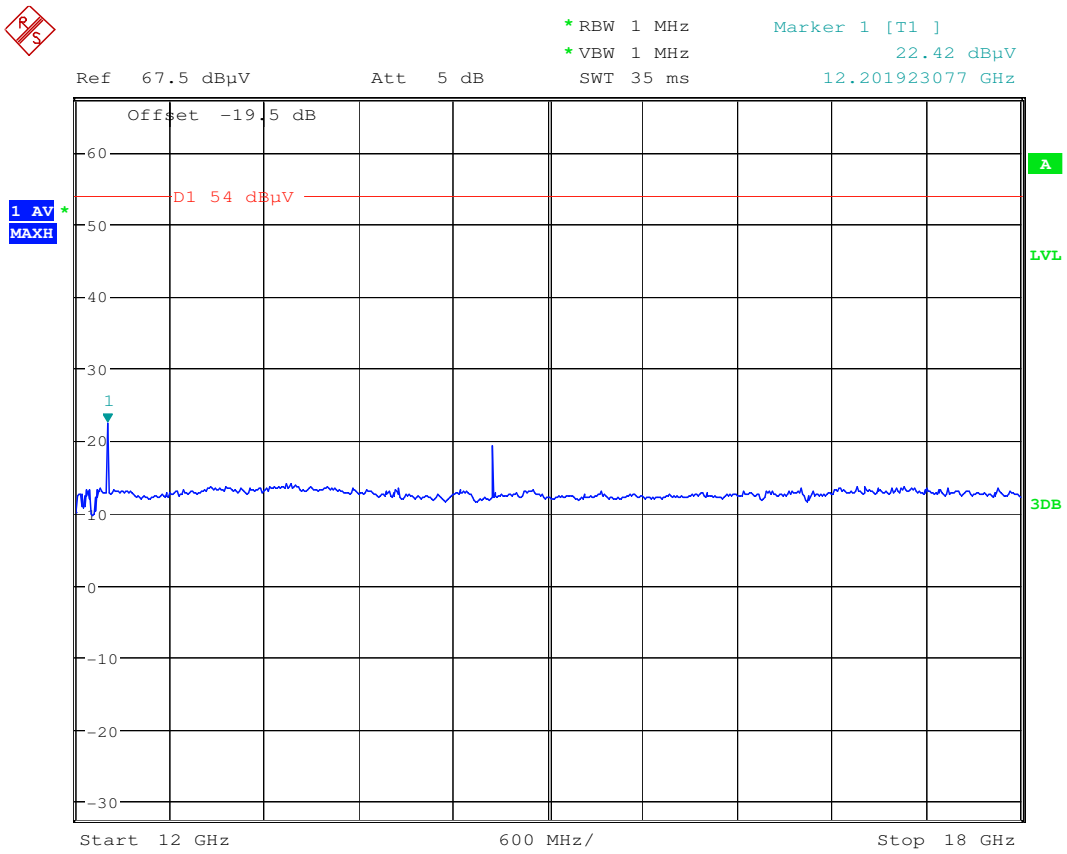


The peak at 2.44 GHz shows the carrier (equipped with a notch filter)

Plot 22

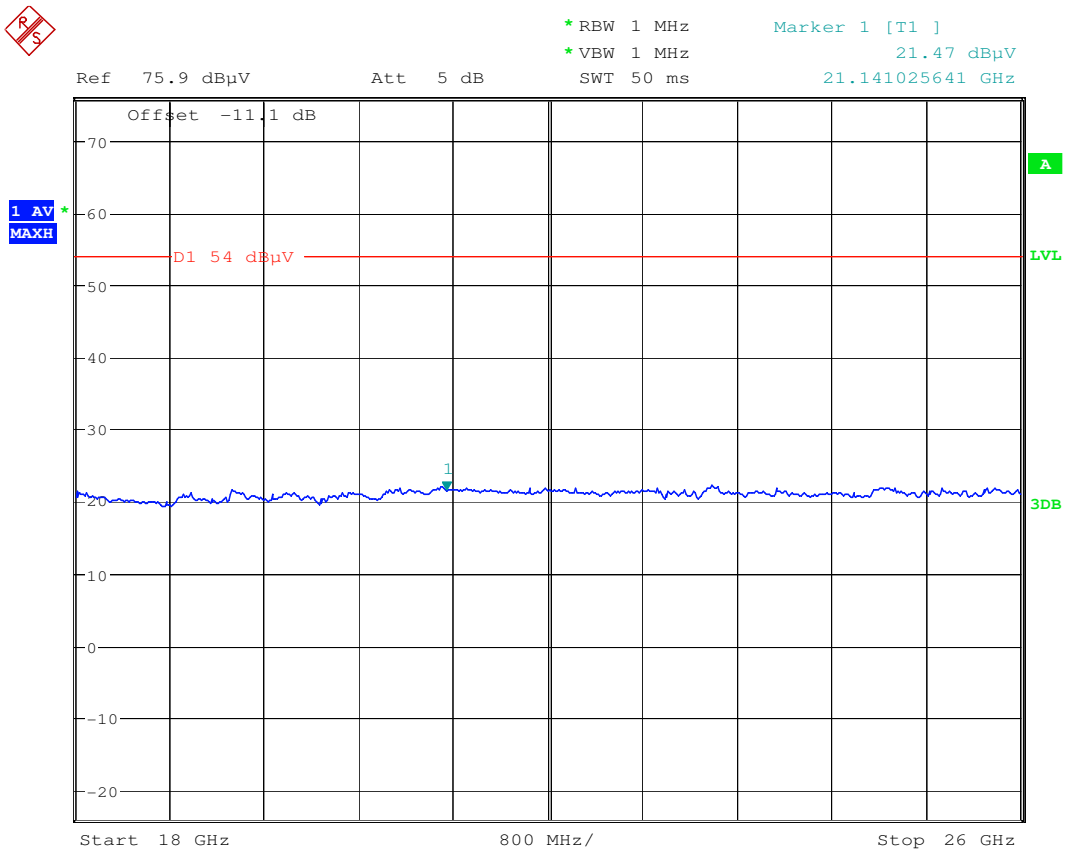

hp
EMI-TEST
EMISSION LEVEL[dBuV/m]
PEAK
21 Aug 2008 13:48:22
FCC Part 15
Berthold Technologies GmbH
Micro-Polar Brix ++
2-4837-2-2/07
RX antenna vert./hor. max hold
FCC Part 15.209
100
80
60
40
20
3990
10000
12000
FREQUENCY [MHz]

Plot 23



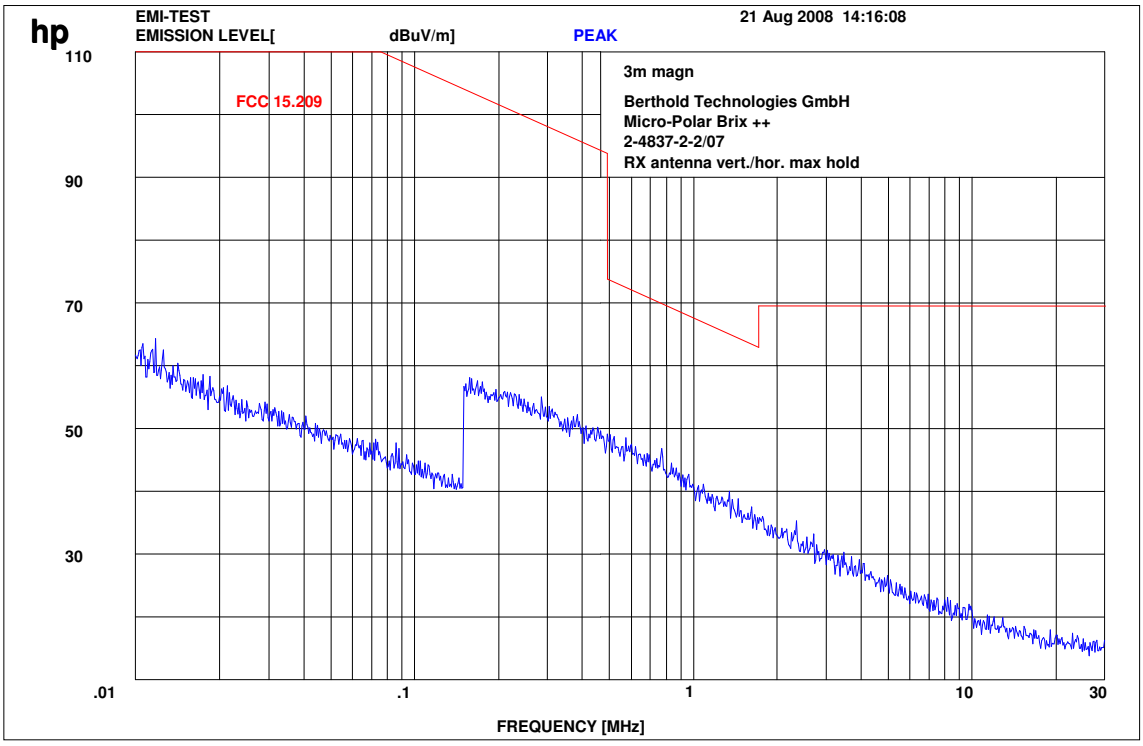
Date: 21.AUG.2008 18:00:59

Plot 24

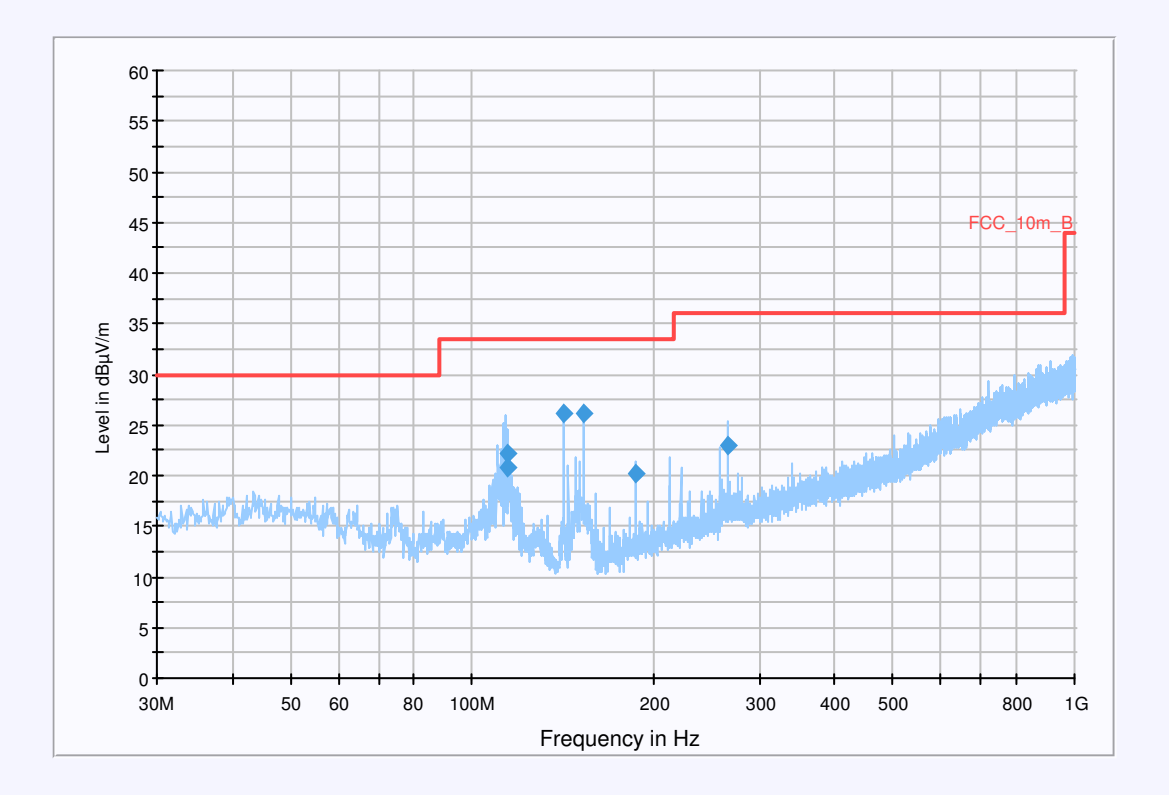


Date: 21.AUG.2008 17:58:20

Plot 25


hp
EMI-TEST
EMISSION LEVEL[dBuV/m]
PEAK
21 Aug 2008 14:16:08
3m magn
Berthold Technologies GmbH
Micro-Polar Brix ++
2-4837-2-2/07
RX antenna vert./hor. max hold
FCC 15.209
110
90
70
50
30
.01
.1
1
10
30
FREQUENCY [MHz]

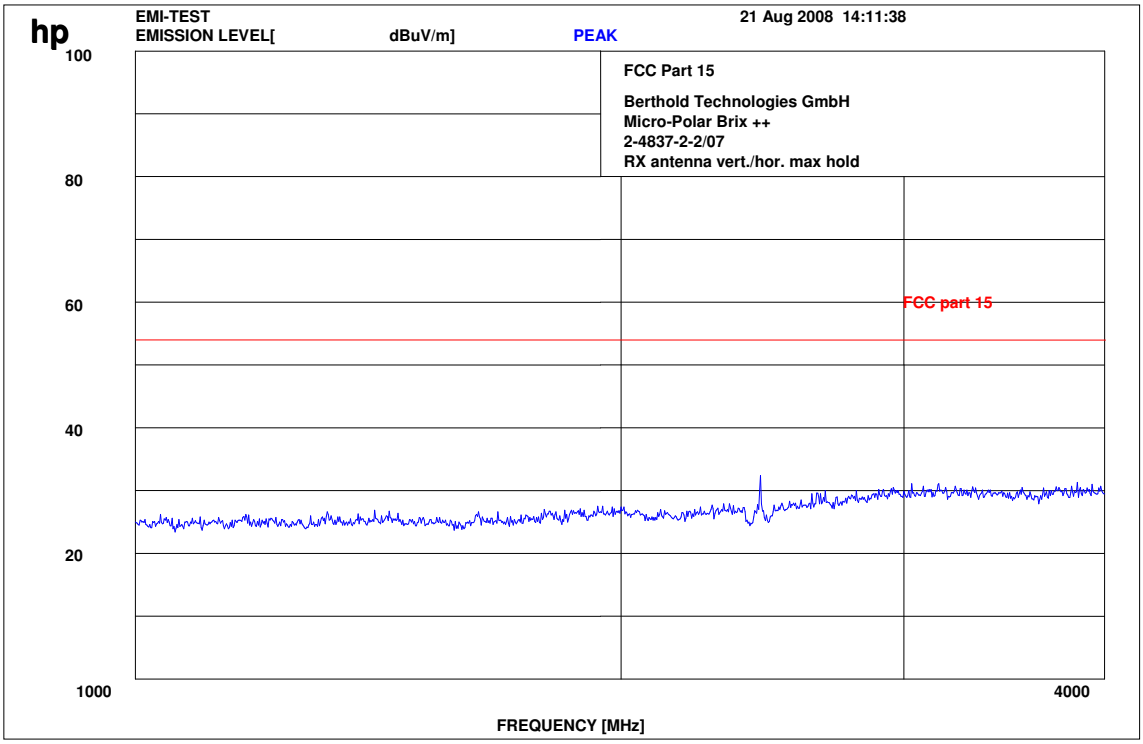
Plot 26



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
114.274450	22.1	15000.000	120.000	100.0	V	277.0	11.0	11.4	33.5	
114.297400	20.9	15000.000	120.000	100.0	V	252.0	11.0	12.6	33.5	
142.220050	26.1	15000.000	120.000	140.0	V	135.0	9.0	7.4	33.5	
153.006900	26.2	15000.000	120.000	200.0	V	85.0	9.3	7.3	33.5	
186.670600	20.1	15000.000	120.000	234.0	V	94.0	11.1	13.4	33.5	
266.673700	22.9	15000.000	120.000	127.0	V	133.0	13.9	13.1	36.0	

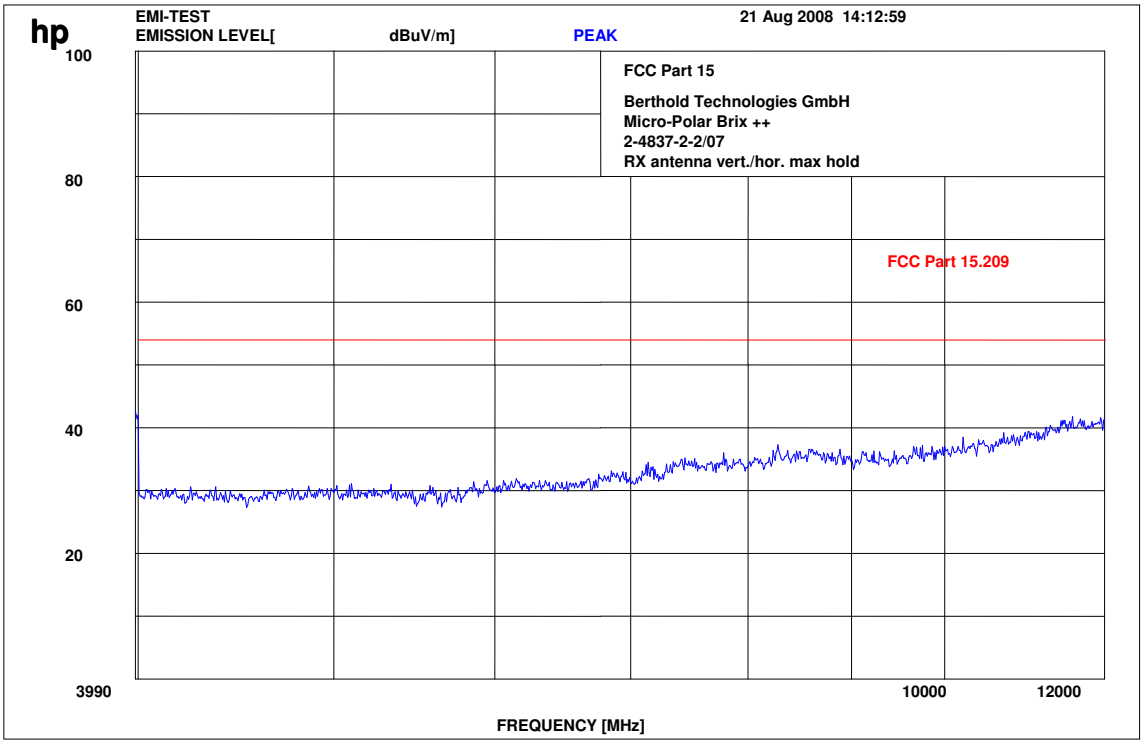
EUT:	51832-01 + 15394
Serial Number:	50009141-P001 + none
Test Description:	FCC @ 10 m
Operating Conditions:	CW, measuring continuouse
Operator Name:	Folz
Comment:	Powered with AC 115V/ 60 Hz

Plot 27

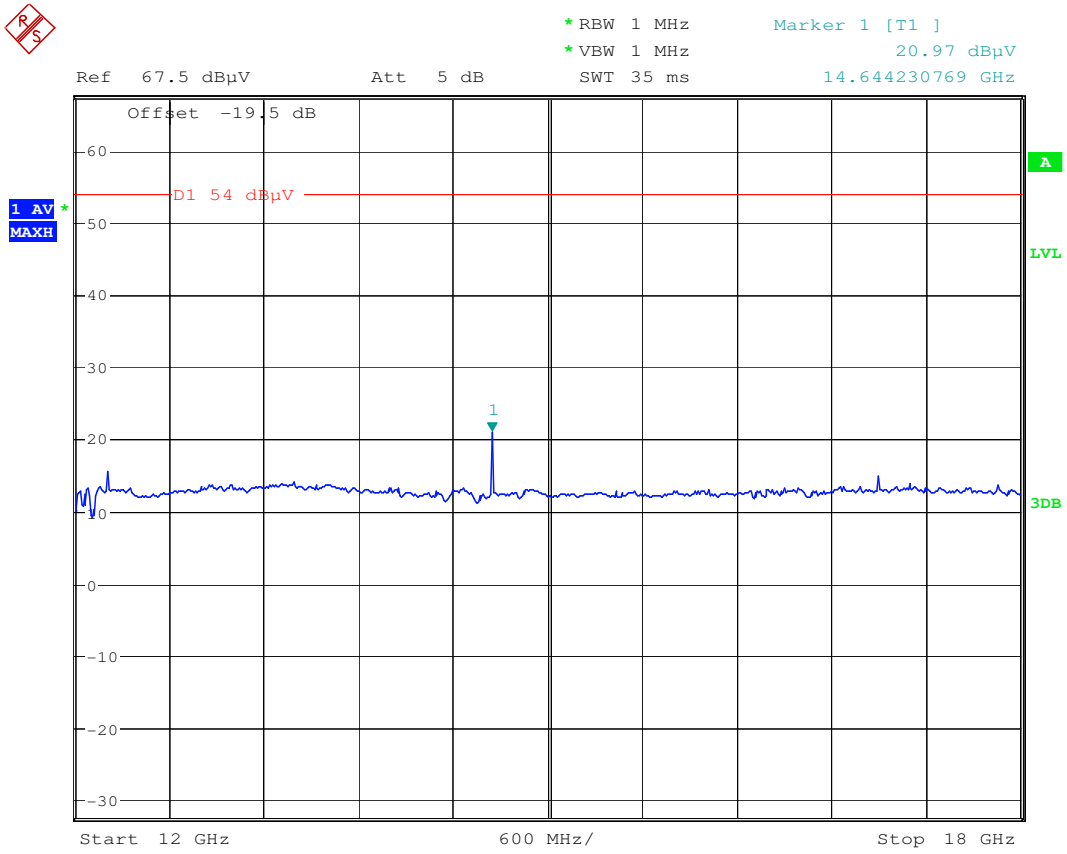


The peak at 2.44 GHz shows the carrier (equipped with a notch filter)

Plot 28

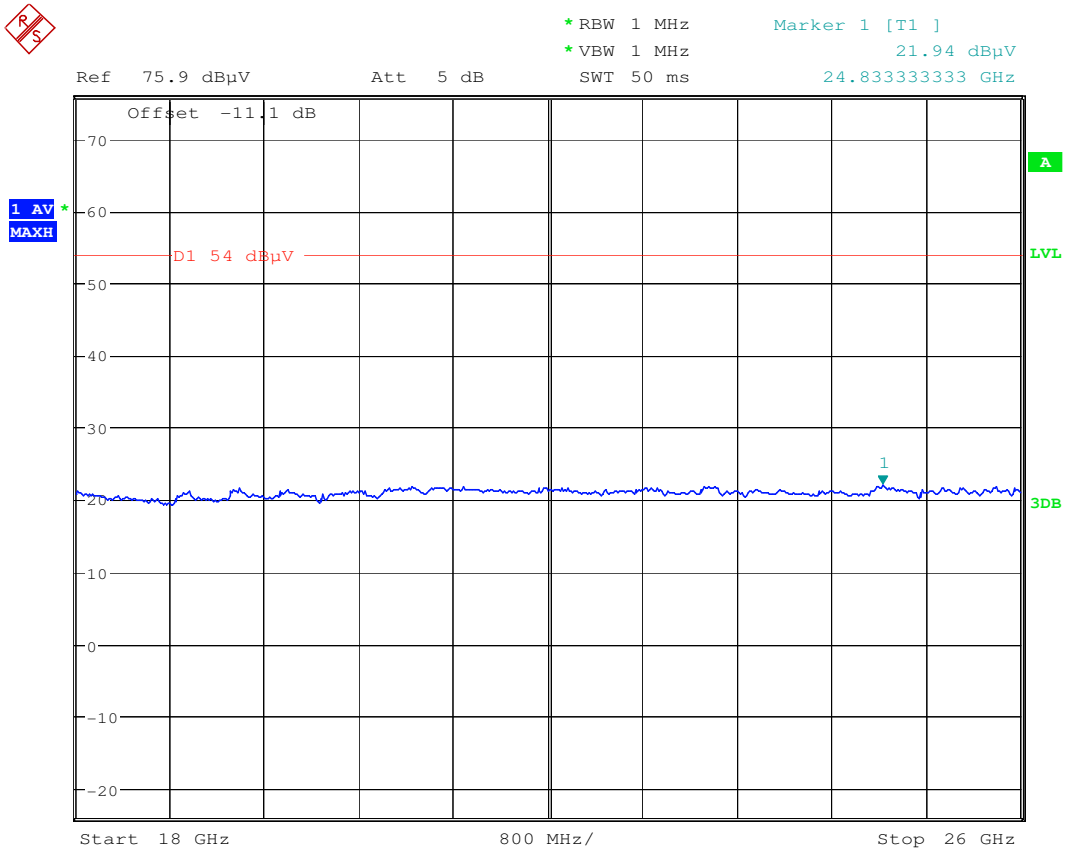

hp
EMI-TEST
21 Aug 2008 14:12:59
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15
Berthold Technologies GmbH
Micro-Polar Brix ++
2-4837-2-2/07
RX antenna vert./hor. max hold
FCC Part 15.209
100
80
60
40
20
3990
10000
12000
FREQUENCY [MHz]

Plot 29



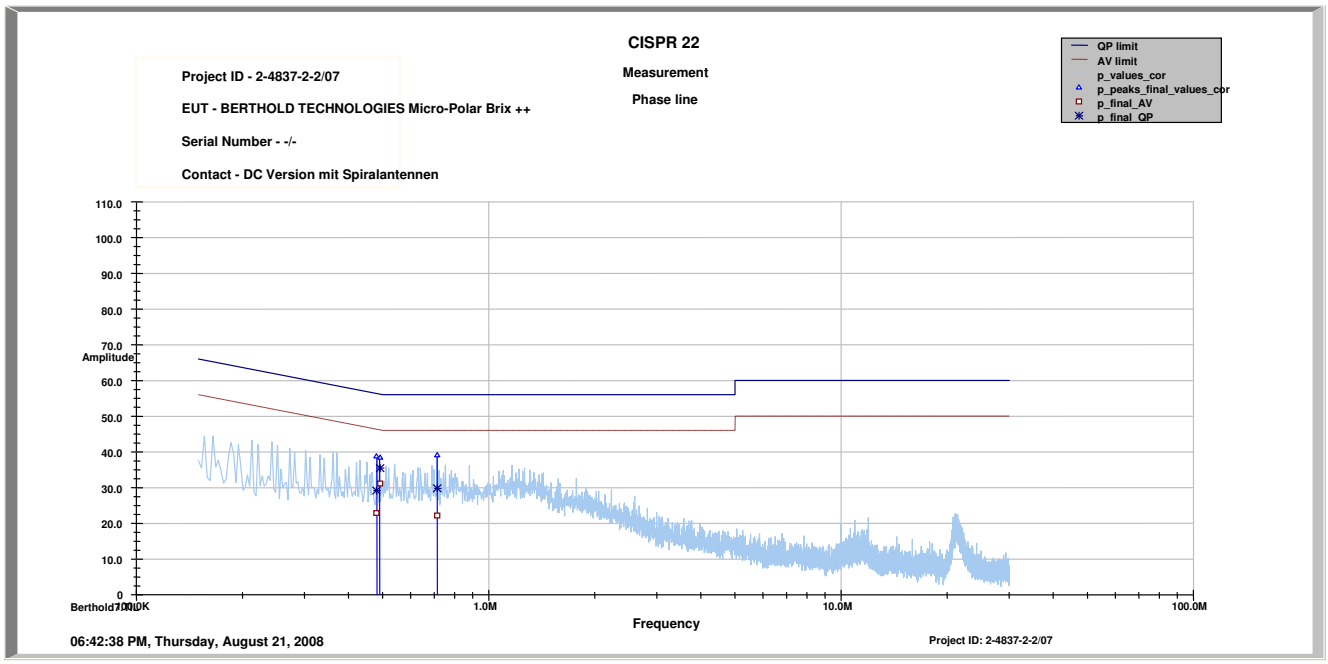
Date: 21.AUG.2008 18:04:58

Plot 30

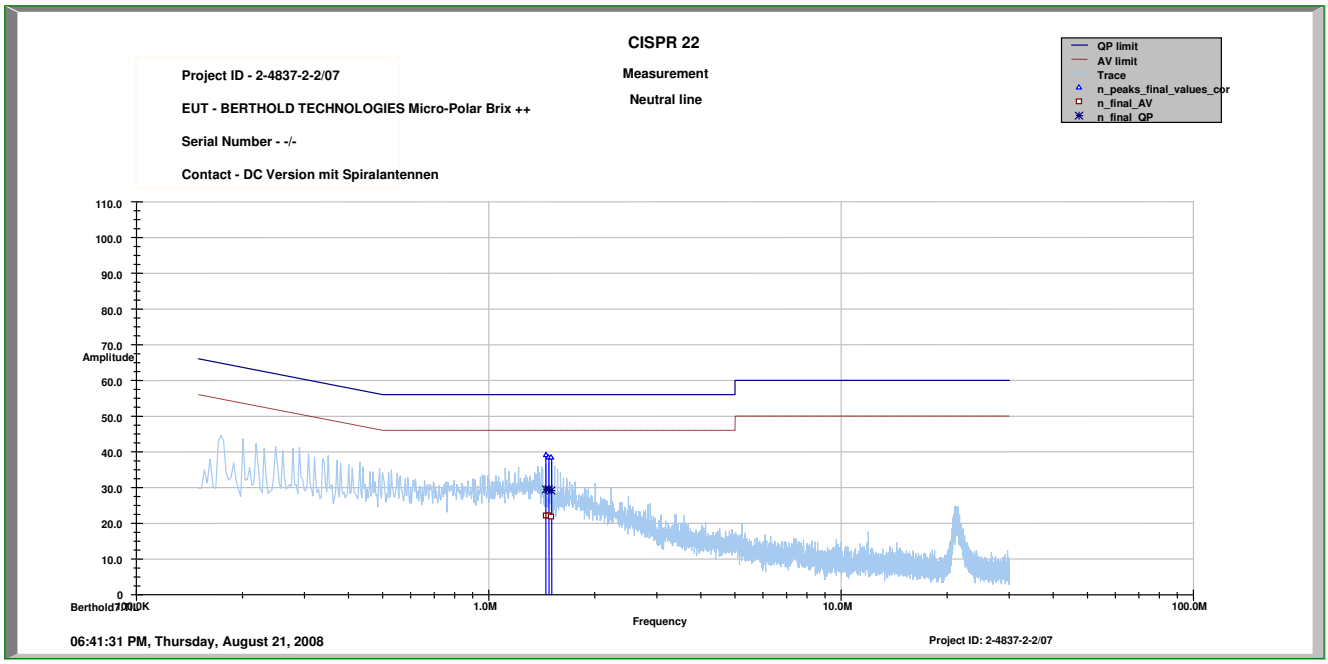


Date: 21.AUG.2008 18:07:49

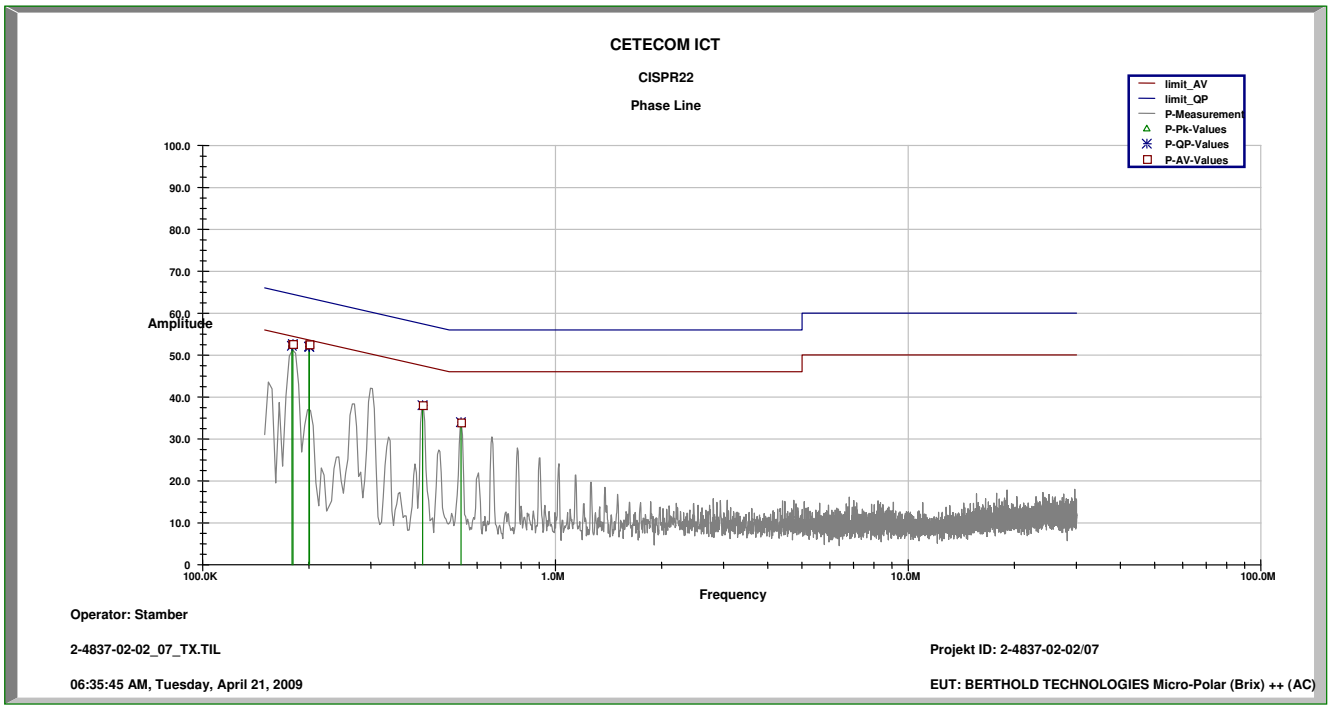
Plot 31



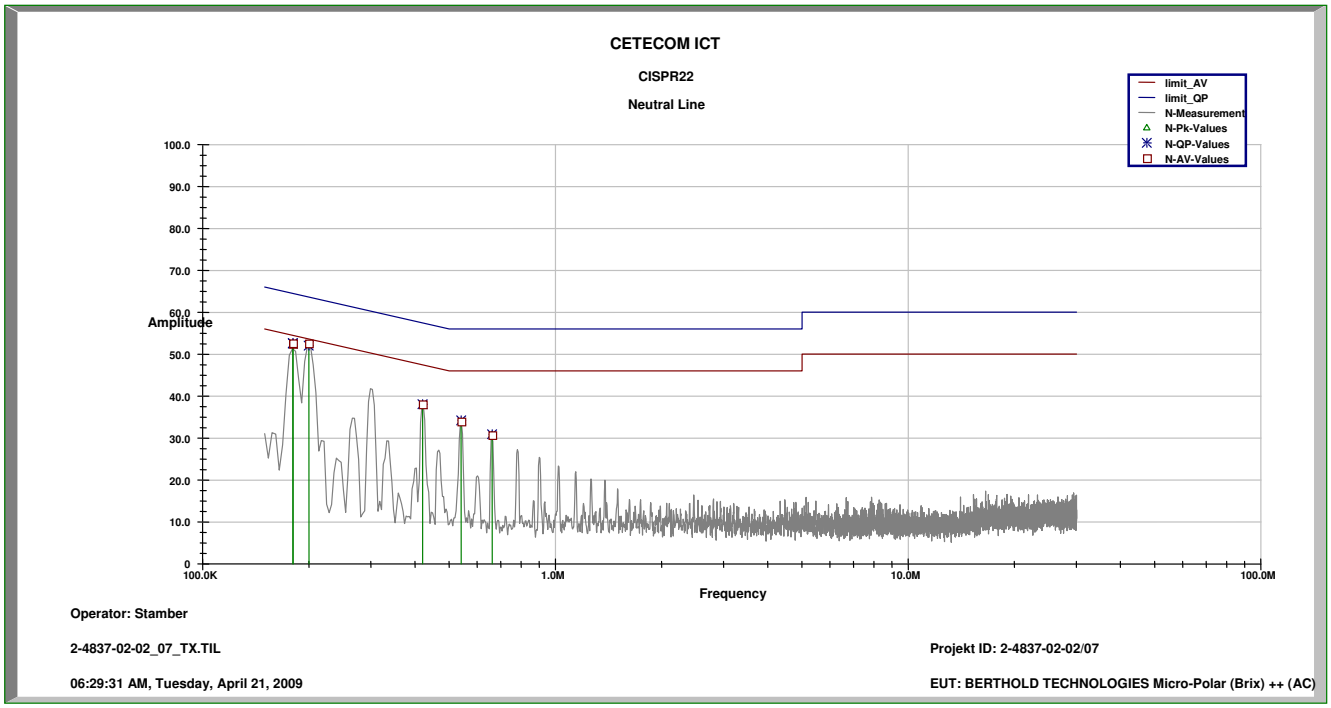
Plot 32



Plot 33



Plot 34



4 Photographs

Photo 1:

Front view of the EUT equipped with spiral antennas

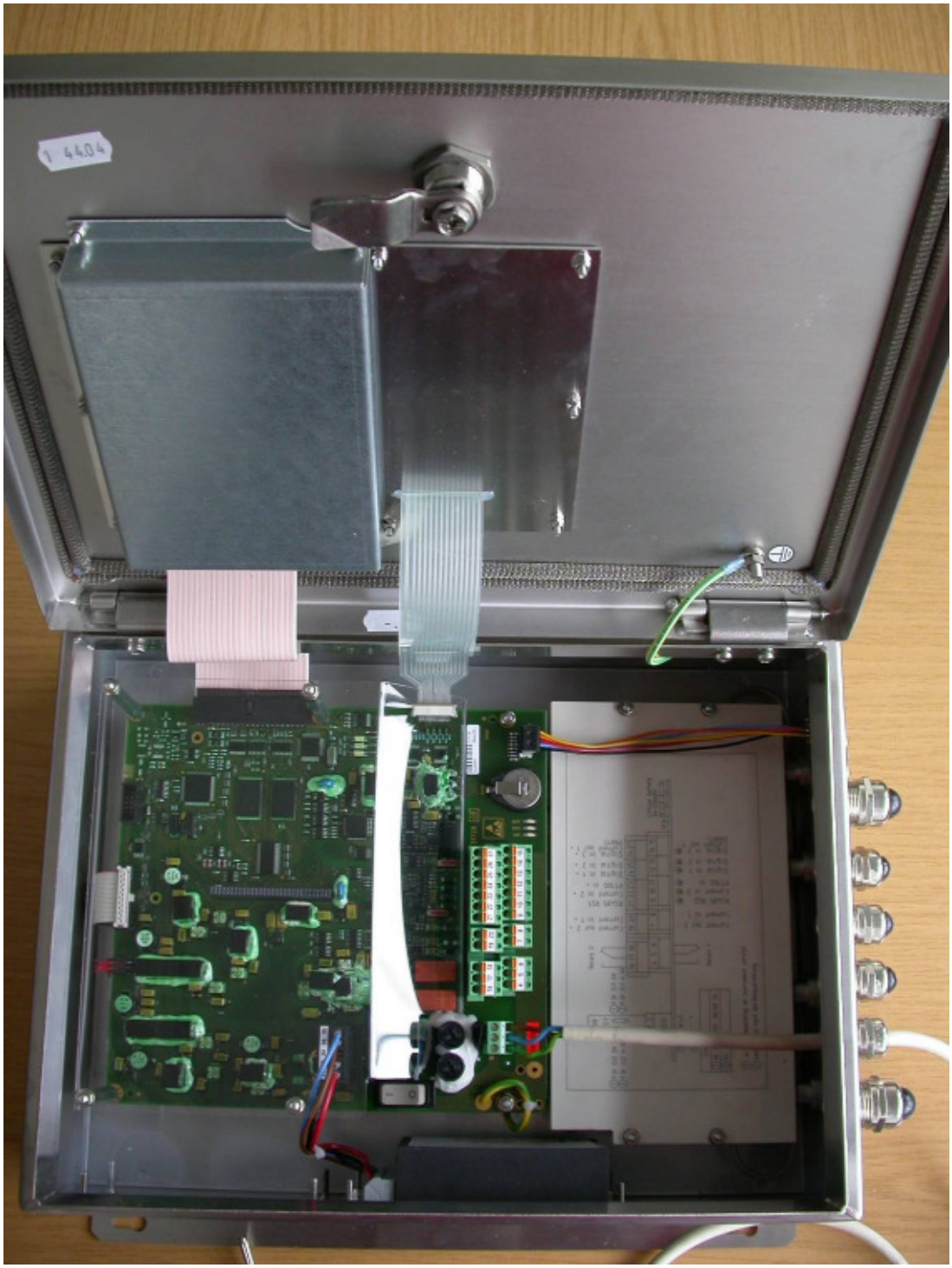
Photo 2:

Front view of the EUT

Photo 3:

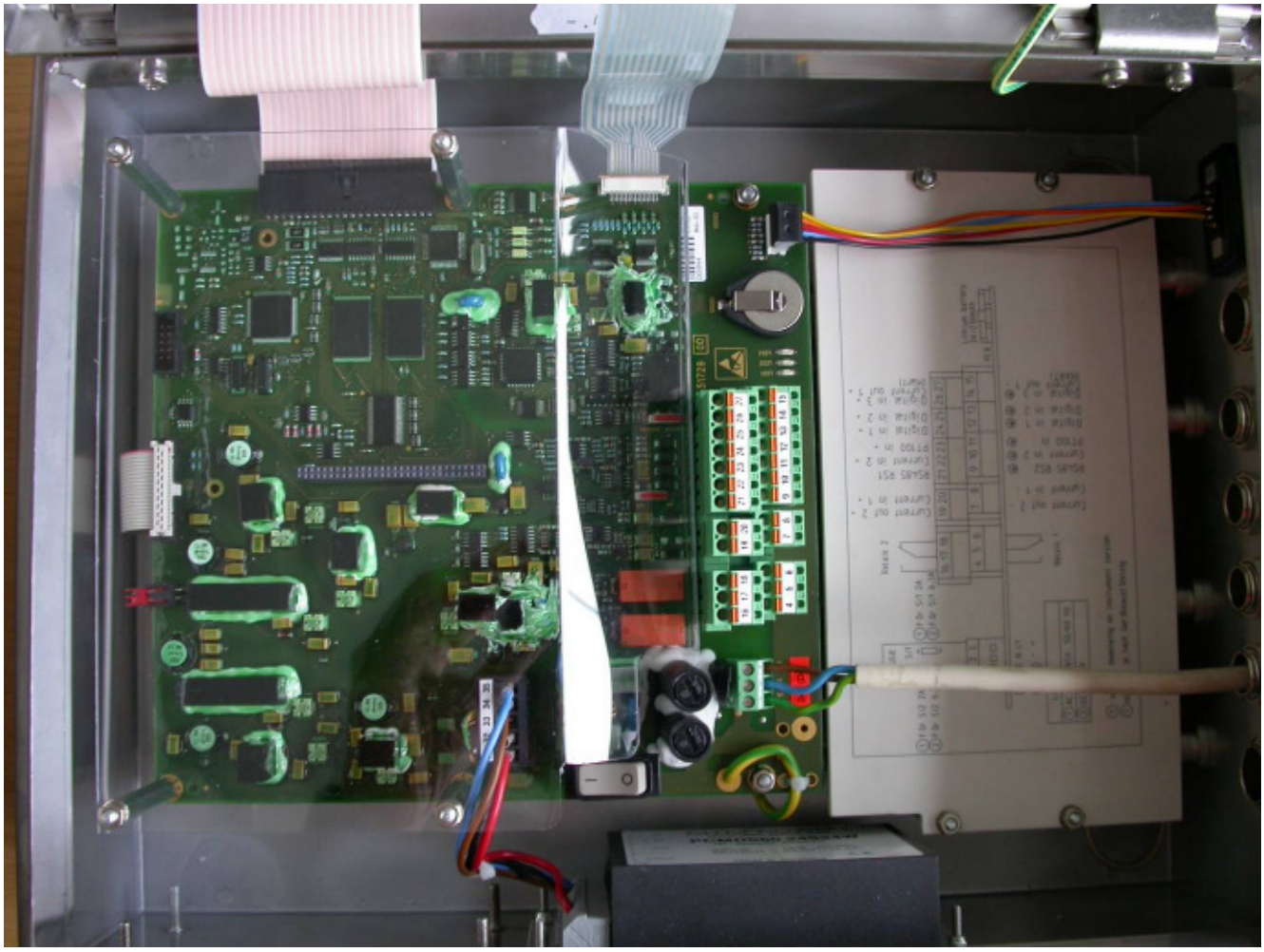
Input and output ports

Photo 4:



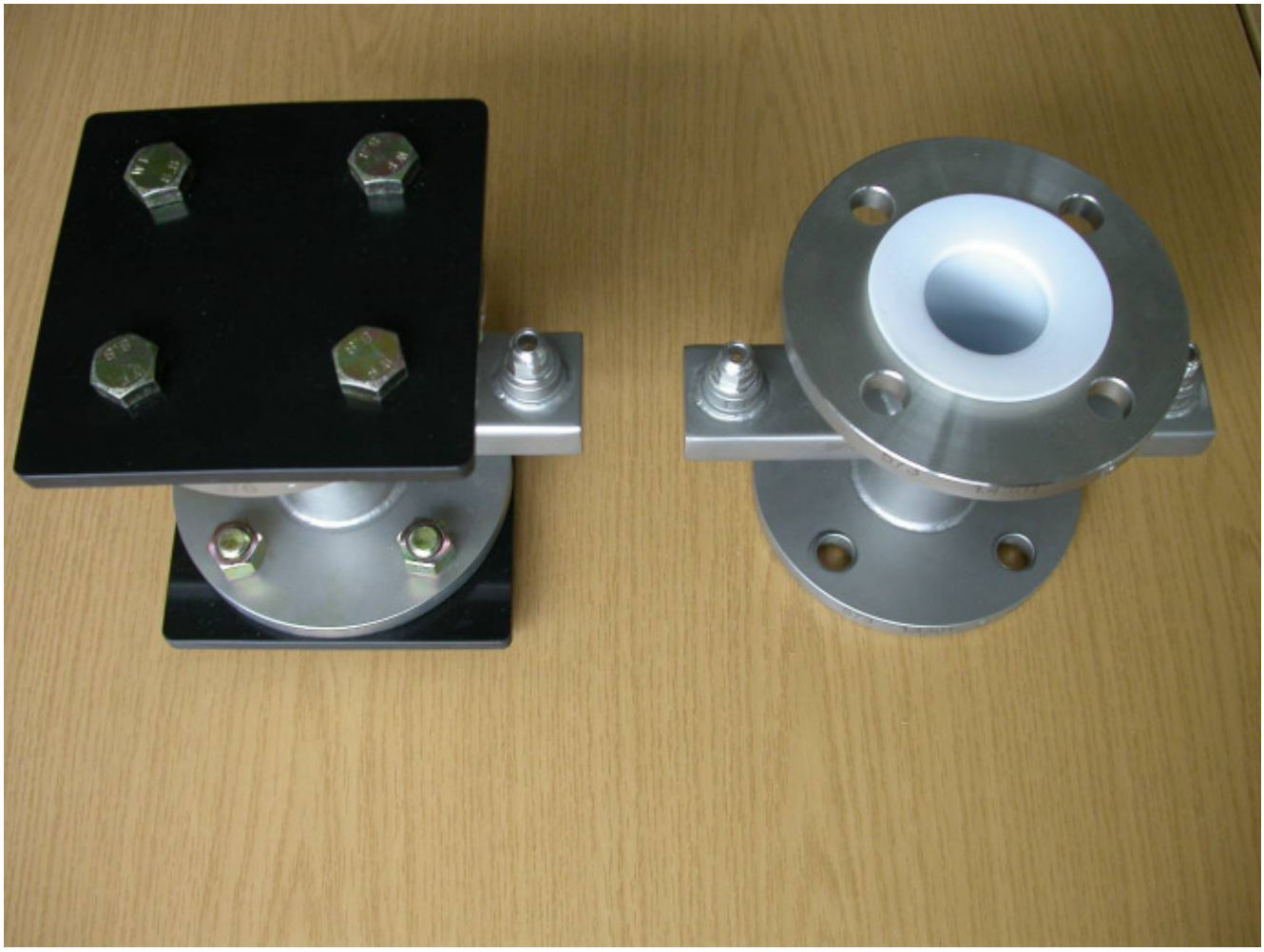
Interior of the EUT

Photo 5:



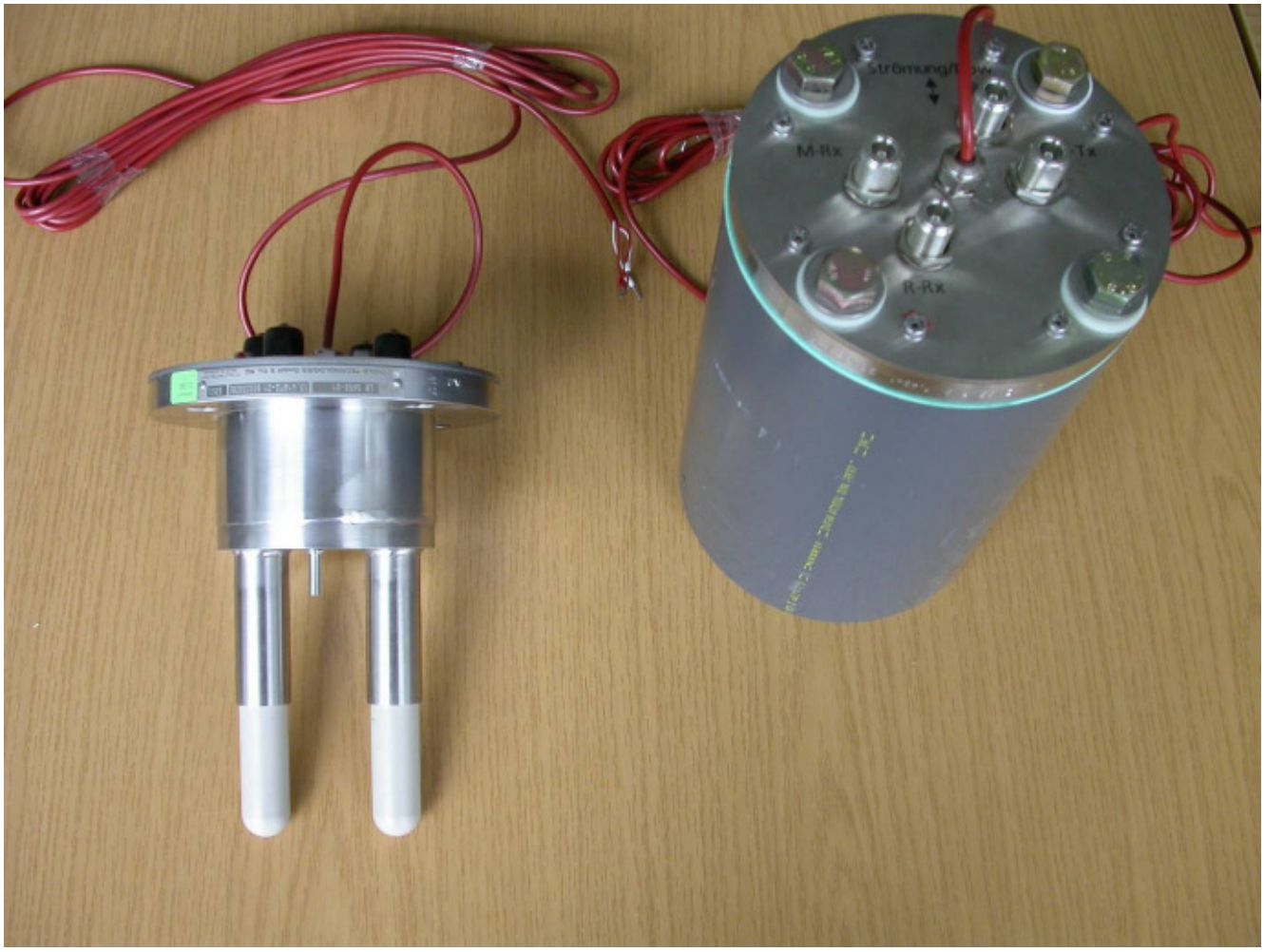
Interior of the EUT

Photo 6:



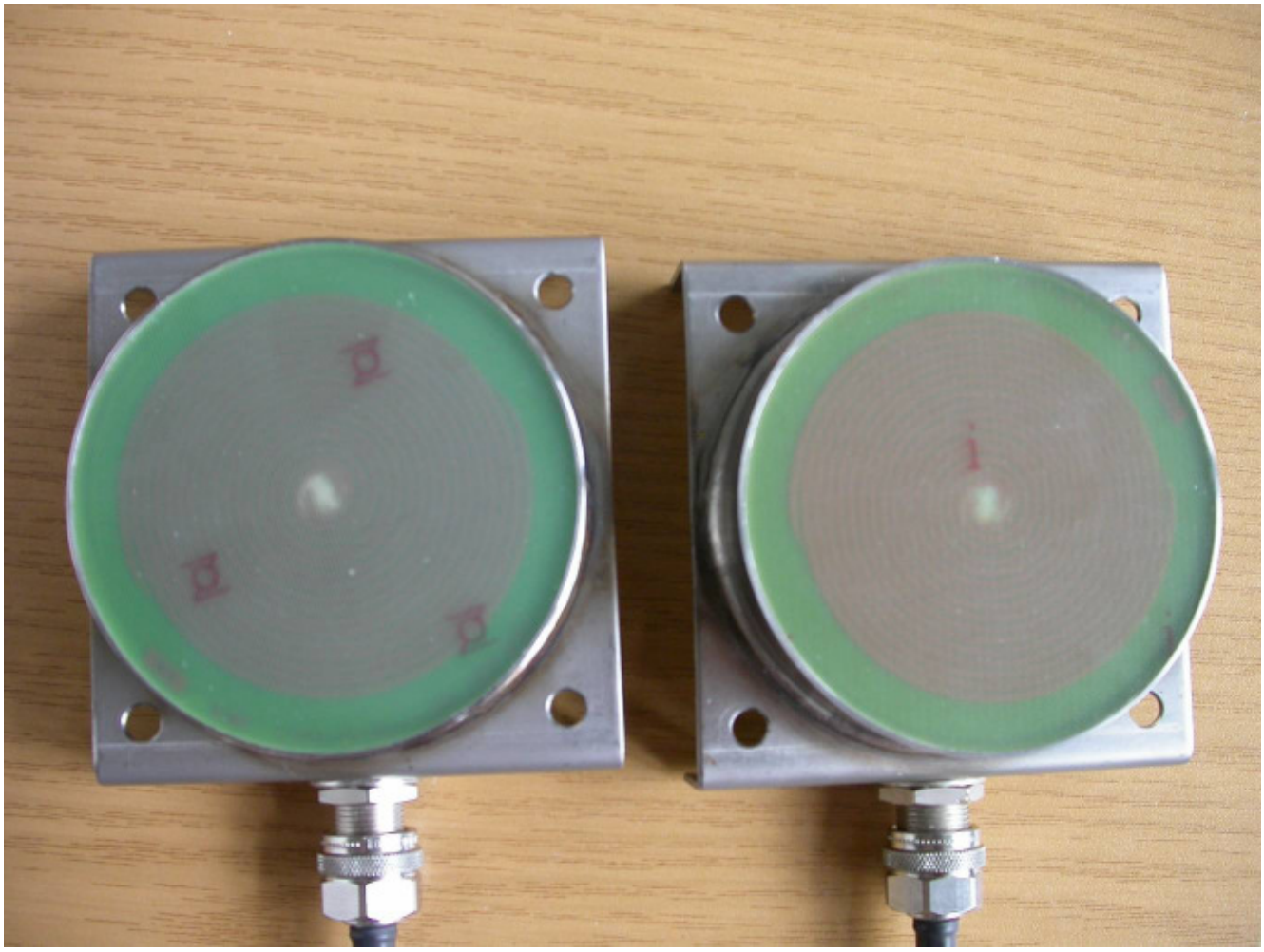
Flow cell sensor with TX and RX adapter

Photo 7:



In tank sensor

Photo 8:

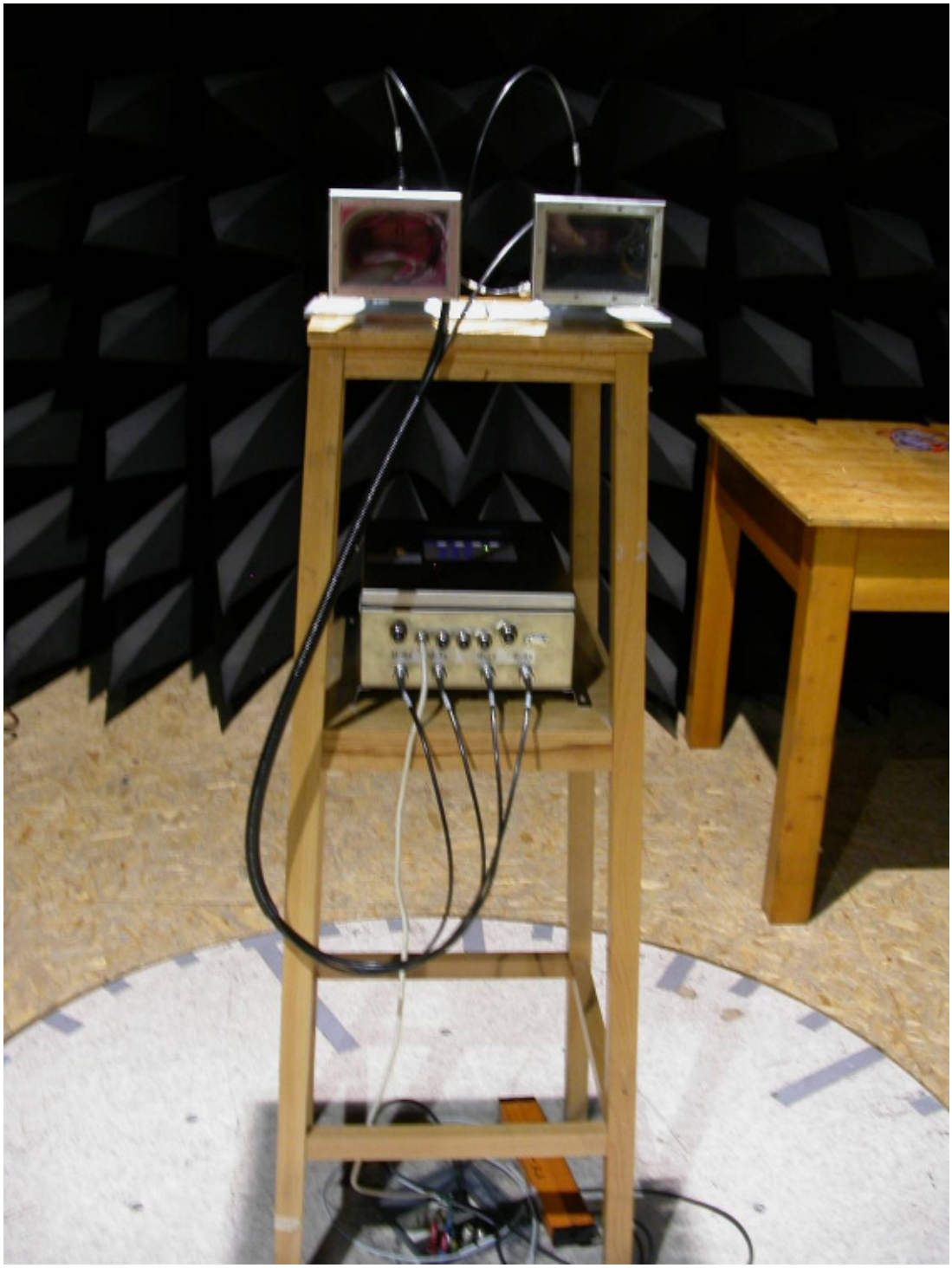


Spiral antenna

Photo 9:

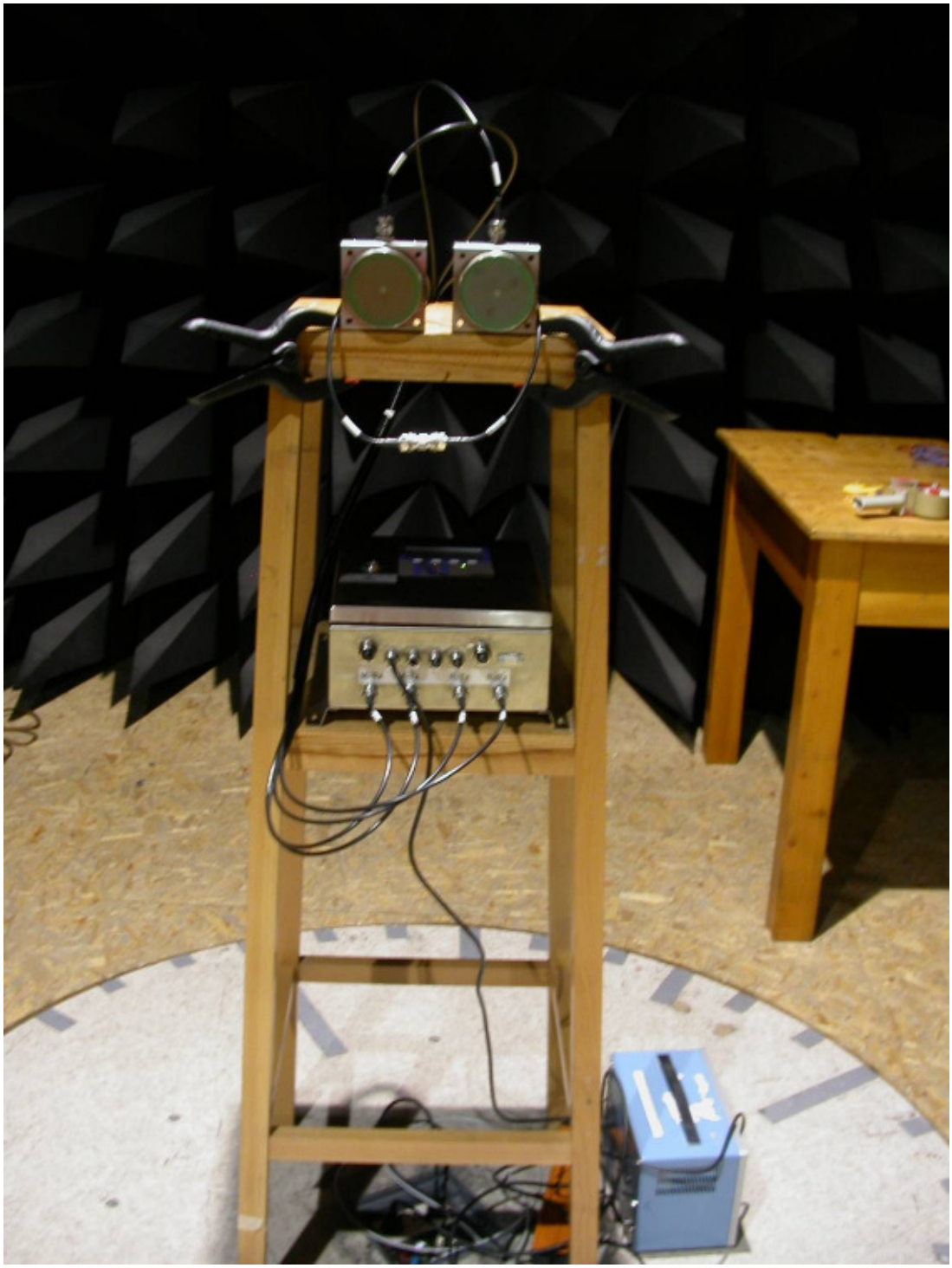
Tx and Rx Horn Antennas

Photo 10:



Spurious emissions measurement up to 12 GHz (Horn antennas)

Photo 11:

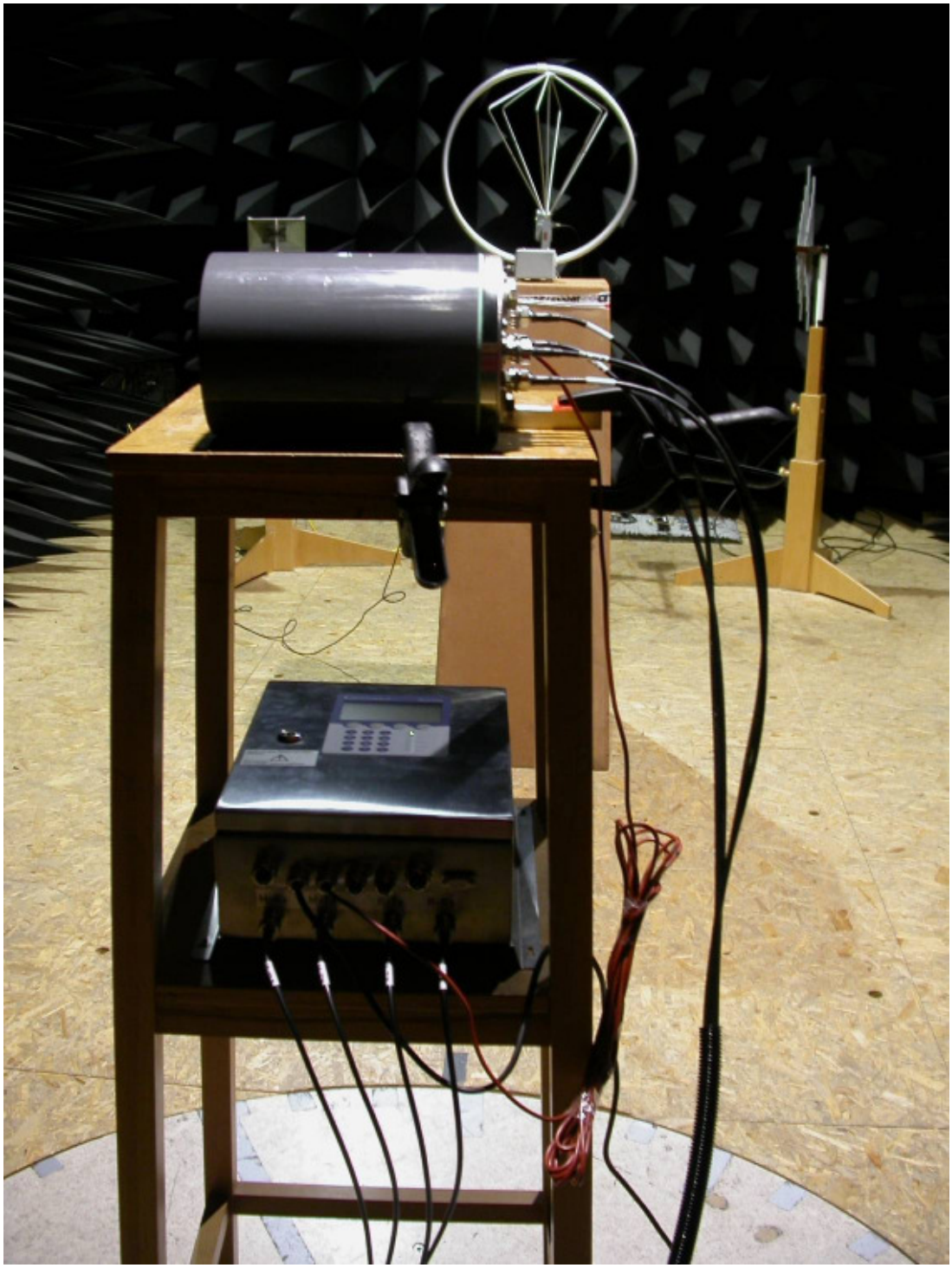


Spurious emissions measurement up to 12 GHz (Spiral antennas)

Photo 12:

Spurious emissions measurement up to 12 GHz (Flow cell sensor)

Photo 13:

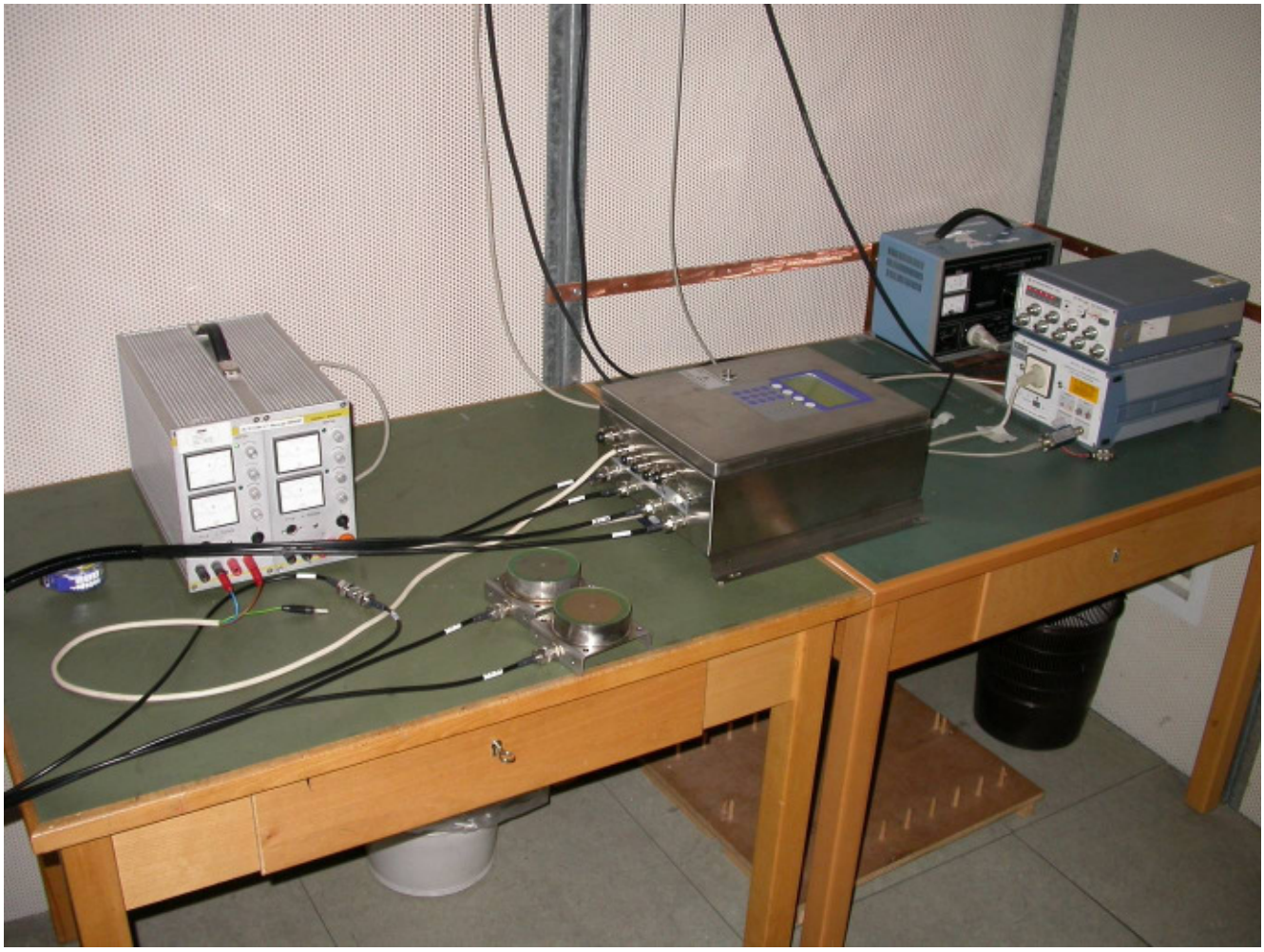


Spurious emissions measurement up to 12 GHz (In tank sensor)

Photo 14:

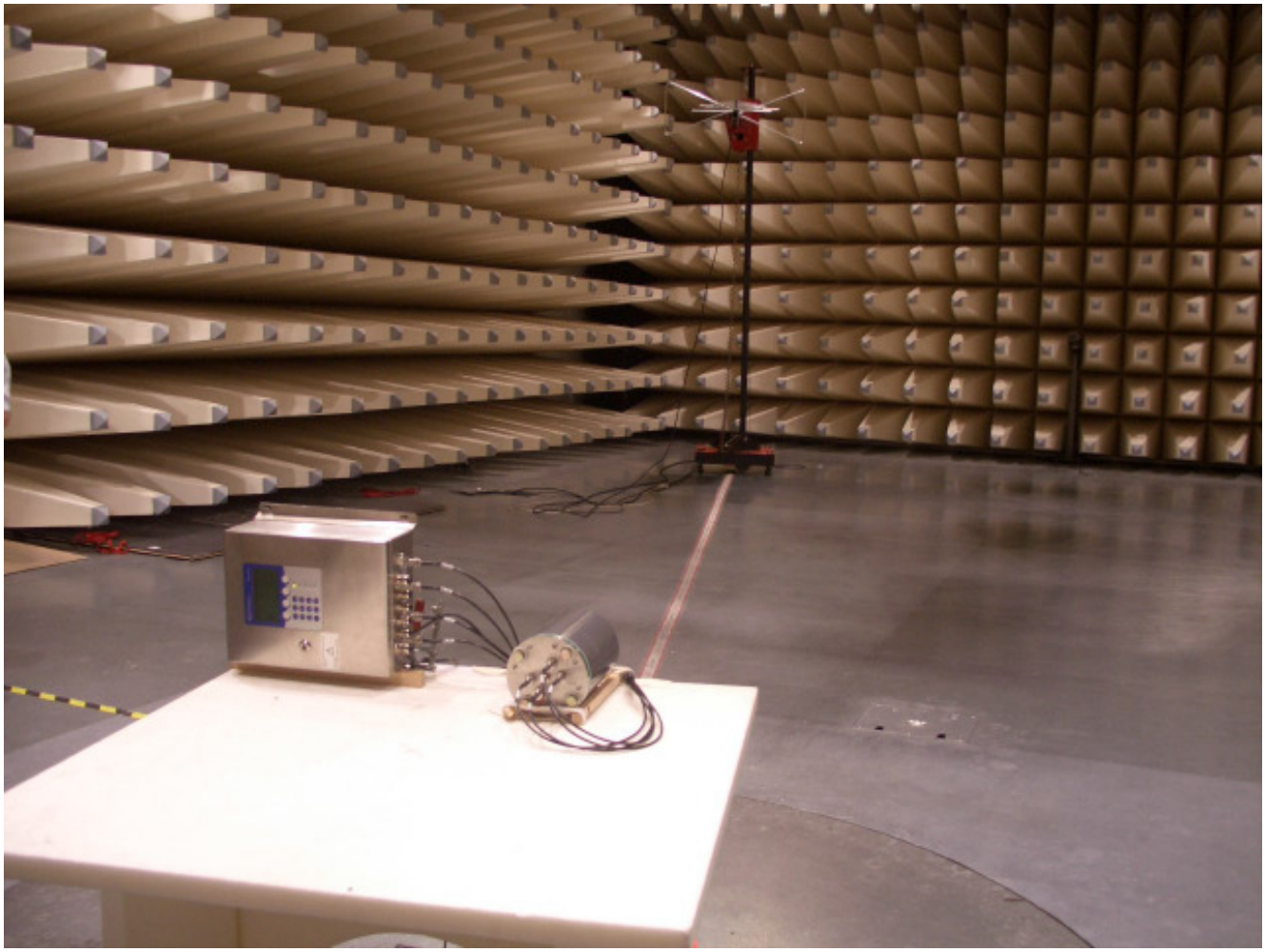
Spurious emissions measurement up to 30 MHz with a magnetic loop antenna

Photo 15:



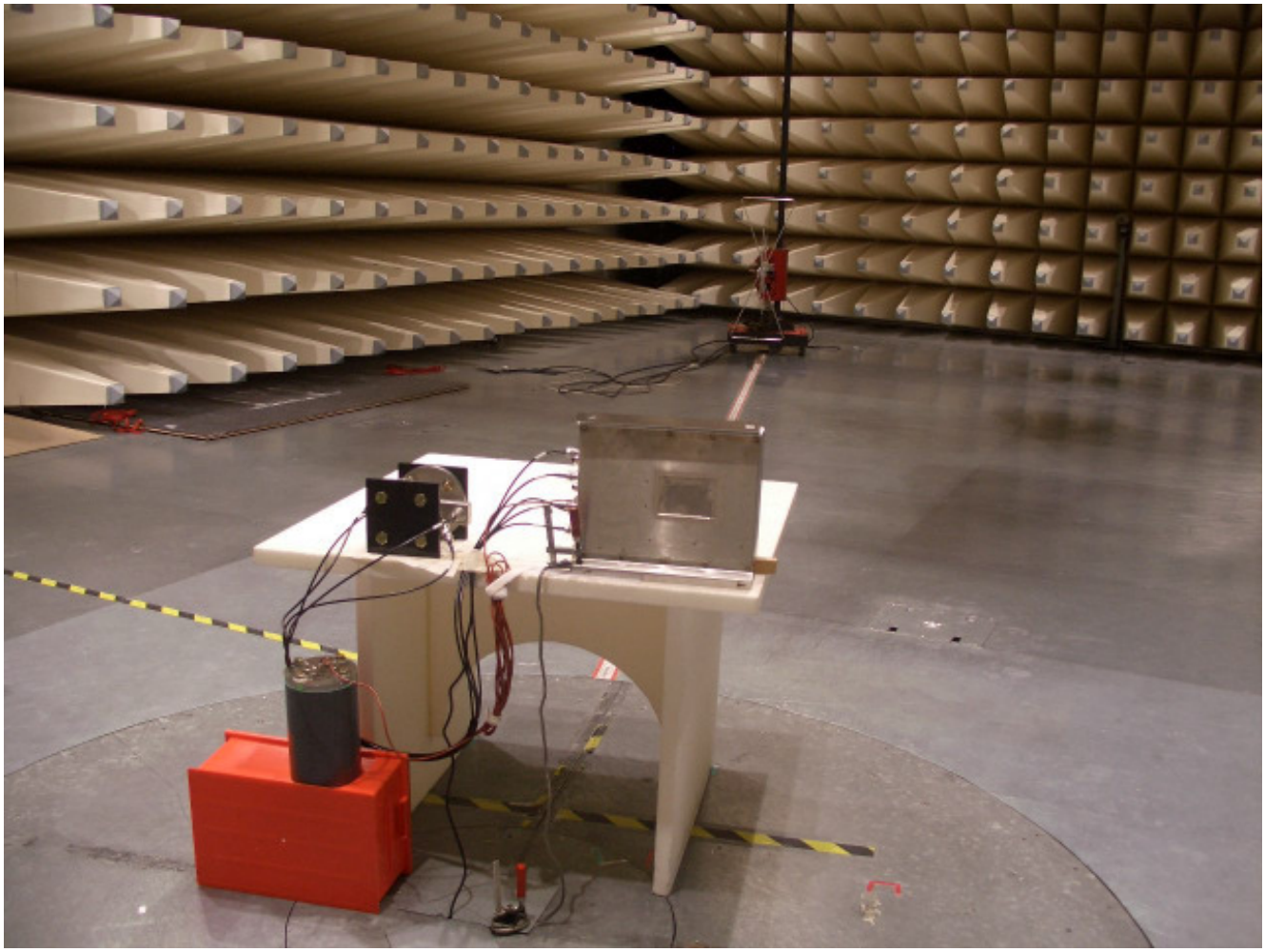
AC-conducted line measurements

Photo 16:



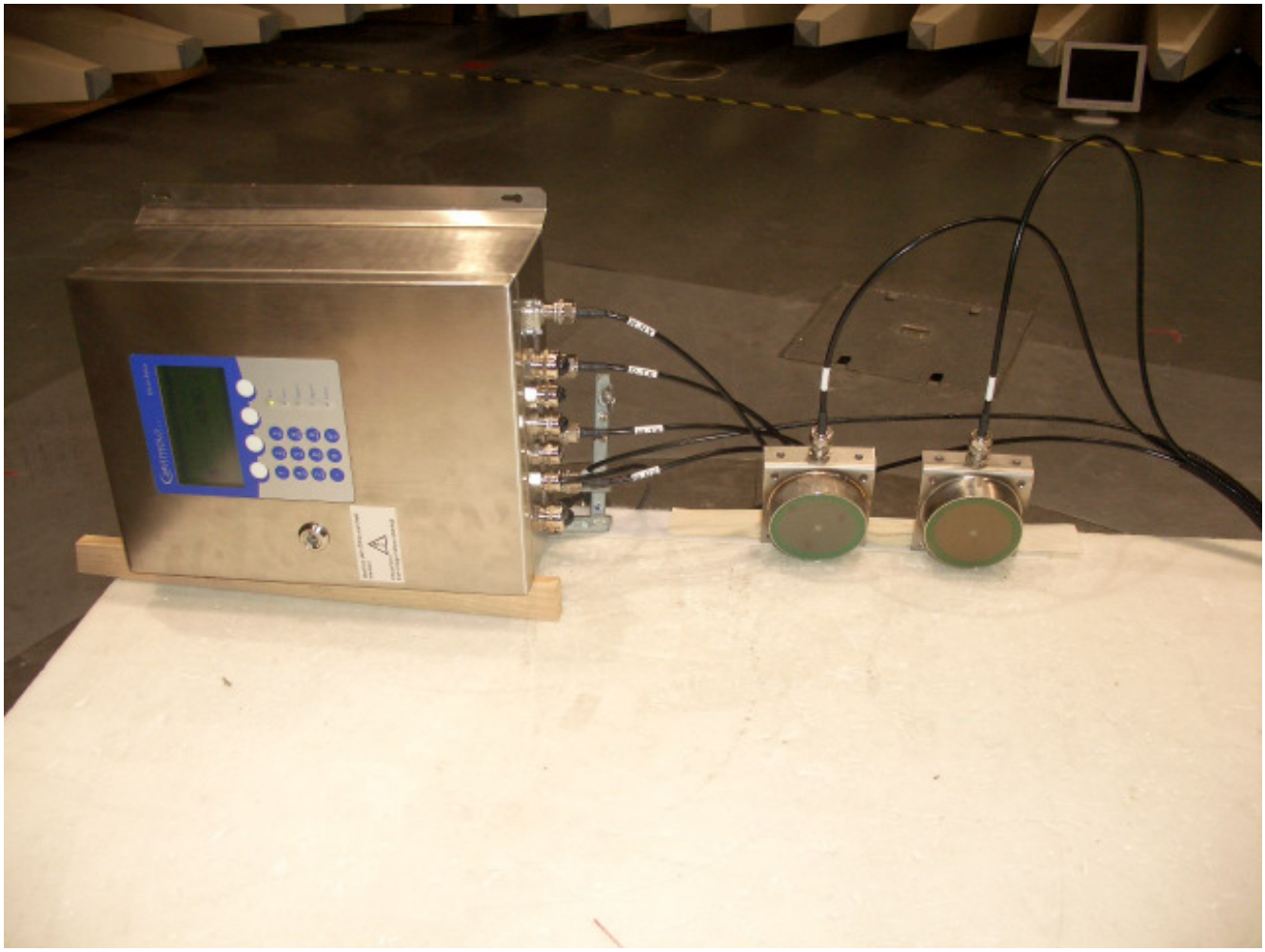
Spurious emissions measurement from 30 MHz up to 1 GHz (In tank sensor)

Photo 17:



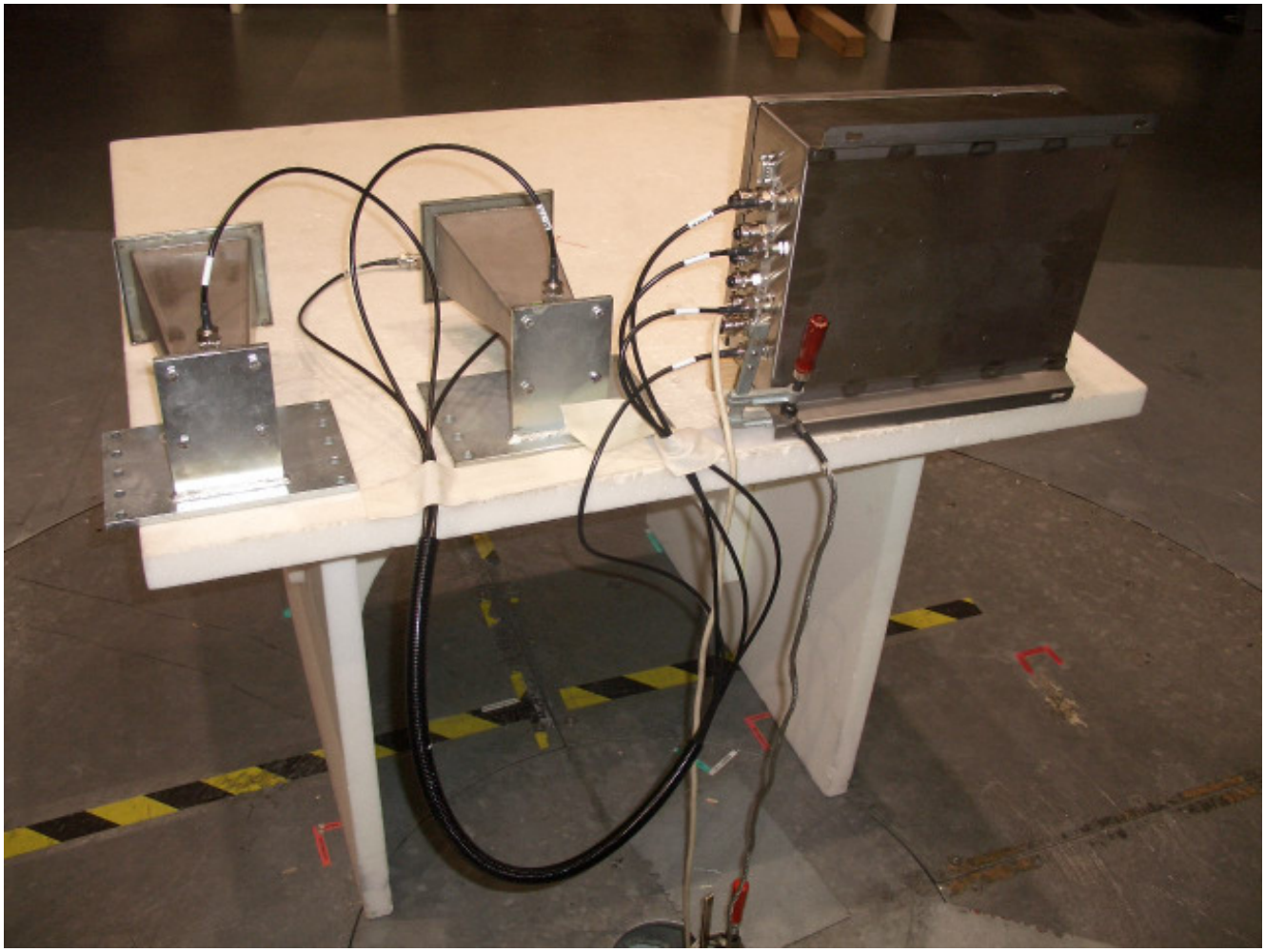
Spurious emissions measurement from 30 MHz up to 1 GHz (Flow cell sensor + PT100 resistor connected)

Photo 18:



Spurious emissions measurement from 30 MHz up to 1 GHz (Spiral antennas)

Photo 19:



Spurious emissions measurement from 30 MHz up to 1 GHz (Horn antennas)

Annex 1 MPE Calculation

These equations are generally accurate in the far field of an antenna but will over predict power density in the near field, where they could be used for making a “worst case” prediction.

$$S = PG/4\pi R^2$$

where S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units e.g. mW)
G = power gain of the antenna in the direction of interest relative to the isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units e.g. cm)

Or

$$S = EIRP/4\pi R^2$$

where EIRP = equivalent isotropically radiated power

Calculation:

Calculated based on EIRP value

Max. EIRP: 5.08 dBm = 3.22 mW

calculated at distance of 20 cm:

Peak power density = 3.22 mW / $4\pi(20cm)^2$ = 6.41 µW/ cm^2

Limit:

1mW/ cm^2 is the reference level for general public exposure according to the OET Bulletin 65, Edition 97-01 Table 1.

Annex 2 Additional EUT information for Industry Canada

IC Registration Number:	**4777A-IC01X12**
Model Name:	**Micro-Polar (Brix) ++ LB 565-11 / LB 565-12 LB 566-11 / LB 566-12**
Manufacturer (complete Address):	**BERTHOLD TECHNOLOGIES GmbH & Co KG Calmbacher Strasse 22 75323 Bad Wildbad Germany**
Tested to Radio Standards Specification (RSS) No.:	**RSS-210 Issue 7**
Open Area Test Site Industry Canada Number:	**IC 3463C-1**
Frequency Range (or fixed frequency) [GHz]:	**2.441 GHz**
RF: Power (max):	**Max field strength: 100.31 dBµV/m in 3m (horn antenna)**
Antenna Type:	**DUT can be equipped with the following antennas: In tank sensor Flow cell sensor Horn antenna Spiral antenna**
Peak Power Density [µW/cm² in 3m]:	**2.85 nW/cm²**
Occupied Bandwidth (99% BW):	**3.5 MHz**
Type of Modulation:	**N0N (CW-signal)**
Emission Designator (TRC-43):	**3M50N0N**
Transmitter Spurious (worst case) [µV/m in 3m]:	**58.9 µV/m (4.89 GHz)**
Receiver Spurious (worst case) [µV/m in 3m]:	**receive-only not applicable** (Tx+Rx operate simultaneously)

ATTESTATION:

I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned departmental standard(s), and that the radio equipment identified in this application has been subject to all applicable test conditions specified in the departmental standards and all of the requirements of the standards have been met.

Signature:

Test engineer: Nicolas Stamber Date: 2009-04-23

Annex 3 RF Technical Brief Cover Sheet acc. to RSS-102

All Fields must be completed with the requested information or the following codes: N/A for Not Applicable, N/P for Not Performed or N/V for Not Available. Where applicable, check appropriate box.

1. COMPANY NUMBER: 4777A

2. MODEL NUMBER: Micro-Polar (Brix) ++ LB 565-11 / LB 565-12
LB 566-11 / LB 566-12

3. MANUFACTURER: BERTHOLD TECHNOLOGIES GmbH & Co
Calmbacher Strasse 22
75323 Bad Wildbad
Germany

4. TYPE OF EVALUATION: **(c) RF Evaluation**

- Evaluated against exposure limits: General Public Use ☒ Controlled Use ☐
- Duty cycle used in evaluation: 100%
- Standard used for evaluation: RSS-102 Issue 2 (2005-11)
- Measurement distance: 20 cm
- RF value: 64.1 mW/m²

Measured ☐ Computed ☐ Calculated ☒

Declaration of RF Exposure Compliance

ATTESTATION:

I attest that the information provided in this test report are correct; that a Technical Brief was prepared and the information it contains is correct; that the device evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed and that the device meets the SAR and/or RF exposure limits of RSS-102.

N. Stamber

Name: Nicolas Stamber
Company: Cetecom ICT Services GmbH