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

Accredited by the
German Accreditation Council
DAR–Registration Number DAT-P-176794-D1

Independent ETSI
compliance test house

Accredited Bluetooth® Test Facility (BQTF)

Test report No.	2-3389-01-02/03
Applicant:	Berthold Technologies GmbH & Co KG
Type:	Micro Polar
Test standard:	FCC Part 15.245
FCCID:	R9ZFCC01X01
IC:	4777A-IC01X01

Table of contents

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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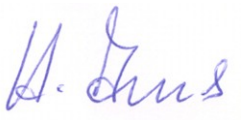
Tester :

Date	Name	Signature
2005-09-21	Manfred Paschwitz	

Technical responsibility for area of testing:

Date	Name	Signature
2005-09-21	Harro Ames	

1.2 Testing laboratory

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

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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 : Calmbacherstr. 22
Town : D-75323 Bad Wildbad
Country : Germany
Phone : +49 (0) 7081 177 0
Fax : +49 (0) 7048 177 100

Contact person
Name : Mr. Heinz-Peter Tetzlaff
Phone : +49 (0) 7081 177 124
Fax : +49 (0) 7081 177 505
E–Mail : heinz.tetzlaff@bertholdtech.com

1.4 Application details

Date of receipt of application : 2005-08-31
Date of receipt of test item : 2005-08-31
Date of test : 2005-08-31
Person(s) who have been present during the test : Mr. Heinz-Peter Tetzlaff
: Mr. Yves Jung

1.5 Test item (EUT)

Description	:	Field disturbance sensor; Humidity Sensor
Type:		Micro Polar
Manufacturer	:	Berthold Technologies GmbH & Co KG Calmbacherstr. 22 D-75323 Bad Wildbad Germany

1.6 Technical data

Frequency range	:	2.435 000 GHz to 2.465 000 GHz
Operational frequency	:	2.441 000 GHz
Field strength	:	80.816 mV/m
Type of modulation	:	15M0P0N (Stepped CW)
Frequency steps	:	1
Blanking time	:	10 µs
Dwell time	:	30 ms
Antennas	:	In tank sensor LB X650-XX (Gain « 0 dBi) Flow cell sensor LB X54X-XX MP(Gain < 0 dBi) Horn antenna LB X60X-XX (Gain = 8.5 dBi)
Normal power supply (U nom)	:	115.0 V AC
Normal power supply (U nom)	:	24.0 V DC
Nominal AC frequency		45 Hz to 65 Hz

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 LB 565-01 with 3 different type of antennas.

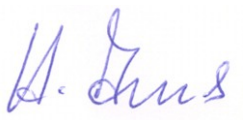
- Horn antenna LB X60X-XX
- Flow Cell Sensor LBX54X-XX MP
- Tank Sensor LB X650-XX

Test Report Cover Sheet / Performance Test Data

Equipment Model Number:	Micro Polar
Certification Number:	4777A-IC01X01
Manufacturer:	Berthold Technologies GmbH & Co KG Calmbacherstr. 22 D-75323 Bad Wildbad Germany Mr. Heinz-Peter Tetzlaff +49 7081 177 124 heinz.tetzlaff@berthold.com
Tested to Radio Standards Specification (RSS) No.:	RSS210 Issue 5
Open Area Test Site Industry Canada Number:	3463
Frequency Range (or fixed frequency):	24.441 GHz
Field Strength:	80.8 mV/m
Occupied Bandwidth (99% BW):	15 MHz
Type of Modulation:	Pulsed CW
Emission Designator (TRC-43):	15M0P0N
Transmitter Spurious (worst case):	403.1 µV/m @ 3m
Receiver Spurious (worst case):	Not applicable
Antenna Type:	In tank sensor LB X650-XX (Gain << 0 dBi Flow cell sensor LB X 54X-XX MP (Gain < 0 dBi Horn antenna LB X60X-XX (Gain 8.5 dBi)

ATTESTATION:
DECLARATION OF COMPLIANCE: I declare that the testing was performed or supervised by me; that the test
measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

Signature:



Date: 2005-09-21

Test engineer: Harro Ames

1.7 Test standards

	Code of Federal Regulations (CFR 47) Federal Communications Commission (FCC)
FCC Part 15	Radio Frequency Devices (04/2005) 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. Section 15.207 Conducted limits

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

[ ] is only valid with the test report no.

2.2 Test environment

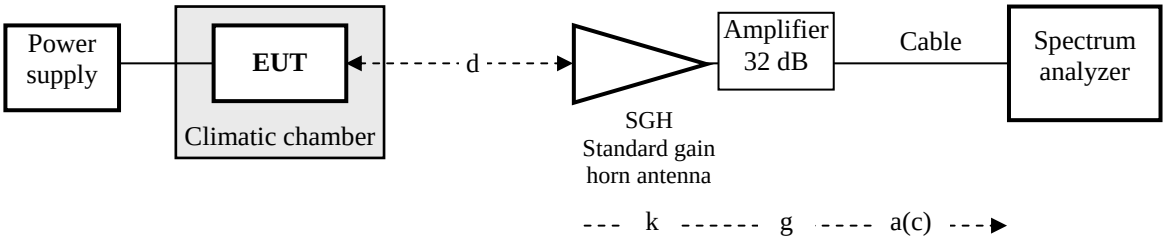
The environmental conditions are documented especially for each test.

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 fundamental and spurious radiation in the frequency range 12 GHz to 26 GHz



Frequency f [GHz]	Distance d [m]	Antenna factor k [dB(1/m)]	Amp.gain g [dB]	Cable loss a(c) [dB]
12.0 to 18.0	3.0	33.97	32.0	2.5 ... 3.5
18.0 ... 26.0	3.0	40.22	32.0 to 28.0	3.5 ... 4.7

Calculation :

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

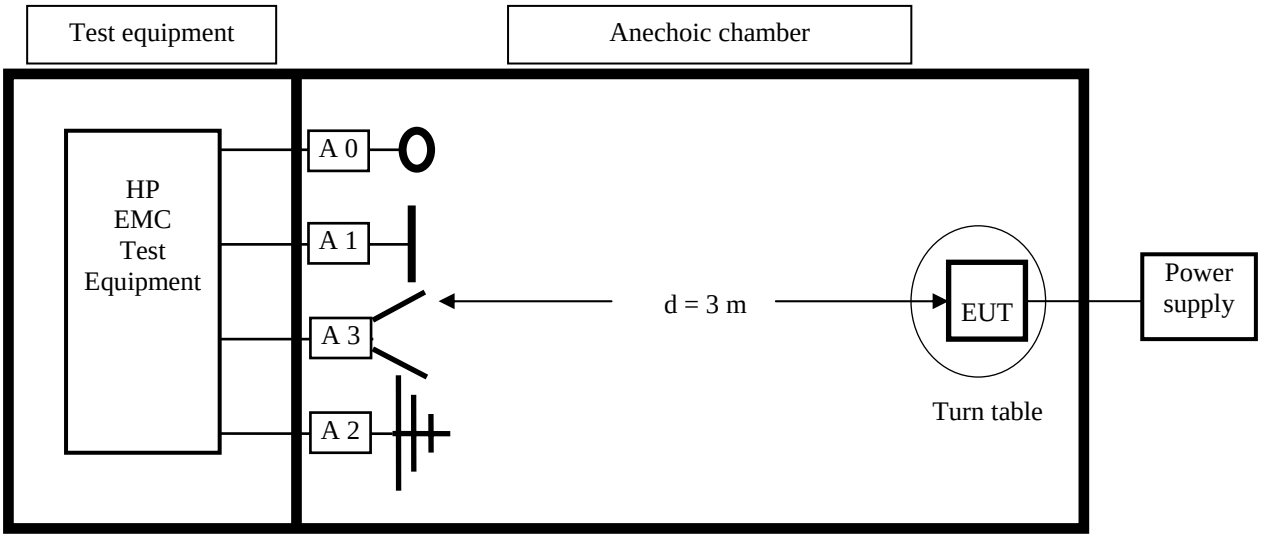
Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300001665
SGH 12.0 to 18.0 GHz	narda	639	300000787
SGH 18.0 to 26.5 GHz	narda	V637	300000487
Amplifier 0.1 ... 26 GHz	HP	HP 83017A	300002267
Climatic chamber	Vötsch	VUK 04/500	300000297
AC Power supply	Grundig	RT 5 A	300001263
RF-cable	HP	5061-5359	300002033

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

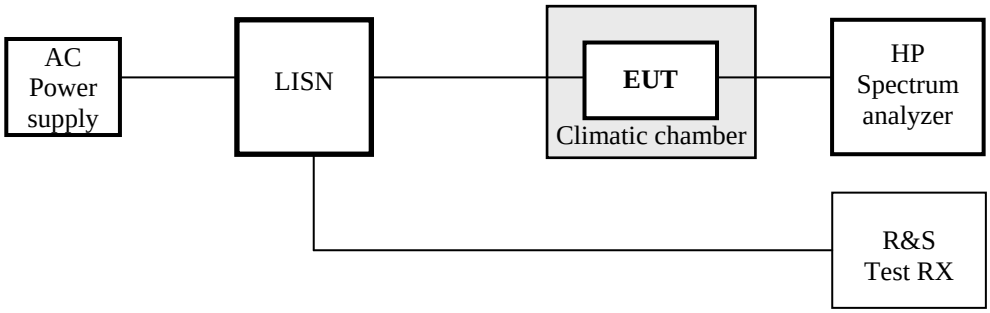


Test equipment	Manufacturer	Type	Serial No.
Spectrum analyser	HP	HP 85660B	2478A05306
Analyser display	HP	HP 85662A	2816A16541
Quasi peak adapter	HP	HP 85650A	2811A01131
RF-preselector	HP	HP 85685A	2833A00768
Loop Antenna A 0	R&S	HFH 2–Z2	881 058/42
Biconical antenna A 1	Emco	3104	3758
Log.-per.-antenna 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

2.4.3 Conducted measurements in the frequency range 9 kHz to 26 GHz



Test equipment	Manufacturer	Type	Serial No.
Spectrum analyser	HP	HP 85660B	2478A05306
Analyser display	HP	HP 85662A	2816A16541
Quasi peak adapter	HP	HP 85650A	2811A01131
RF-preselector	HP	HP 85685A	2833A00768
LISN	R&S	HFH 3–Z5	835.5518.52
Test Receiver	R&S	ESH 3	3758
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 :

☐ in addition to the test report no.

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 is designed to measure humidity of heaped or flowing material by means of microwave transmission. Micro Polar has a separate TX port and an RX port. These ports can be equipped with 3 different sensor antennas. Some antennas are operating within metal tanks, others are made for contact free humidity measurements by means of microwave radiation. For field strength measurements we tested all three antennas

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 26 GHz. 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 are conformed with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4:2003 clause 4.1.5. These 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 analyzers where the detector modes and resolution bandwidths (RBW) over various frequency ranges are set according to requirement ANSI C63.4:2003 clause 4.2.

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 25 GHz. 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 8). 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 30 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 a double ridge horn antenna is used.

In the frequency range 12 GHz to 24 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 HP EMI Receiver ,controlled and displayed with a specially designed PC software.

We tested the samples with two different types of power supplies. One sample was equipped with a build-in 115VAC power supply, the other one was set for DC supply. We used a DC supply from our house to test this sample.
There was no difference in the results.

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

SPURIOUS FREQUENCIES SECTION 15.209
In the frequency range 9 kHz to 12000 MHz

Operation : TX on; RX on EUT operating in stepped CW mode

Antenna assembly: Rectangular horn antenna g = 8.5 dBi

Test condition t = 23.0 ° C AC Power supply	Field strength of Fundamental and spurious			
Frequency range [MHz]	Spurious frequencies [MHz]	S A e [dBµV/m]	E [µV/m]	See plot on page
0.009 – 30.000 (h + v) horizontal and vertical plane	0.0495	Pk. = 42.3	130.325	21
30.000 – 4,000 (h + v.)	324.5	Pk. = 28.6	85.113	22
30.000 – 4,000 (h + v.)	2441.1 (TX)	Pk. = 98.2	80.8 mV/m	23
30.000 – 4,000 (h + v.)	205.8 + TX	see	plot	24

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

TRANSMITTER PARAMETERS SECTION 15.245

SPURIOUS FREQUENCIES
In the frequency range 960 MHz to 24 GHz

Operation : TX on; RX on EUT operating in stepped CW mode

Antenna assembly: Rectangular horn antenna g = 8.5 dBi

Test condition t = 23.0 ° C AC Power supply		Transmitter field strength of fundamental and spurious frequencies			
Frequency range [GHz]		Spurious frequencies [GHz]	e (max.) [dBµV/m]	E [µV/m]	See plot on page
0.960 – 2.4	(h + v)	Noise	41.95	125.17	24
2.4 – 2.5	(h + v)	TX = 2.441		80,800	25
2.5 – 4.0	(h + v)	Noise	39.58	95.28	26
4.0 – 6.0	(h + v)	4.882	63.11	403.1	27
6.0 – 8.0	(h + v)	7.320	44.39	69.58	28
8.0 – 12.0	(h + v)	9.767	48.37	87.39	29
12.0 – 18.0	(h + v)	Noise	46.64	71.61	30
18.0 – 26.0	(h + v)	24.067	56.72	228.50	31

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

LIMITS: SECTION 15.205 / 15.209 / 15.245

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 outside restricted band	3	64.1	1 600
Harmonics inside restricted band	3	53.9	500

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 12000 MHz

Operation : TX on; RX on EUT operating in stepped CW mode

Antenna assembly: **Flow Cell Sensor LBX54X-XX MP**

Test condition t = 23.0 ° C AC Power supply	Field strength of Fundamental and spurious		
Frequency range [MHz]	Spurious frequencies [MHz]	E [µV/m]	See plot on page
0.009 – 30.000 (h + v) horizontal and vertical plane	0.0495	130.32	21
30.000 – 4,000 (h + v.)	2441.1 (TX)	467.7	32
4,000 – 12,000 (h + v.)	4882.2 (TX)	26.6	33
All other spurs < 15 dB	below limit		

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

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

TRANSMITTER PARAMETERS SECTION 15.245

SPURIOUS FREQUENCIES
In the frequency range 12 GHz to 24 GHz

Operation : TX on; RX on EUT operating in stepped CW mode

Antenna assembly: Flow Cell Sensor LBX54X-XX MP

The measurements from 12 to 25 GHz were made at a distance of 0.2 m.

The correction factor for the limit from 3m to 0.2 m is 21.58 dB.

The analyzer correction factor including path loss, antenna gain and cabel loss is 31.8 dB. (inside analyzer)

Test condition t = 23.0 ° C AC Power supply		Transmitter field strength of fundamental and spurious frequencies			
Frequency range [GHz]		Spurious frequencies [GHz]	SA readout (dBµV/m)	Corrected E [µV/m]	See plot on page
12.0 – 18.0	(h + v)	Noise	66.2	284.8	34
18.0 – 26.0	(h + v)	Noise	73.6	205.1	35

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

LIMITS: SECTION 15.205 / 15.209 / 15.245

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 outside restricted band	3	64.1	1 600
Harmonics inside restricted band	3	53.9	500

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 12000 MHz

Operation : TX on; RX on EUT operating in stepped CW mode

Antenna assembly: **In tank sensor LB X650-XX**

Test condition t = 23.0 ° C AC Power supply	Field strength of Fundamental and spurious		
Frequency range [MHz]	Spurious frequencies [MHz]	E [µV/m]	See plot on page
0.009 – 30.000 (h + v) horizontal and vertical plane	0.0495	130.325	21
30.000 – 4,000 (h + v.)	2441.1 (TX)	1174.9 µV/m manual re-measured	36
4,000 – 12,000 (h + v.)	4882.2 (TX)	18.4 µV/m	37
All other spurs < 15 dB	below limit		

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

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

TRANSMITTER PARAMETERS SECTION 15.245

SPURIOUS FREQUENCIES
In the frequency range 960 MHz to 24 GHz

Operation : TX on; RX on EUT operating in stepped CW mode

Antenna assembly: In tank sensor LB X650-XX

The measurements from 12 to 25 GHz were made at a distance of 0.2 m.

The correction factor for the limit from 3m to 0.2 m is 21.58 dB.

The analyzer correction factor including path loss, antenna gain and cabel loss is 31.8 dB. (inside analyzer)

Test condition t = 23.0 ° C AC Power supply		Transmitter field strength of fundamental and spurious frequencies			
Frequency range [GHz]		Spurious frequencies [GHz]	SA readout (dBµV/m)	Corrected E [µV/m]	See plot on page
12.0 – 18.0	(h + v)	Noise	67.7	338.1(noise)	38
18.0 – 26.0	(h + v)	Noise	74.2	276.7(noise)	39

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

LIMITS: SECTION 15.205 / 15.209 / 15.245

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 outside restricted band	3	64.1	1 600
Harmonics inside restricted band	3	53.9	500

Verdict :	Spurious limits are kept

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

TRANSMITTER PARAMETERS SECTION 15.245

AC CONDUCTED SPURIOUS FREQUENCIES SECTION 15.207

Operation : TX on; RX on EUT operating in stepped CW mode

Test condition t = 23.0 ° C AC Power supply	Conducted spurious voltages Measurement with LISN			
Frequency range [MHz]	Spurious frequencies [MHz]	S A u [dBµV]	S A u [dBµV]	See plot on page
0.150 – 30.000 (L1)	0.240	PK. = 64.5	AV = 48.5	40
0.150 – 30.000 (L2)	0.240	PK. = 60.0	AV = 53.0	41

REFERENCE OF TEST EQUIPMENT USED : see test set-up on page 10

LIMITS: SECTION 15.207

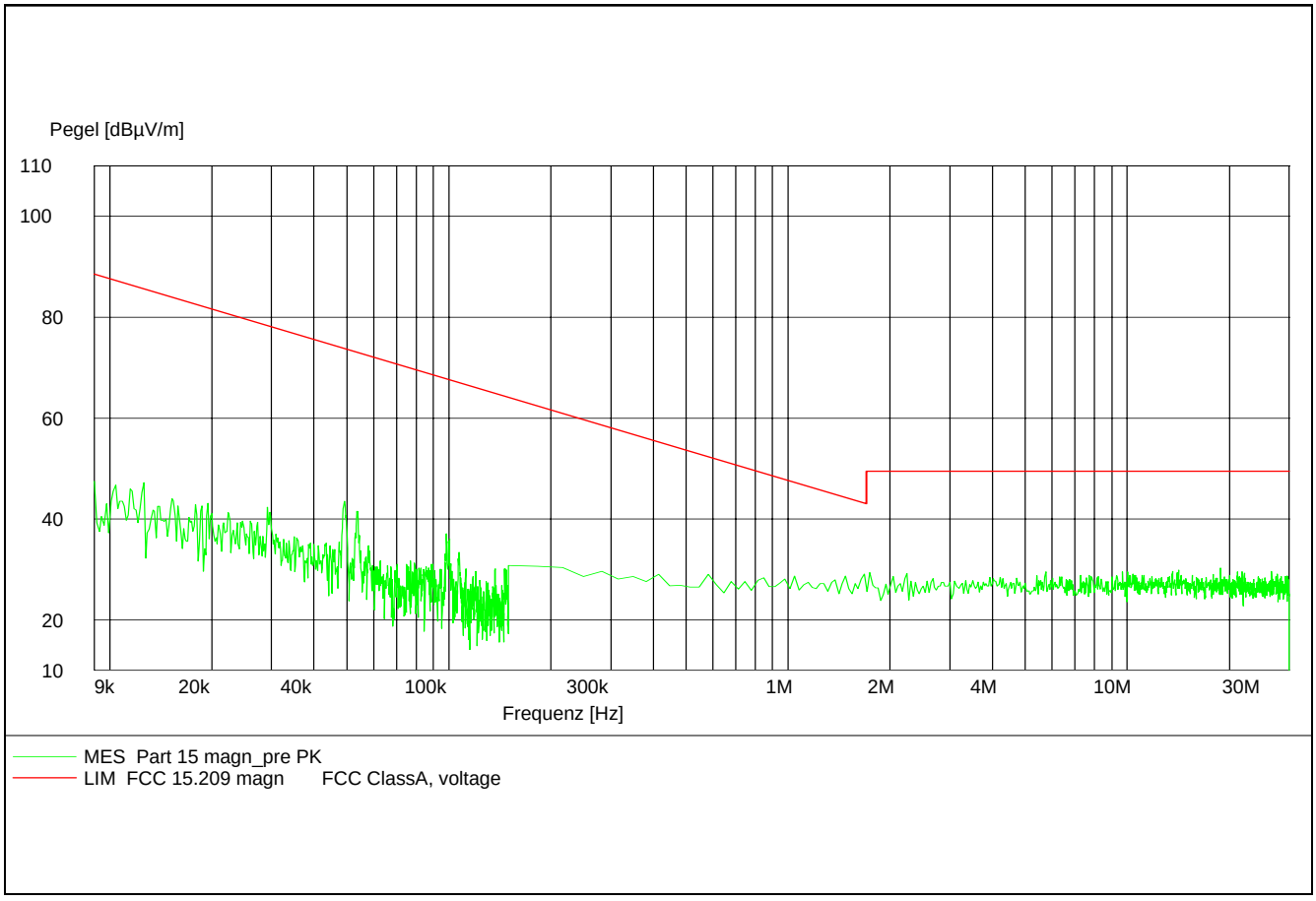
Frequency of emission (MHz)	Conducted limits [dBµV]	
	Quasi-peak (QP)	Average (AV)
0.150 – 0.500	66.0 – 56.0	56.0 – 46.0
0.500 – 5.000	56.0	46.0
5.000 – 30.000	60.0	50.0

Verdict :	Spurious limits are kept

3 Plots, graphs and data sheets

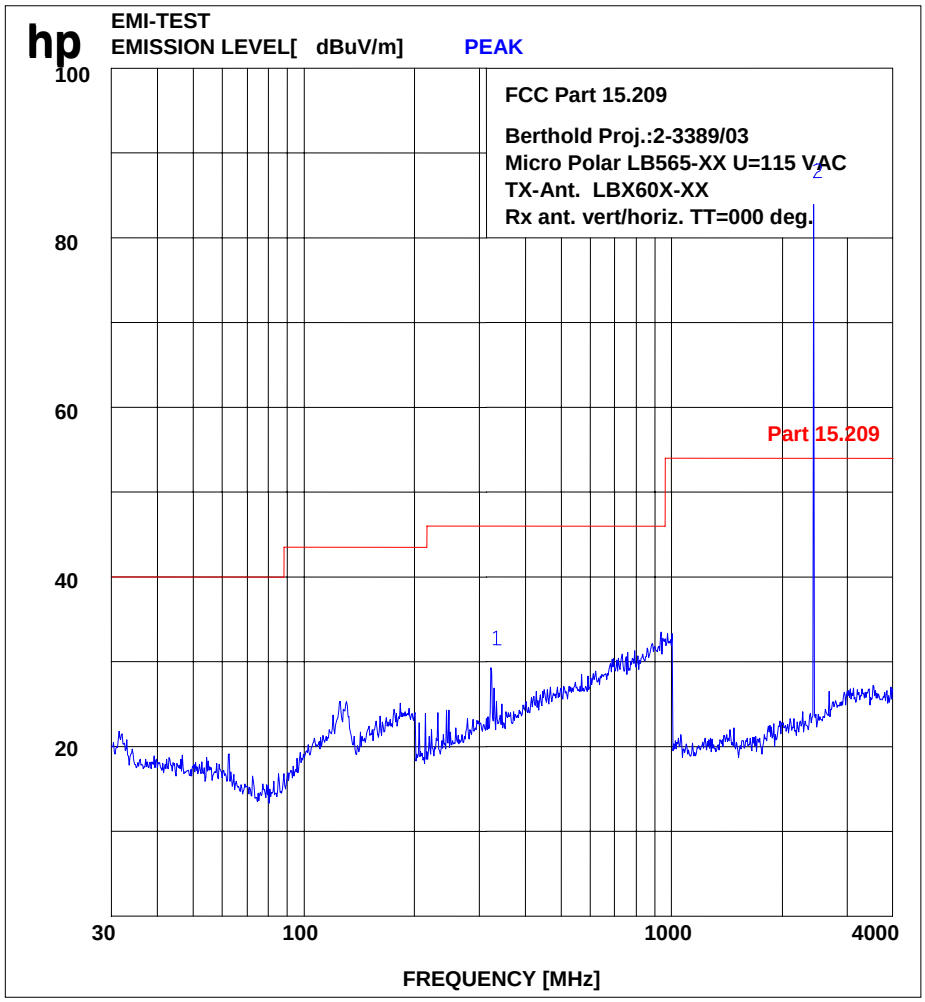
Plot 1

EUT:	Field disturbance sensor Micro Polar
Manufacturer:	Berthold
RX-Antenna:	R & S HFH Z2
Operating conditions:	TX on and RX on, vertical plane and horizontal plane; trace max. hold
AC Power supply:	U = 115.0 V
Test specification:	FCC 15.209



This result is valid for all antennas and both types of power supply.

Plot 2

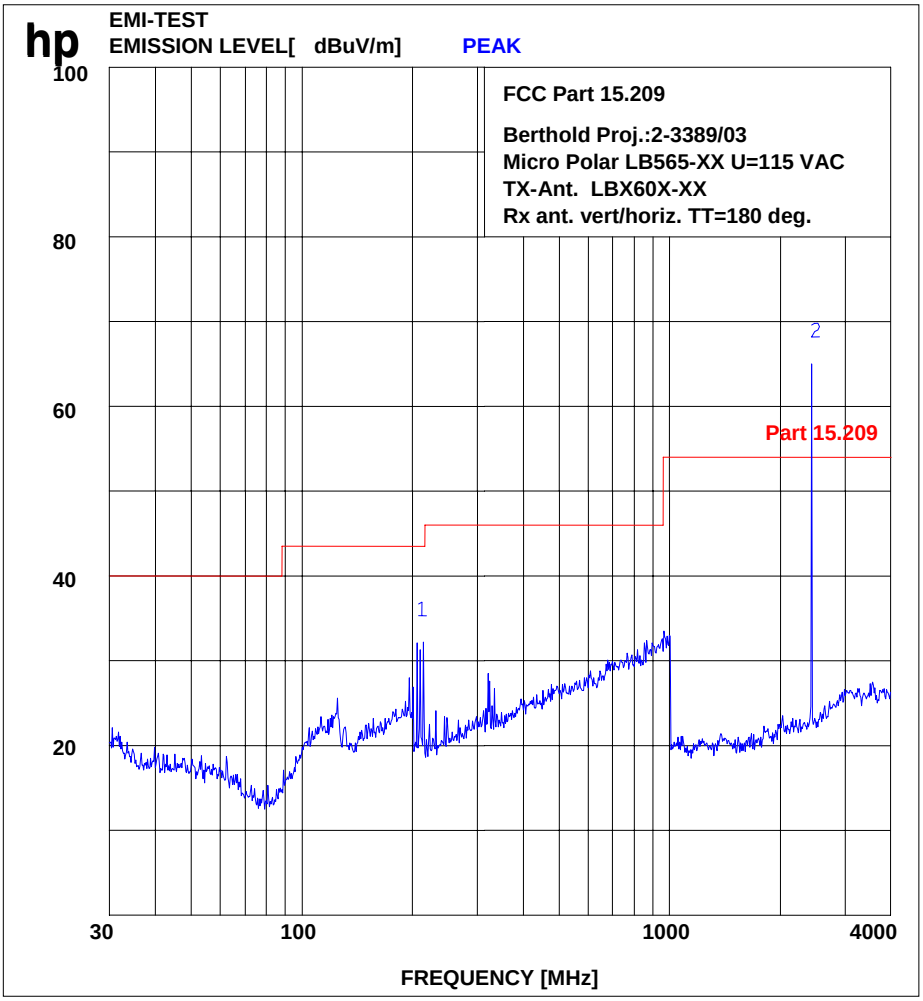


Remark: The spectrum analyser plot shows a snap shot of spurious emissions produced by the EUT. Maximum emission levels are investigated separately by scanning over antenna height (Ant. hgt) and azimuth of the turn table (Azm. TT) and employing different detector modes.

RX-Antenna vertical. Measurement distance = 3.0 m

MKR	Spurs (MHz)	Lim. e (dBµV/m)	Meas. e (dBµV/m)	Diff. (dB)	Detector mode	Ant. hgt (m)	Azm. TT (deg.)
01	324.5	46.0	28.6	-18.4	Peak	1.25	23
02	2441.4	53.9	97.5 (TX)		Peak	1.50	00

Plot 3

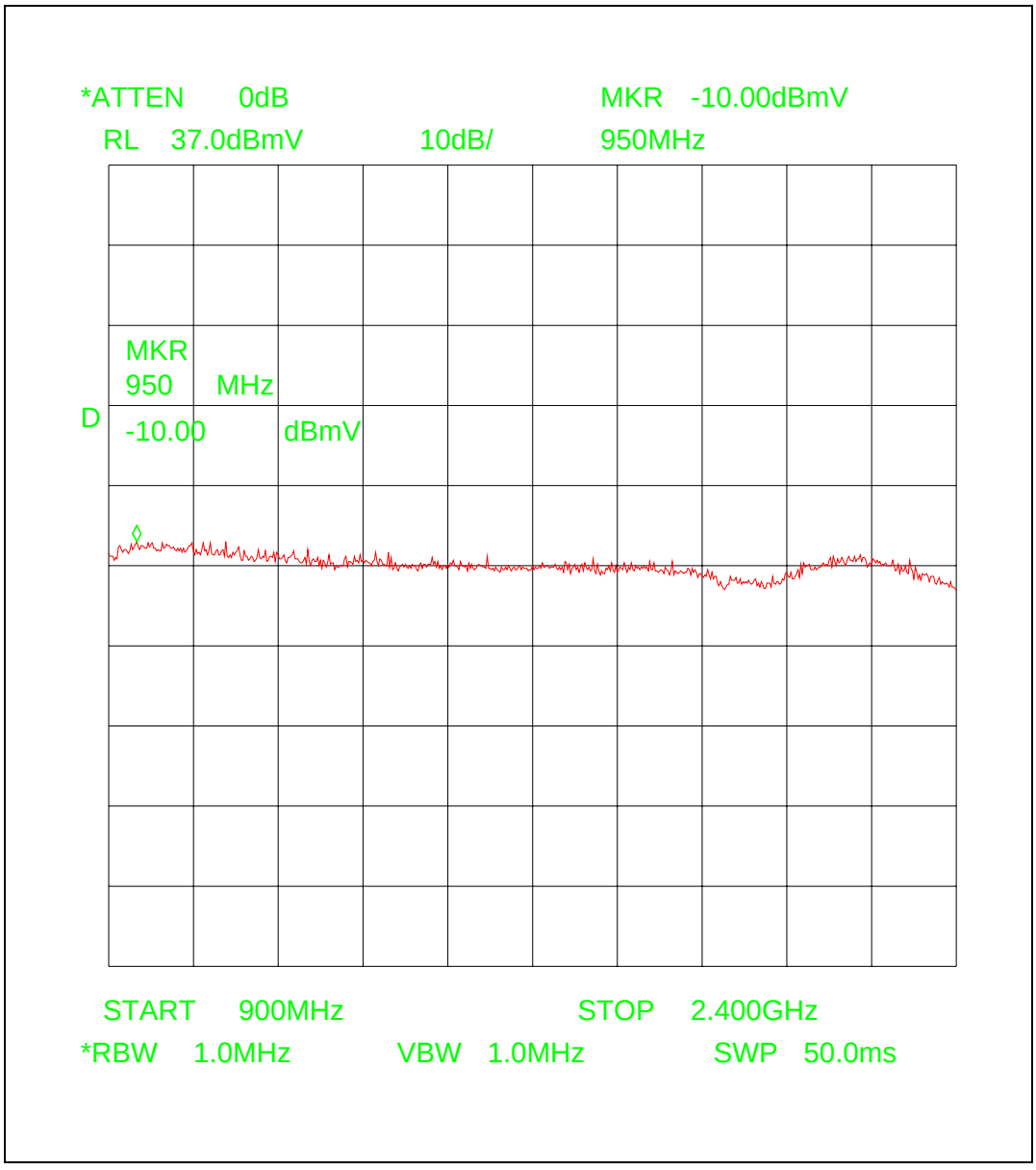


Remark: The spectrum analyser plot shows a snap shot of spurious emissions produced by the EUT. Maximum emission levels are investigated separately by scanning over antenna height (Ant. hgt) and azimuth of the turn table (Azm. TT) and employing different detector modes.

RX-Antenna horizontal. Measurement distance = 3.0 m

MKR	Spurs (MHz)	Lim. e (dBµV/m)	Meas. e (dBµV/m)	Diff. (dB)	Detector mode	Ant. hgt (m)	Azm. TT (deg.)
01	205.8	43.5	32.4	-11.1	Peak	1.50	160
02	2441.1	53.9	65.4 (TX)		Peak	1.50	180

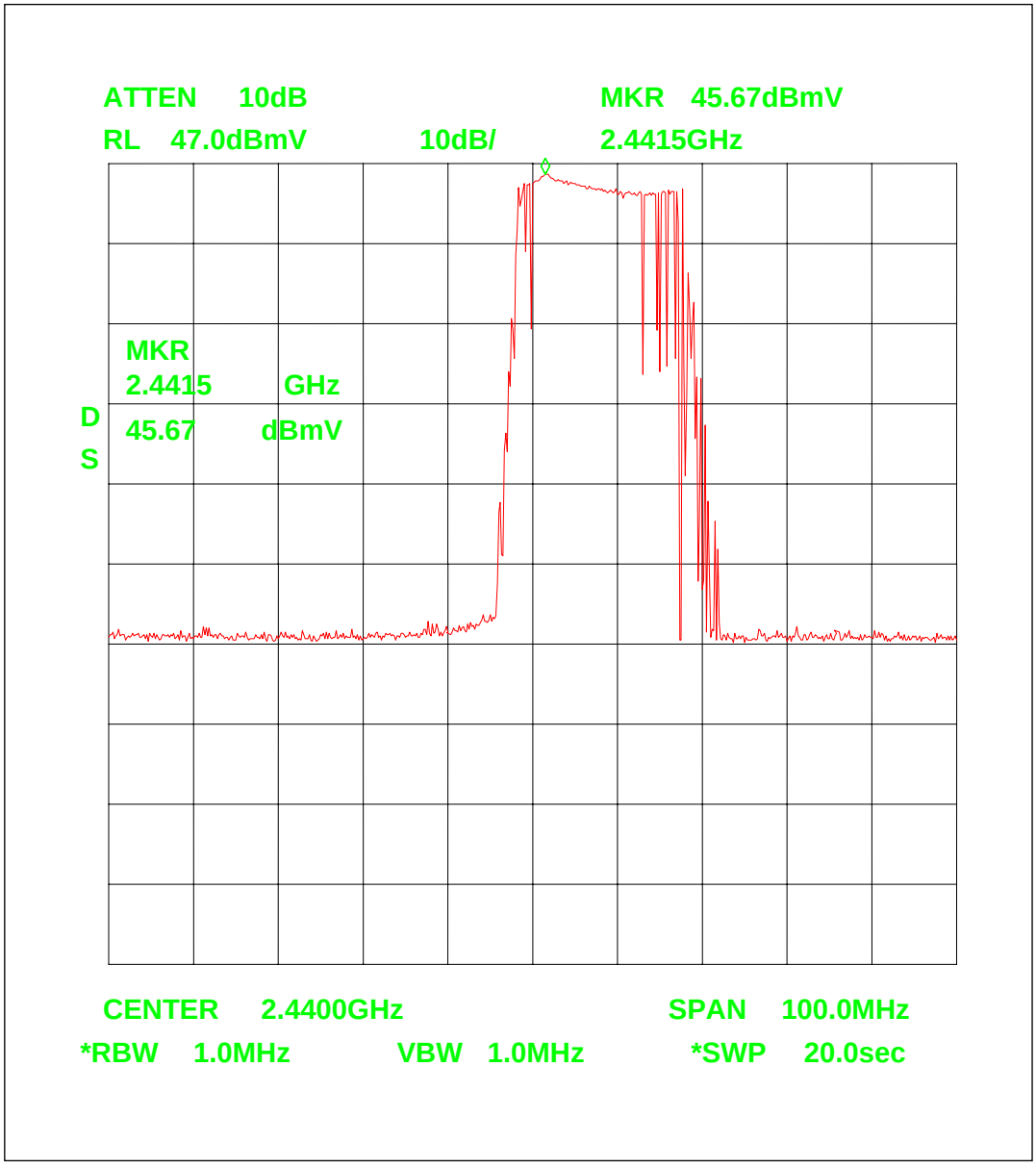
Plot 4



Measurement distance d = 3.0 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]
e	=	-10.0	+	0.5	-	32.0	+	23.45
e	=	-18.05 dB(mV/m)						
e	=	41.95 dB(µV/m)						
E	=	125.17 µV/m (Noise)						

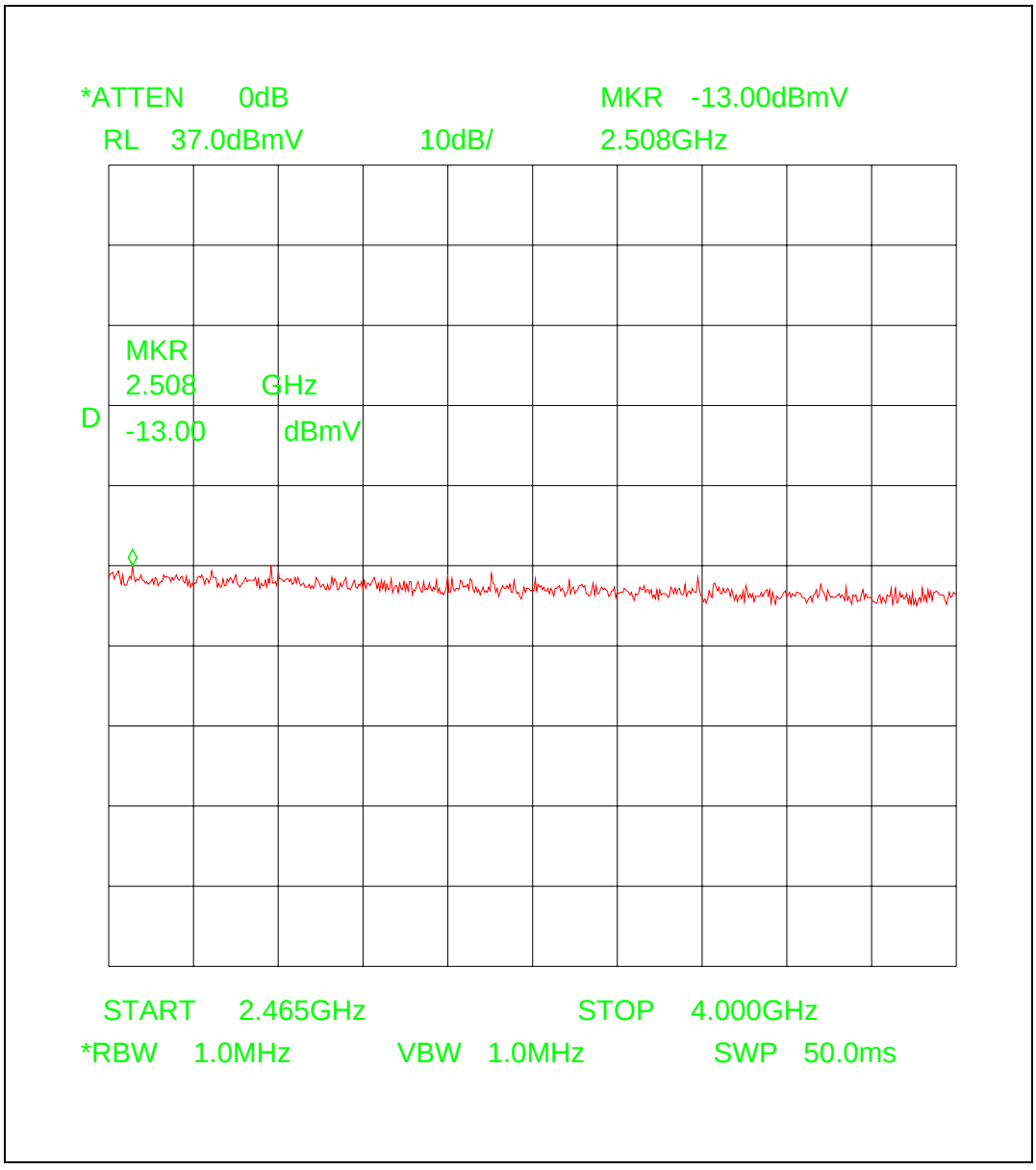
Plot 5



Measurement distance d = 3.0 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]
e	=	45.67	+	0.8	-	32.0	+	23.68
e	=	38.15 dB(mV/m)						
E	=	80.816 mV/m						

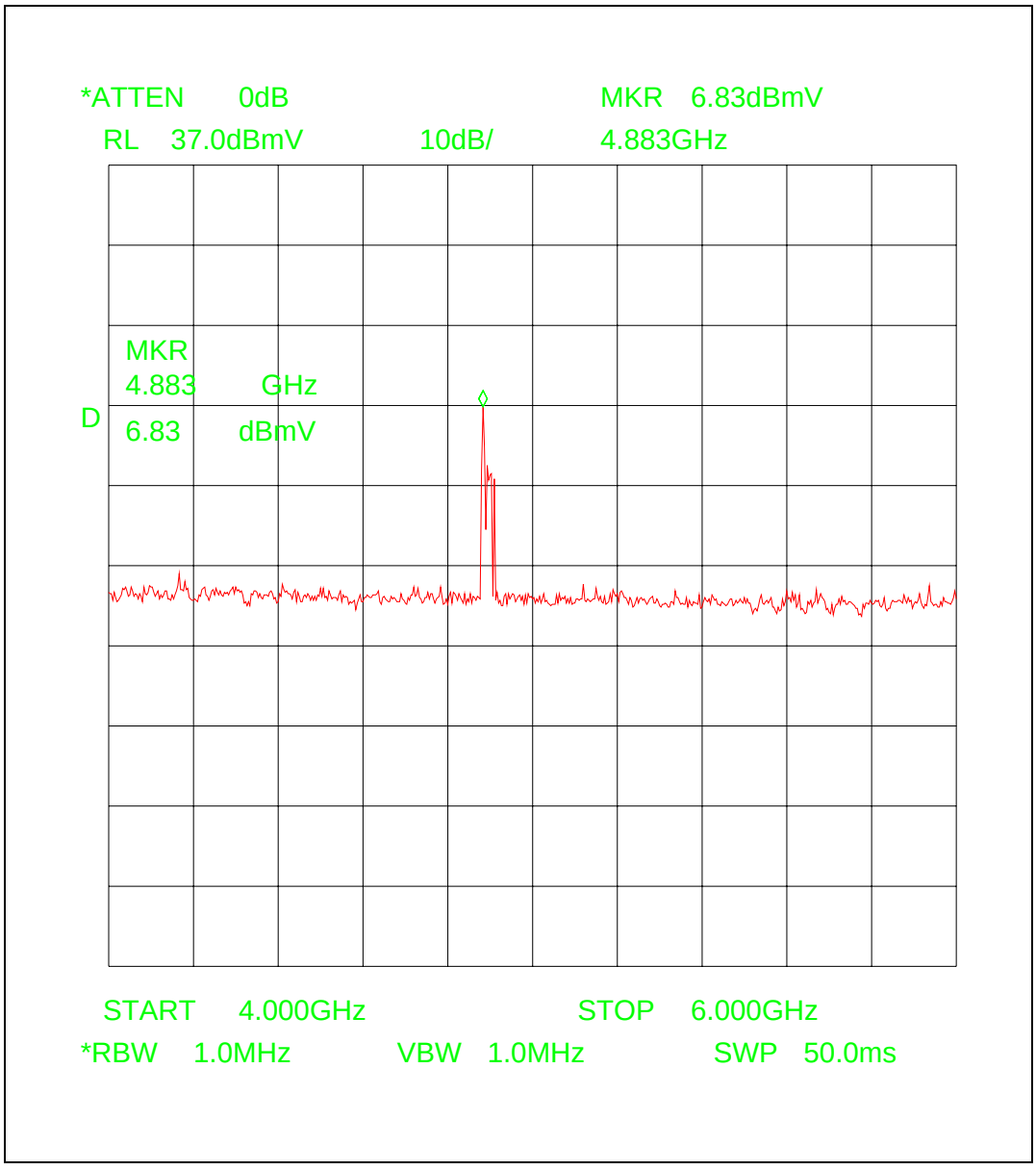
Plot 6



Measurement distance d = 3.0 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]
e	=	-13.0	+	0.9	-	32.0	+	23.68
e	=	-20.42 dB(mV/m)						
e	=	39.58 dB(µV/m)						
E	=	95.28 µV/m (Noise)						

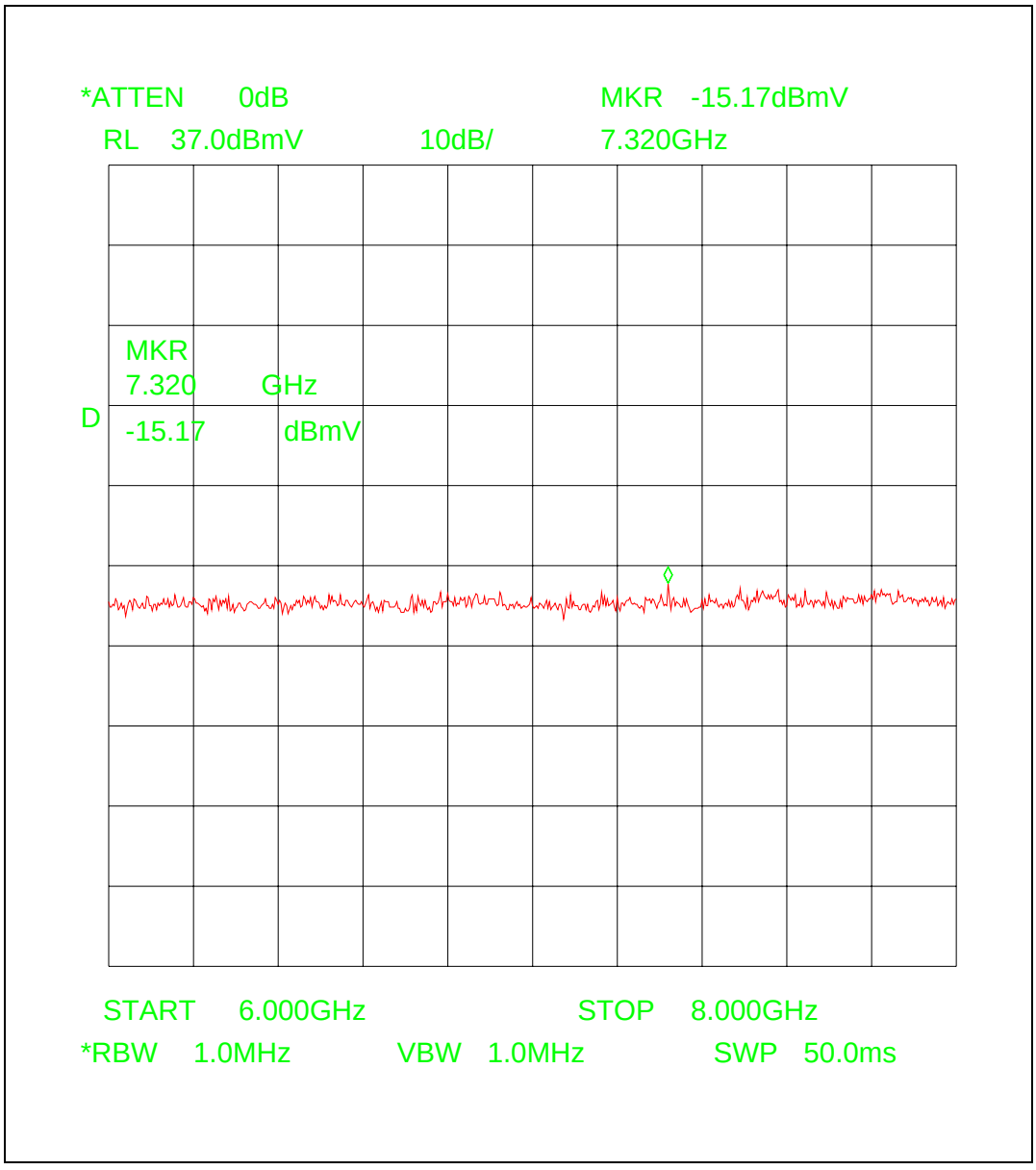
Plot 7



Measurement distance d = 1.0 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor	+	distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]	+	dc [dB]
e	=	6.8	+	1.0	-	32.0	+	27.31	+	-9.54
e	=	-6.43 dB(mV/m)								
e	=	53.57 dB(µV/m)								
E (Peak)	=	476.97 µV/m (2nd Harmonic) Peak.								
E (AV)	=	403.1 µV/m (2nd Harmonic) AV								

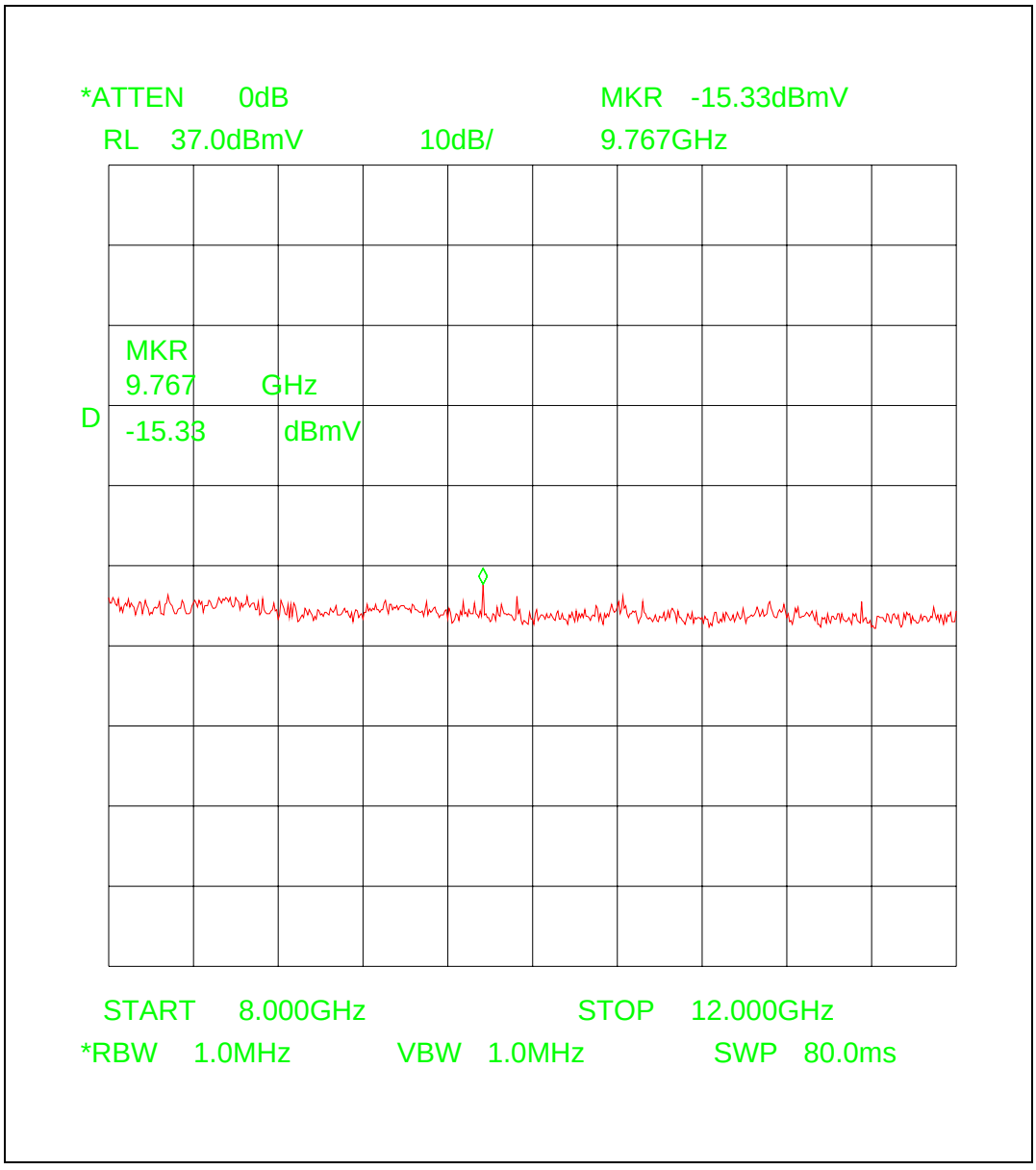
Plot 8



Measurement distance d = 1.0 m

Field strength	=	analyser reading	+	cable loss	- amplifier gain	+	antenna factor	+ distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	- g [dB]	+	k [dB(1/m)]	+ dc [dB]
e	=	-15.17	+	1.5	-32.0	+	30.06	+ -9.54
e	=	-23.15 dB(mV/m)						
e	=	36.85 dB(µV/m)						
E	=	69.58 µV/m (3rd Harmonic)						

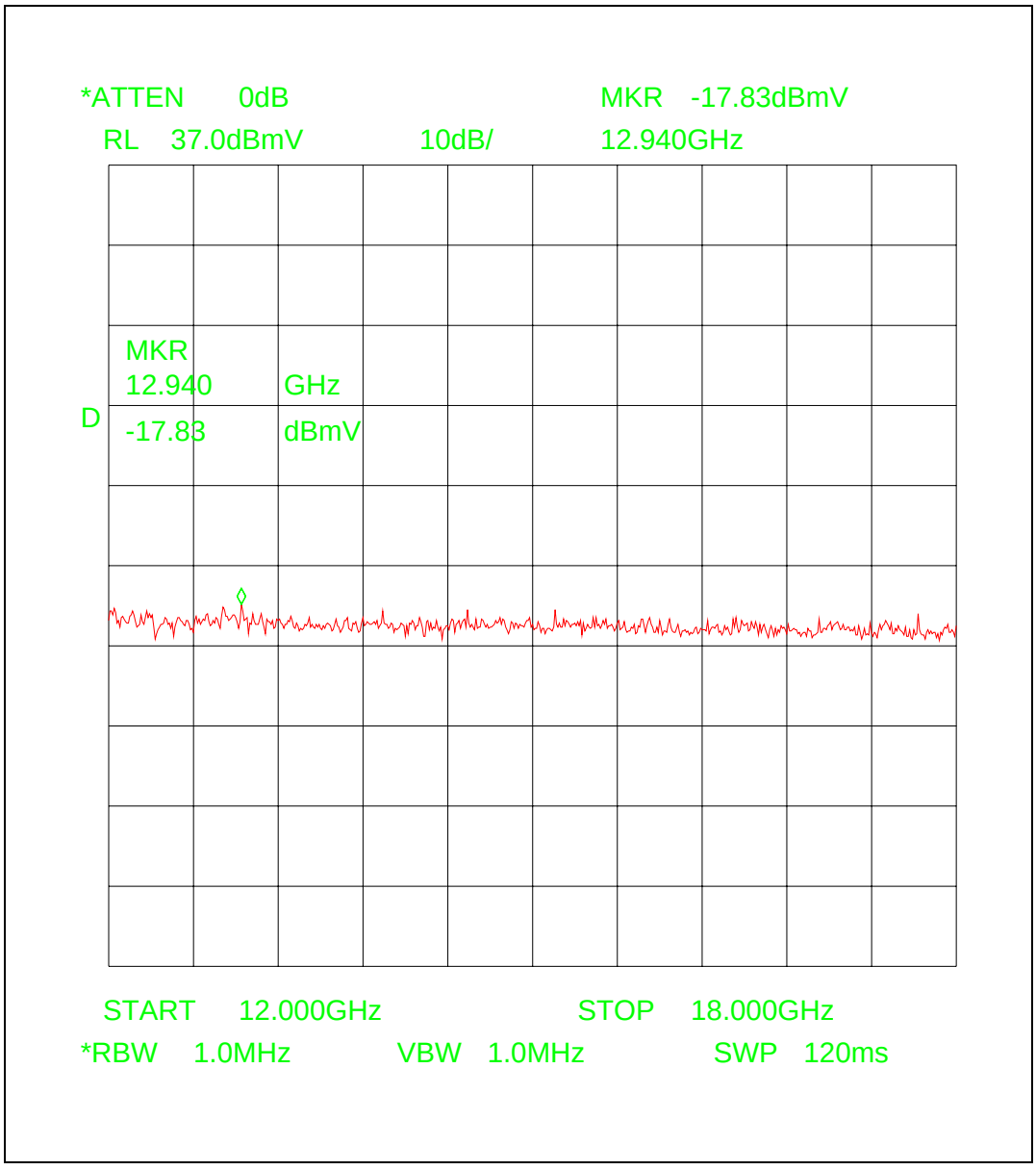
Plot 9



Measurement distance d = 1.0 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor	+	distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]	+	dc [dB]
e	=	-15.33	+	2.0	-	32.0	+	33.70	+	-9.54
e	=	-21.17 dB(mV/m)								
e	=	38.83 dB(µV/m)								
E	=	87.39 µV/m (4th Harmonic)								

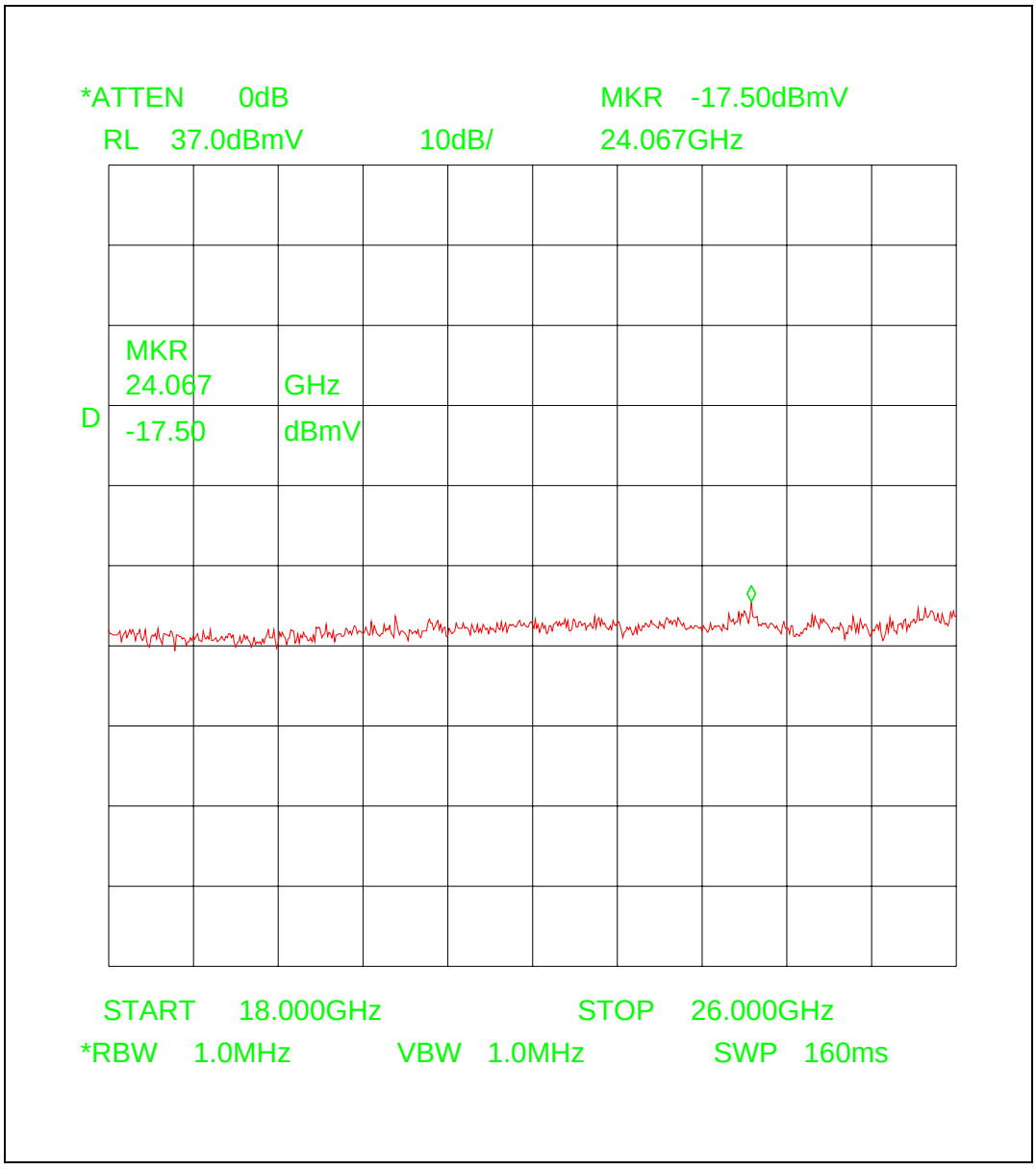
Plot 10



Measurement distance d = 1.0 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor + distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)] + dc [dB]
e	=	-17.83	+	2.5	-	32.0	+	33.97 + -9.54
e	=	-22.9 dB(mV/m)						
e	=	37.1 dB(µV/m)						
E	=	71.61 µV/m (Noise)						

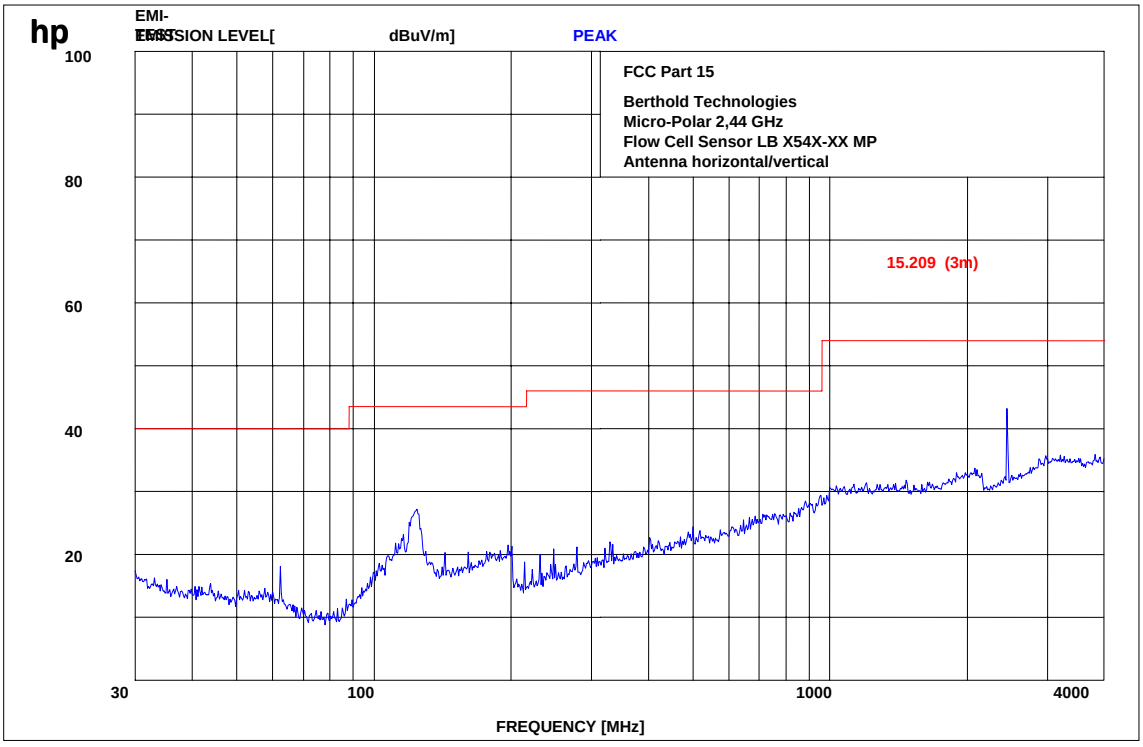
Plot 11



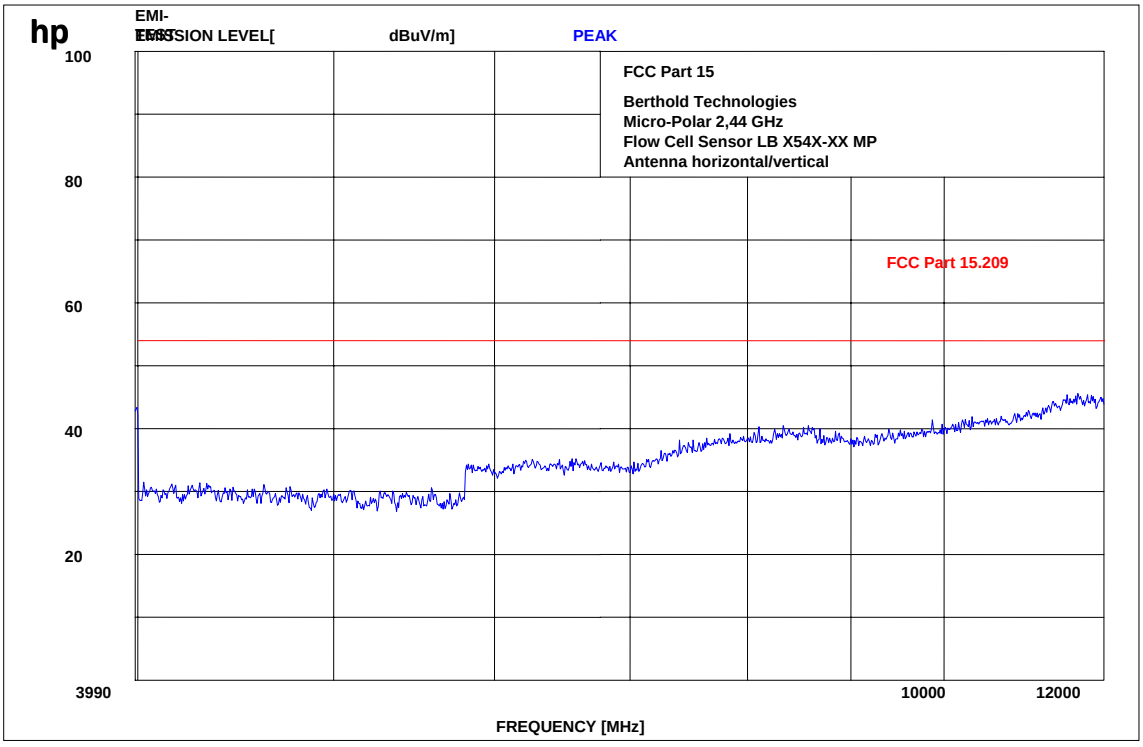
Measurement distance d = 1.0 m

Field strength	=	analyser reading	+	cable loss	- amplifier gain	+	antenna factor	+ distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	- g [dB]	+	k [dB(1/m)]	+ dc [dB]
e	=	-17.50	+	3.0	- 29.0	+	40.22	+ -9.54
e	=	-12.82 dB(mV/m)						
e	=	47.12 dB(µV/m)						
E	=	228.5 µV/m (Noise)						

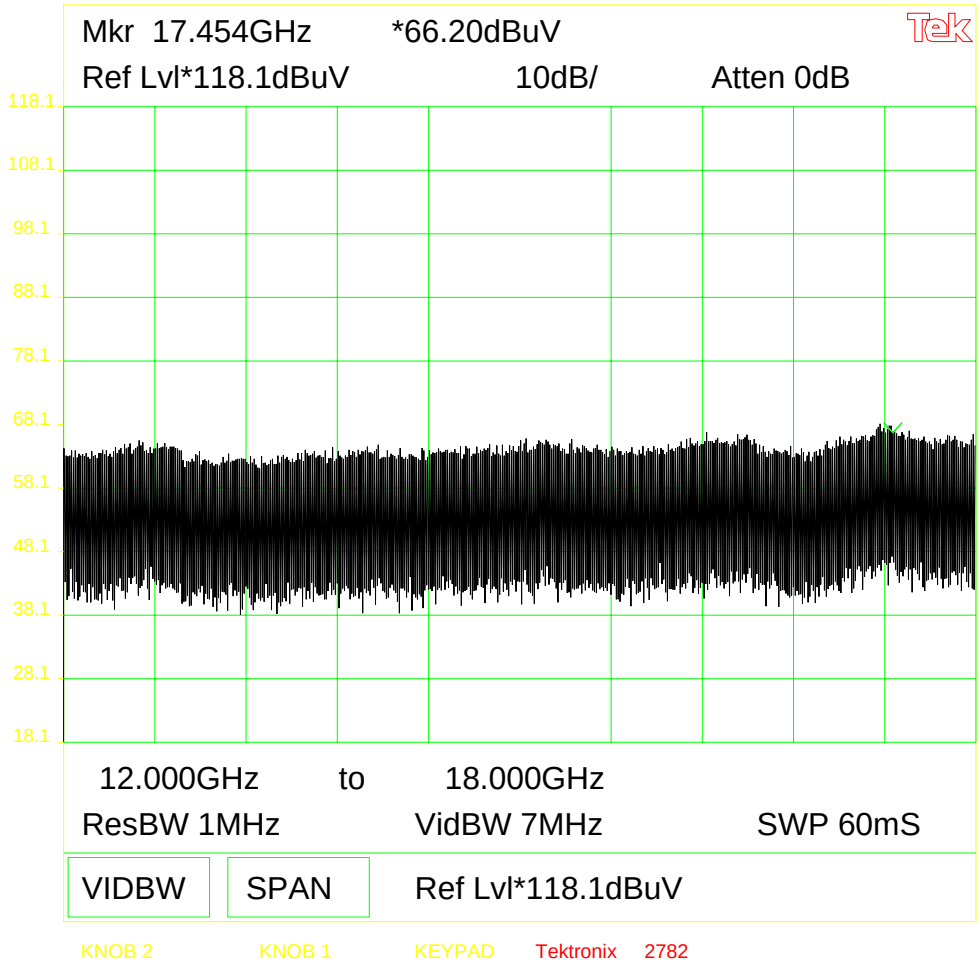
PLOT 12


hp
EMI-
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15
Berthold Technologies
Micro-Polar 2,44 GHz
Flow Cell Sensor LB X54X-XX MP
Antenna horizontal/vertical
15.209 (3m)
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

PLOT 13


hp
EMI-
EMISSION LEVEL[dBuV/m]
PEAK
100
80
60
40
20
3990
10000
12000
FREQUENCY [MHz]
FCC Part 15
Berthold Technologies
Micro-Polar 2,44 GHz
Flow Cell Sensor LB X54X-XX MP
Antenna horizontal/vertical
FCC Part 15.209

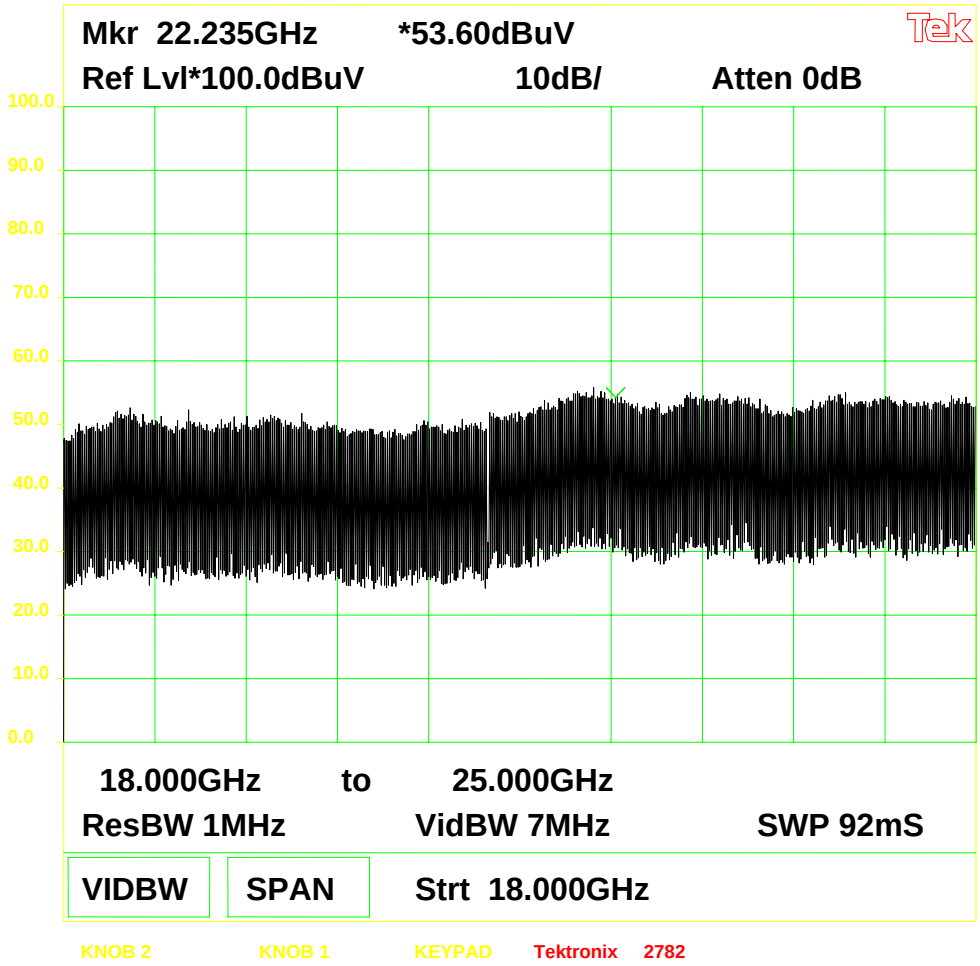
Plot 14



Measurement distance d = 0.2 m

Field strength	=	analyser reading	+	cable loss	- amplifier gain	+	antenna factor	+ distance corr.
e [dB(mV/m)]	=	u [dB(µV)]	+	a [dB]	- g [dB]	+	k [dB(1/m)]	+ dc [dB]
e	=	66.2	+	2.5	- 32.0	+	33.97	+ -21.58
e	=	49.09 dB(µV/m)						
E	=	284.77 µV/m (Noise)						

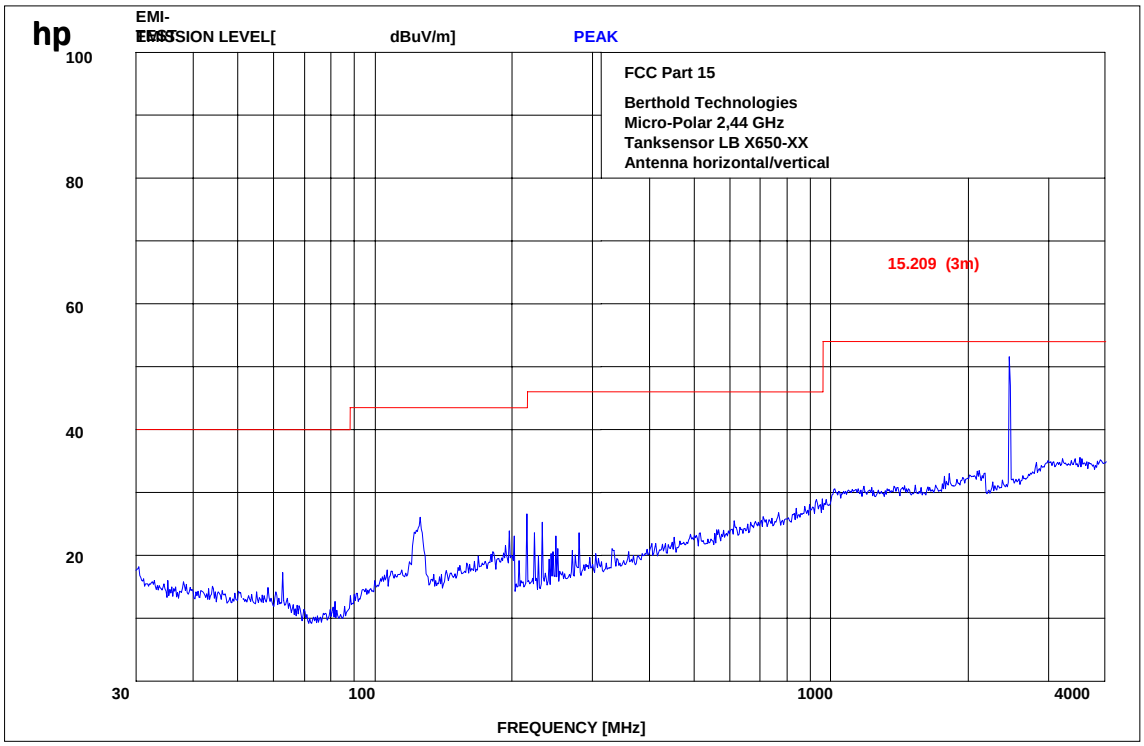
PLOT 15



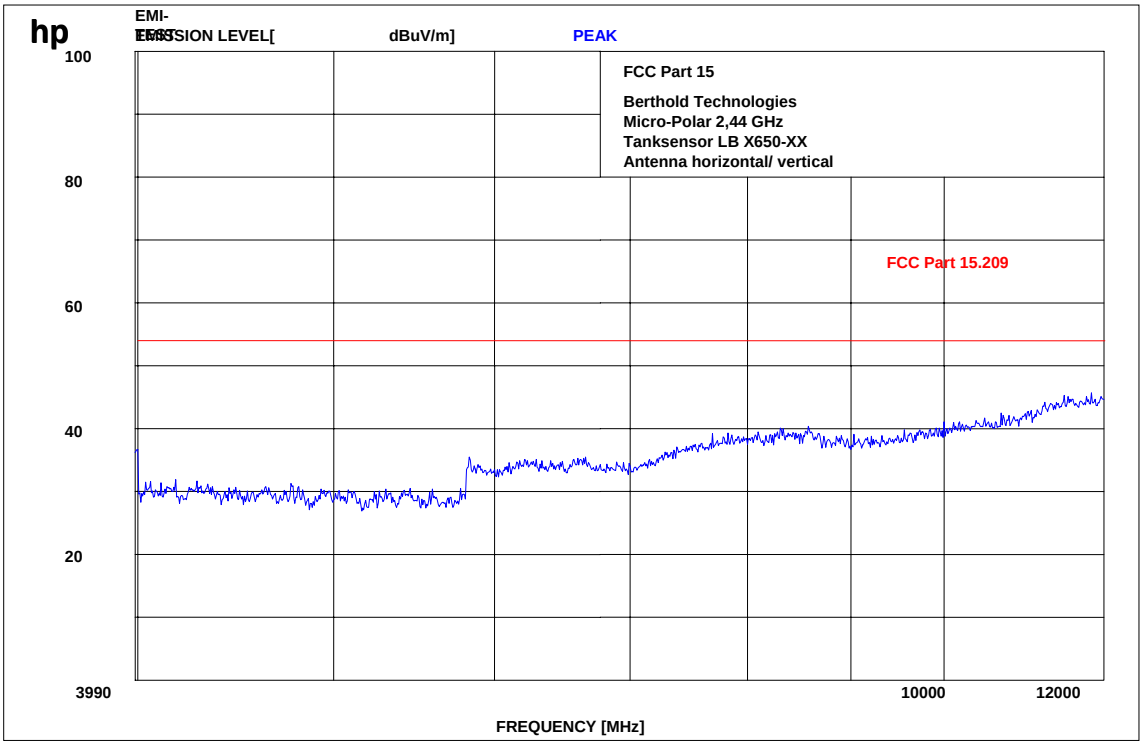
Measurement distance d = 0.2 m

Field strength	=	analyser reading	+ cable loss	- amplifier gain	+ antenna factor	+	distance corr.
e [dB(mV/m)]	=	u [dB(µV)]	+ a [dB]	- g [dB]	+ k [dB(1/m)]	+	dc [dB]
e	=	53.6 +	3.0	- 29.0	+ 40.22	+	-21.58
e	=	46.24 dB(µV/m)					
E	=	205.1µV/m (Noise)					

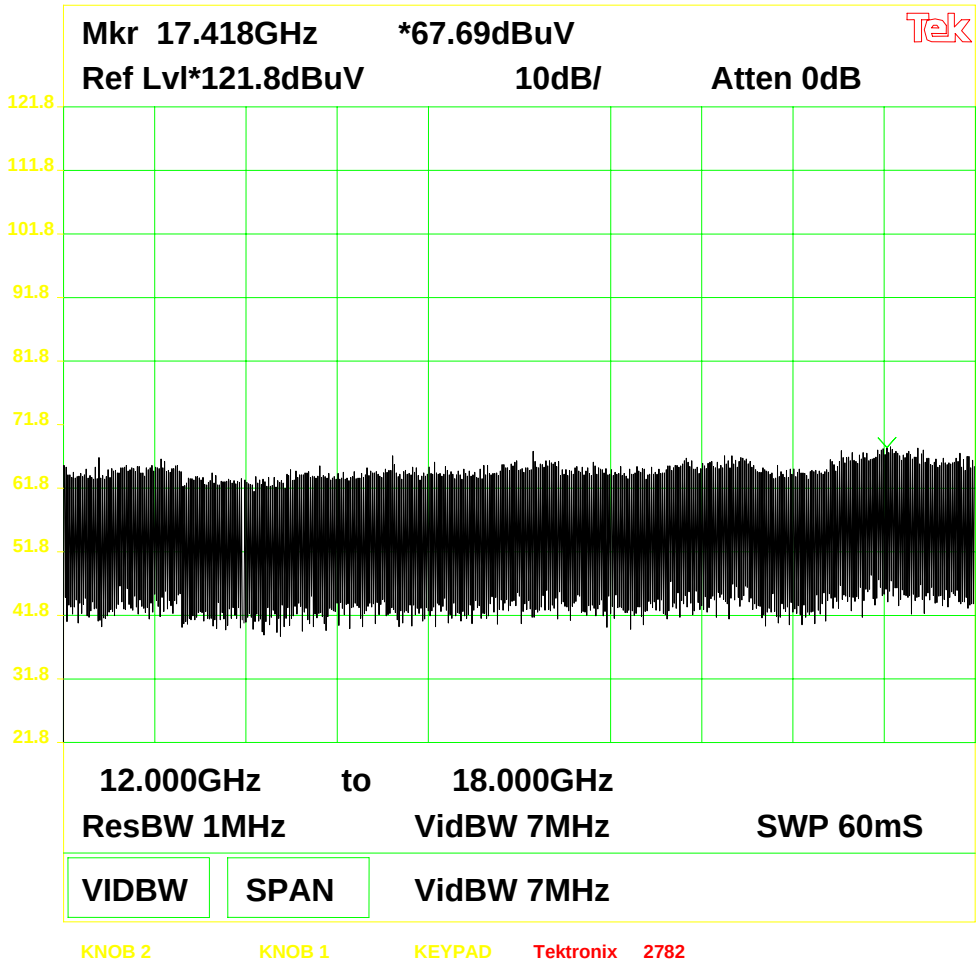
PLOT 16


hp
EMI-
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15
Berthold Technologies
Micro-Polar 2,44 GHz
Tanksensor LB X650-XX
Antenna horizontal/vertical
15.209 (3m)
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

PLOT 17


hp
EMI-
EMISSION LEVEL[dBuV/m]
PEAK
100
80
60
40
20
3990
10000
12000
FREQUENCY [MHz]
FCC Part 15
Berthold Technologies
Micro-Polar 2,44 GHz
Tanksensor LB X650-XX
Antenna horizontal/ vertical
FCC Part 15.209

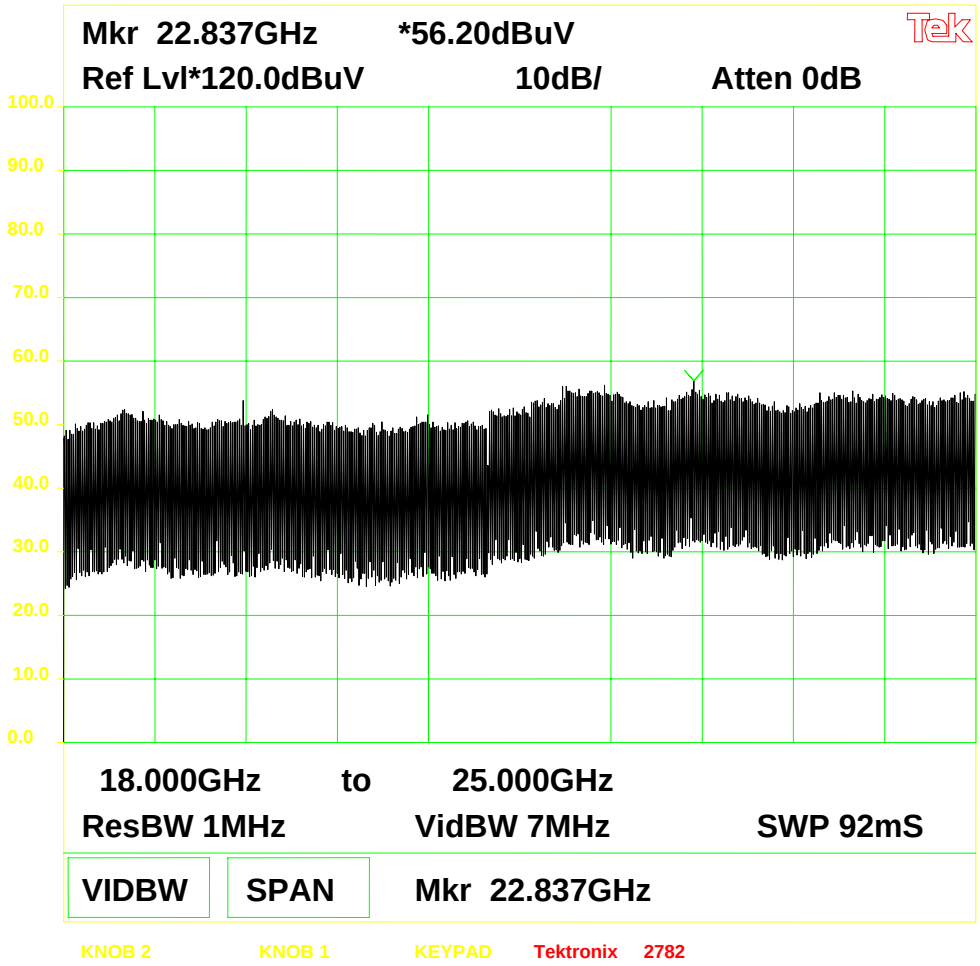
PLOT 18



Measurement distance d = 0.2 m

Field strength	=	analyser reading	+	cable loss	- amplifier gain	+	antenna factor	+ distance corr.
e [dB(mV/m)]	=	u [dB(µV)]	+	a [dB]	- g [dB]	+	k [dB(1/m)]	+ dc [dB]
e	=	67.69	+	2.5	- 32.0	+	33.97	+ -21.58
e	=	50.5 dB(µV/m)						
E	=	338.06 µV/m (Noise)						

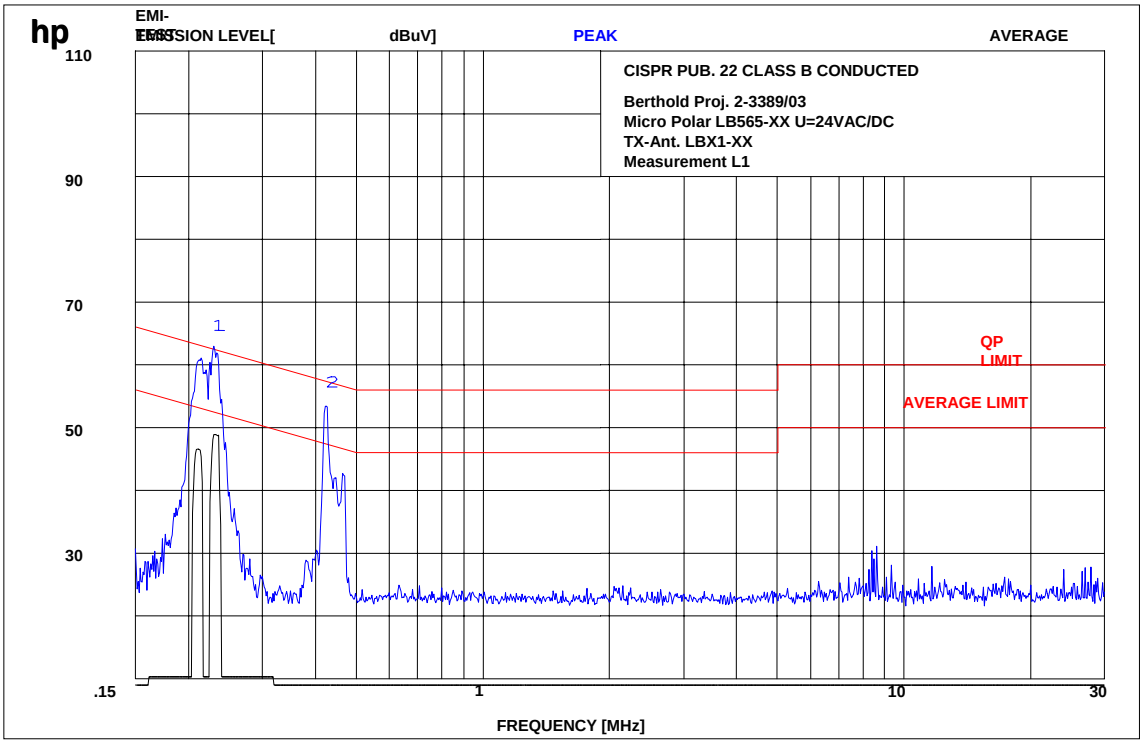
PLOT 19



Measurement distance d = 0.2 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor	+	distance corr.
e [dB(mV/m)]	=	u [dB(µV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]	+	dc [dB]
e	=	56.2	+	3.0	-	29.0	+	40.22	+	-21.58
e	=	48.84 dB(µV/m)								
E	=	276.7 µV/m (Noise)								

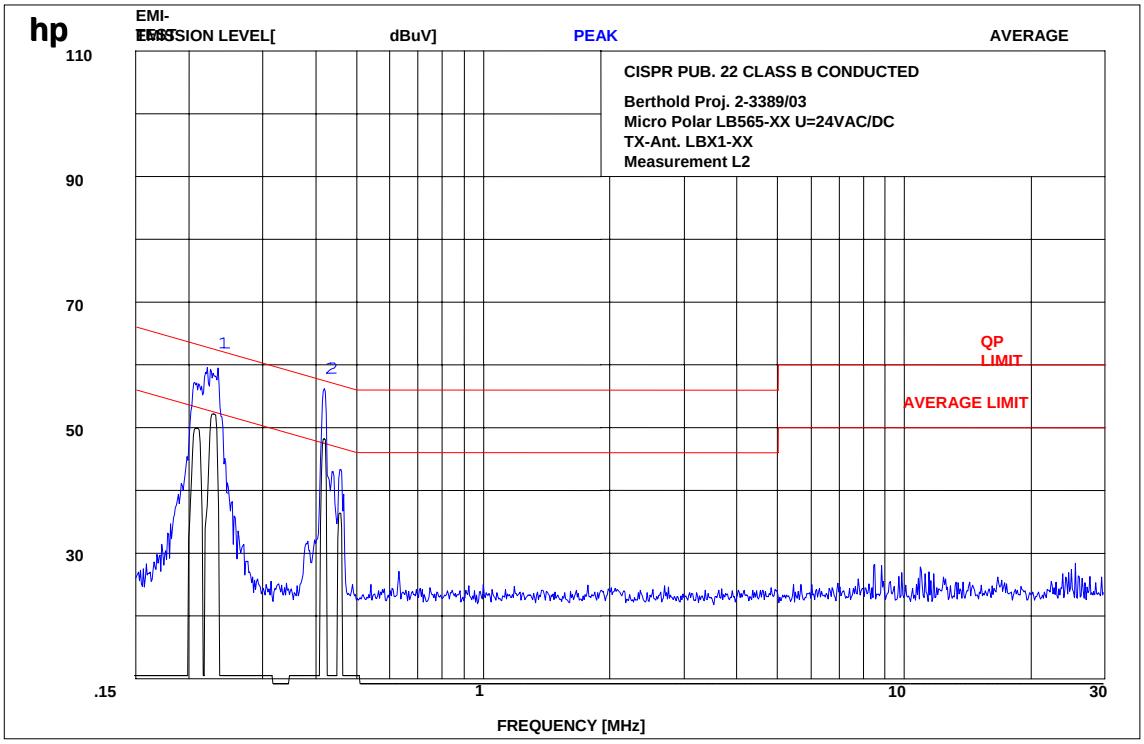
Plot 20



MKR	Spurs (MHz)	Lim.QP (dBµV)	Meas. PK (dBµV)	Diff. (dB)	Detector mode
01	0.240	63.5	64.9	1.4	Peak
02	0.420	53.0			Peak

MKR	Spurs (MHz)	Lim.AV (dBµV)	Meas. AV (dBµV)	Diff. (dB)	Detector mode
01	0.240	53.5	48.5	-5.0	Average

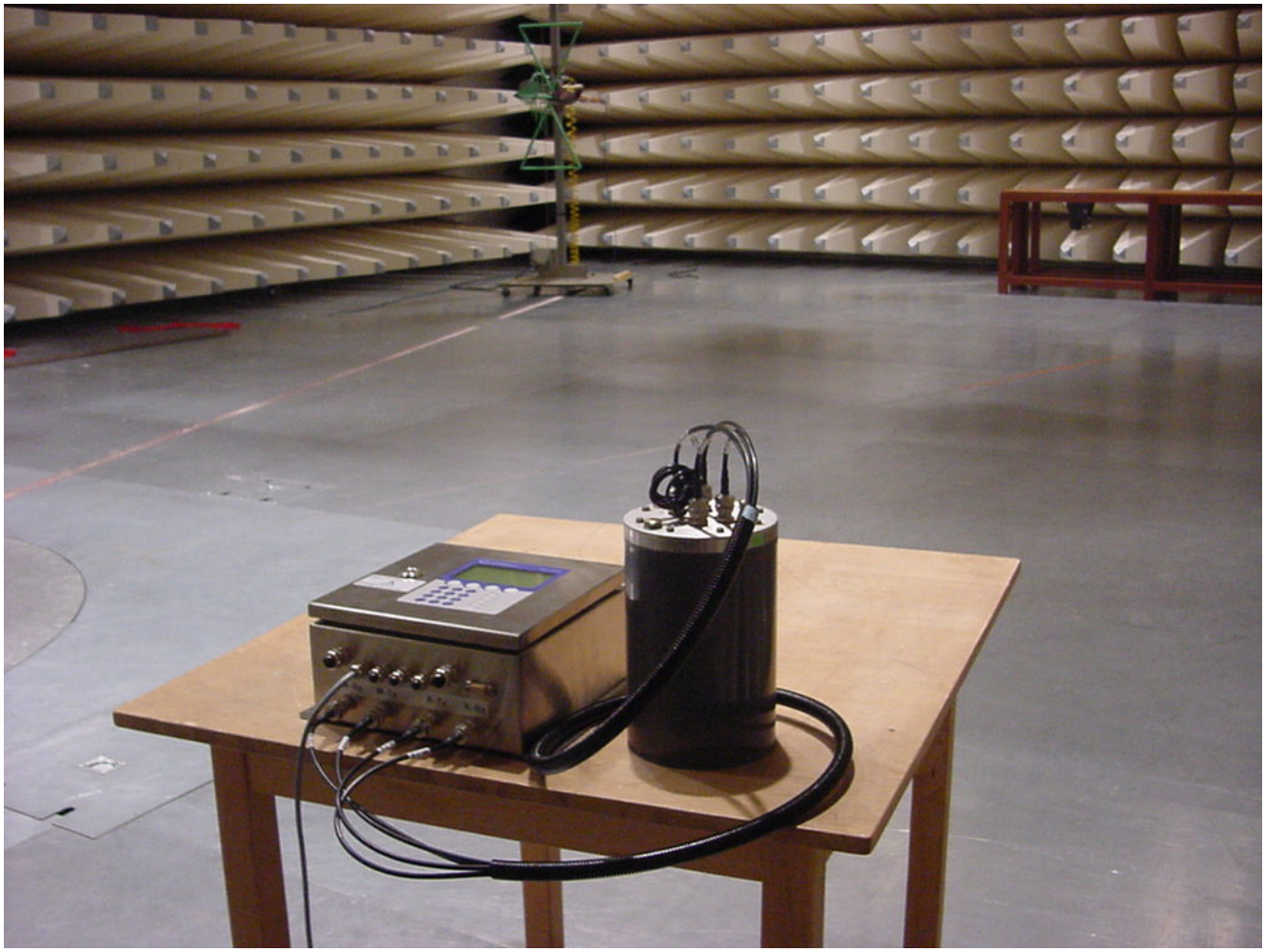
Plot 21



MKR	Spurs (MHz)	Lim.QP (dBµV)	Meas. PK (dBµV)	Diff. (dB)	Detector mode
01	0.240	63.5	60.0	3.5	Peak
02	0.420	58.0	57.0	1.0	Peak

MKR	Spurs (MHz)	Lim.AV (dBµV)	Meas. AV (dBµV)	Diff. (dB)	Detector mode
01	0.240	53.5	53.0	0.0	Average
02	0.420	47.2	47.2	0.0	Average

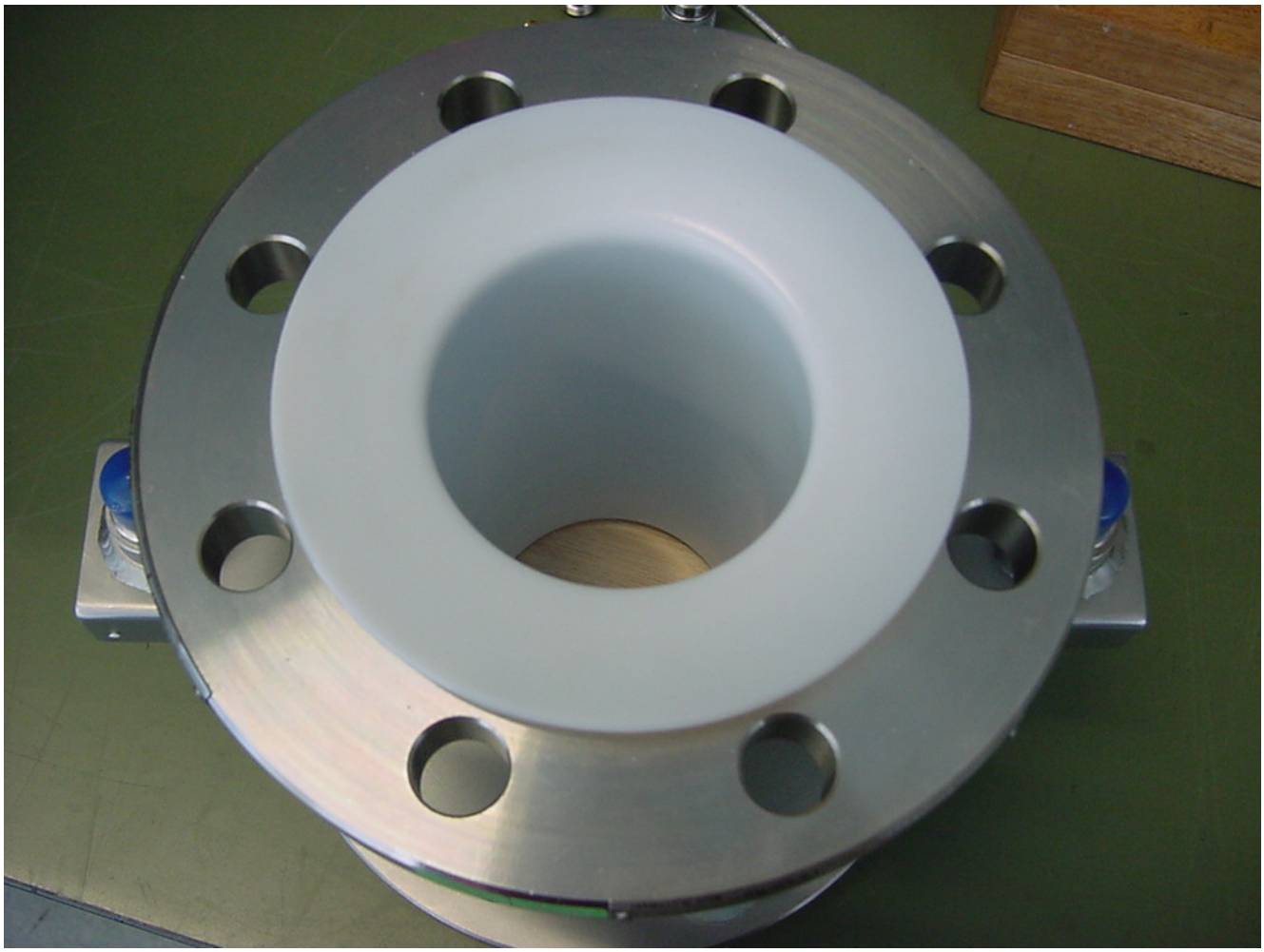
4 Photographs



Test set-up for field strength measurements up to 12 GHz

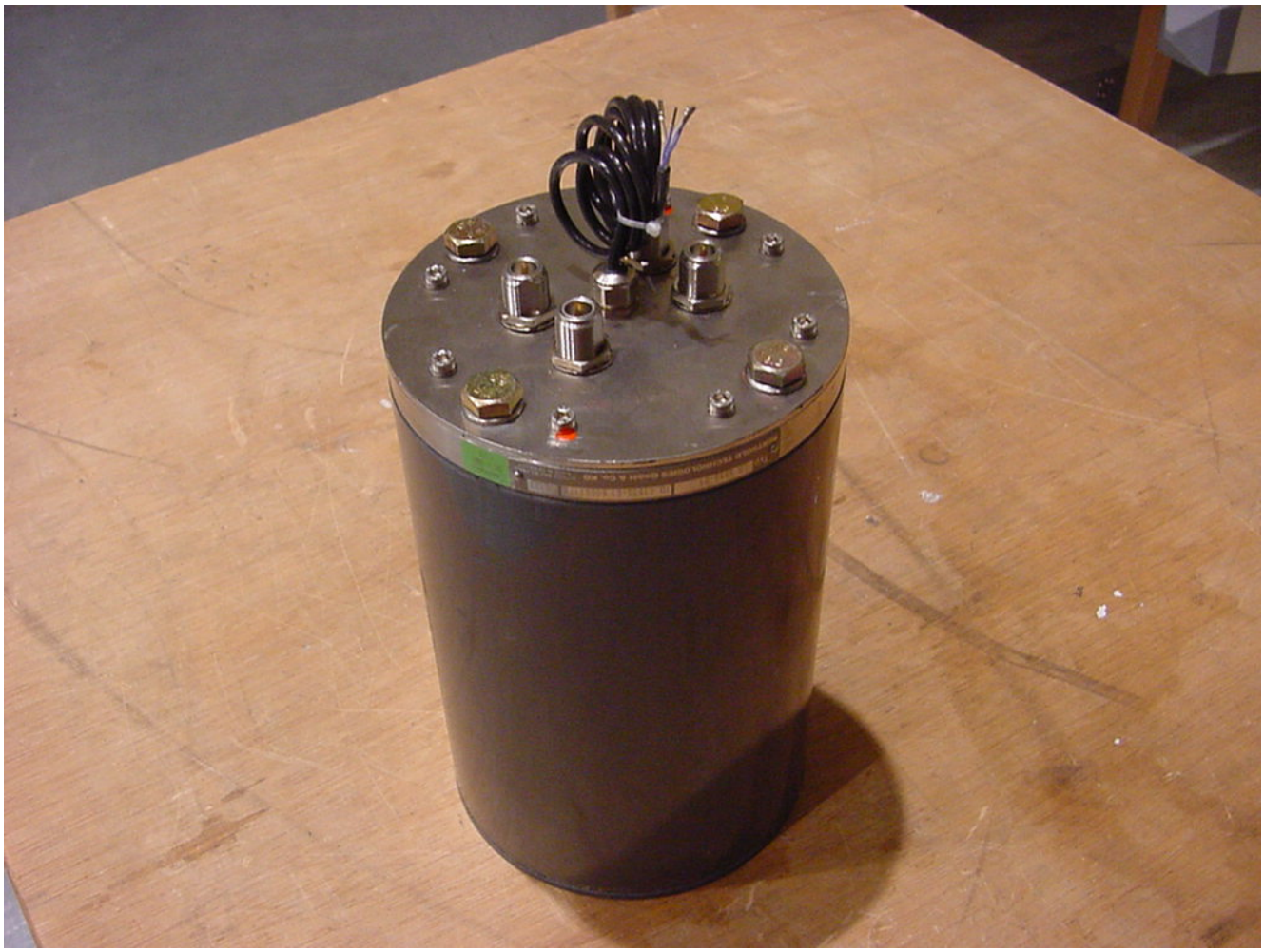
Test set-up for field strength measurements up to 25 GHz

TX and RX horn antennas LB X60X-XX



Flow cell sensor LB X54X-XX

In tank sensor LB X650-XX (same antenna , different housings)

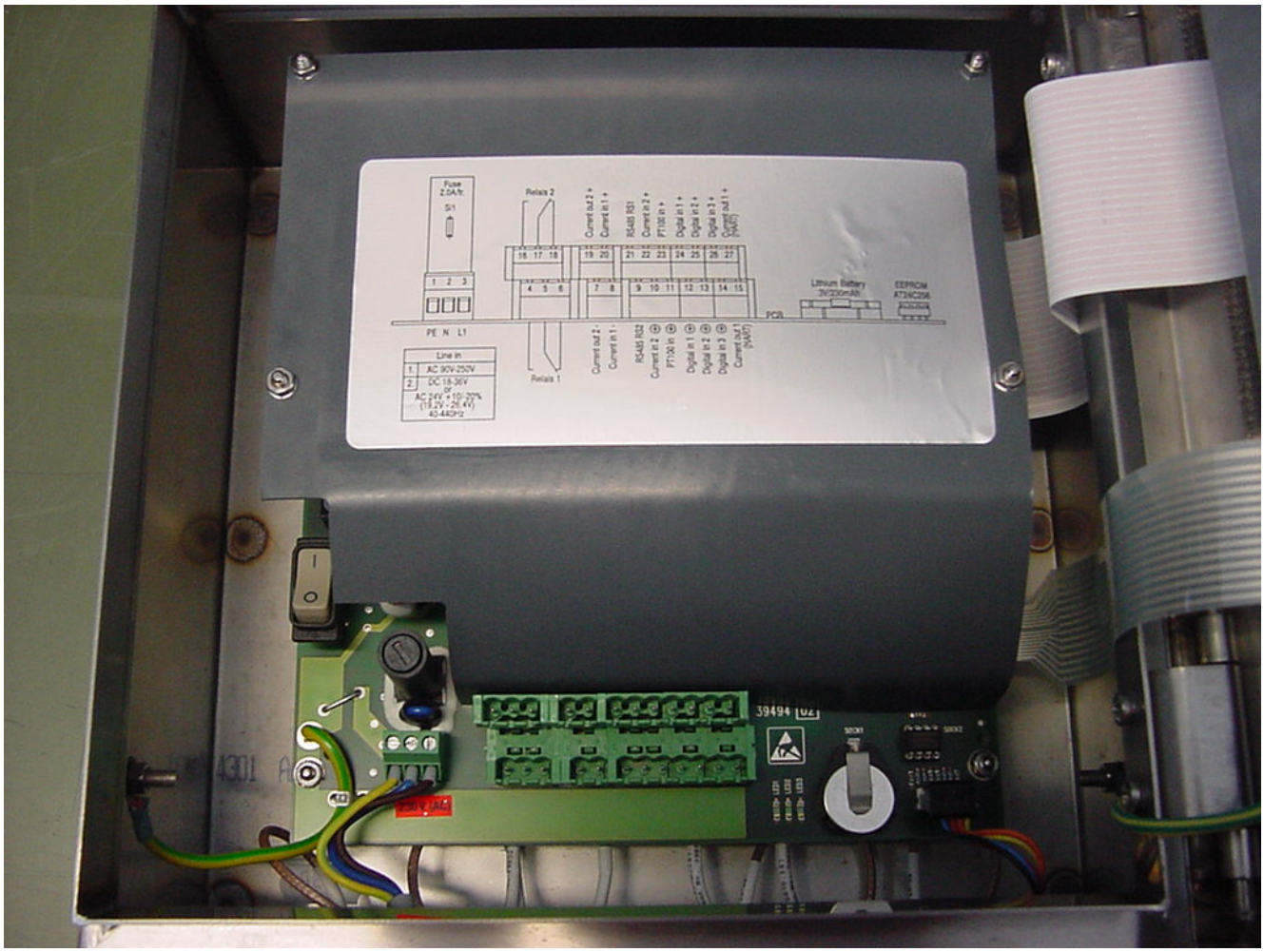


In tank sensor LB X650-XX (housing simulates build-in tank)

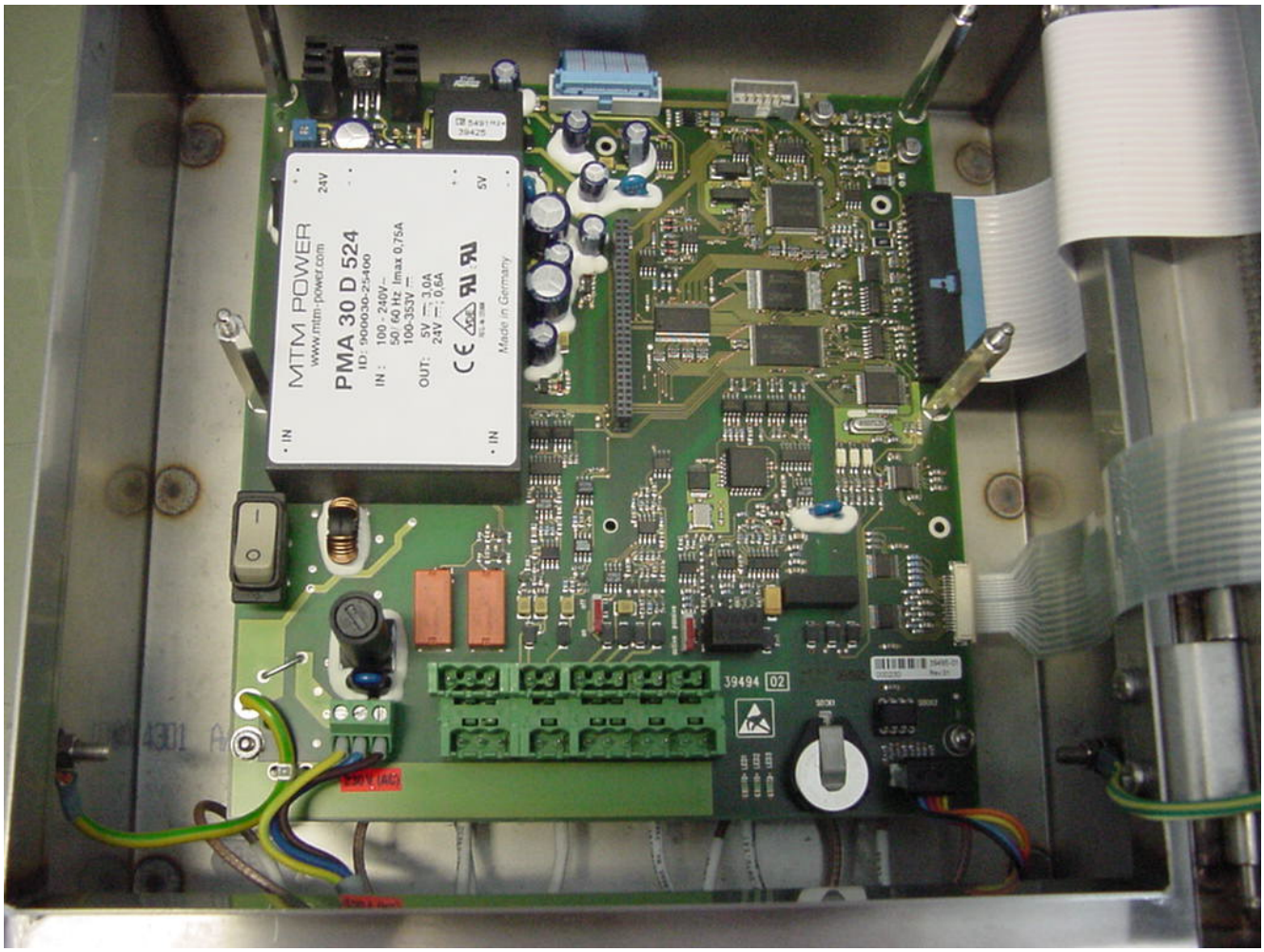
Input and output ports

Input and output ports

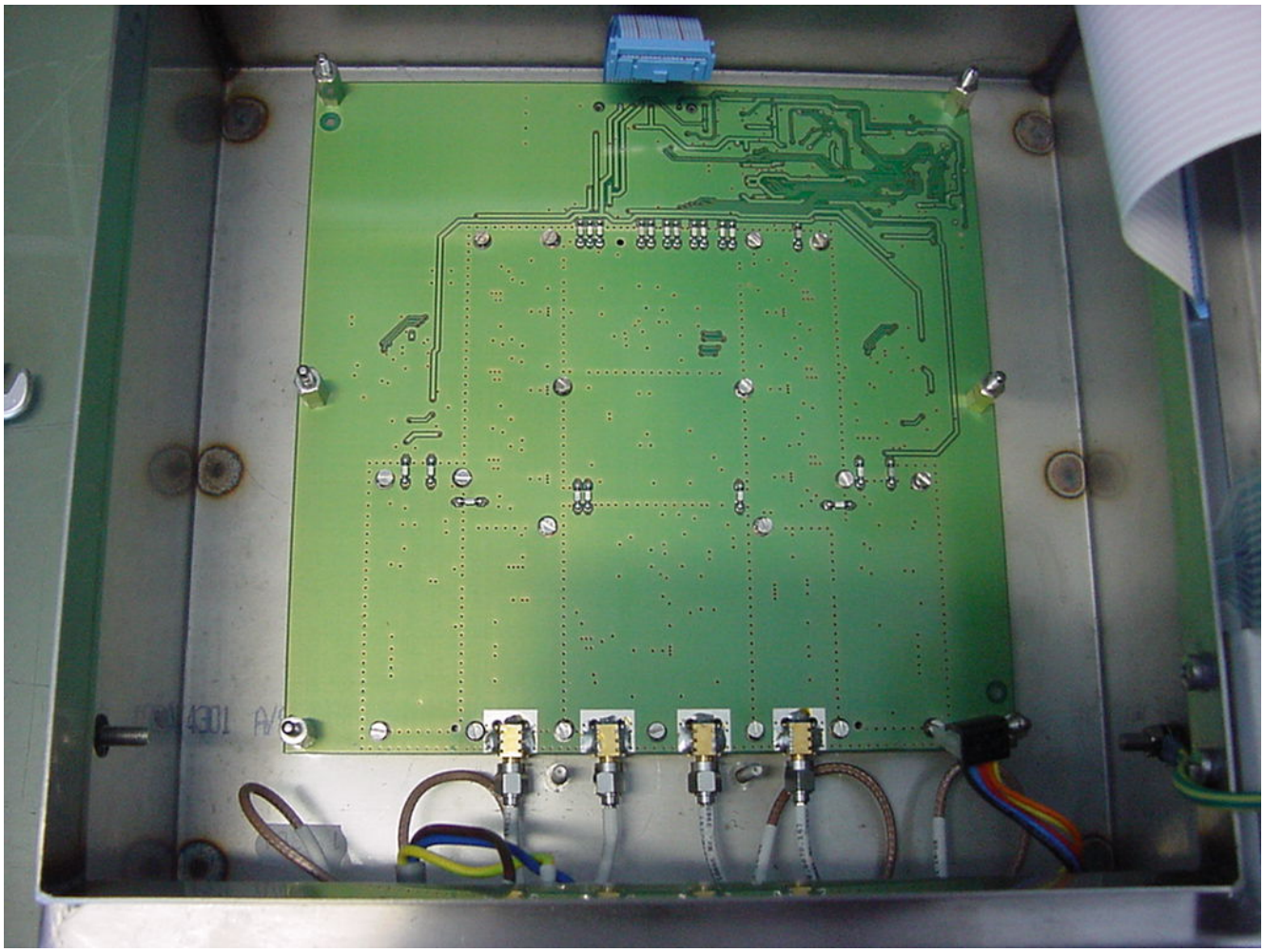

Id. 39531-01 / LB 565-01
Nr. 182963 - 0027
VAC 90-260
VA 30
Hz 50/60
Rev 02
Slow Blow Fuse 2A
CE 0682
BERTHOLD TECHNOLOGIES
D-75323 Bad Wildbad
Made in Germany



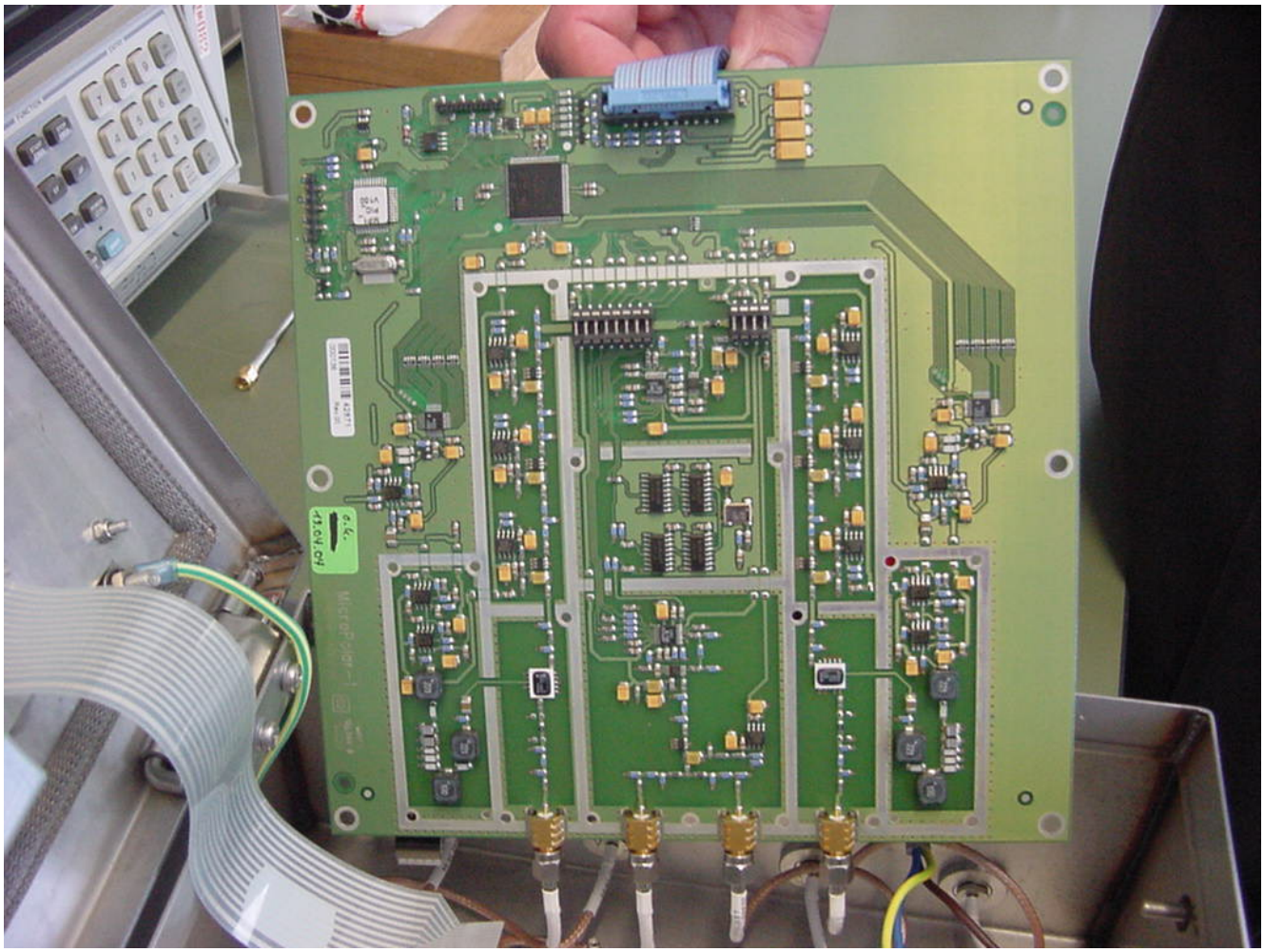
Here 115V AC version



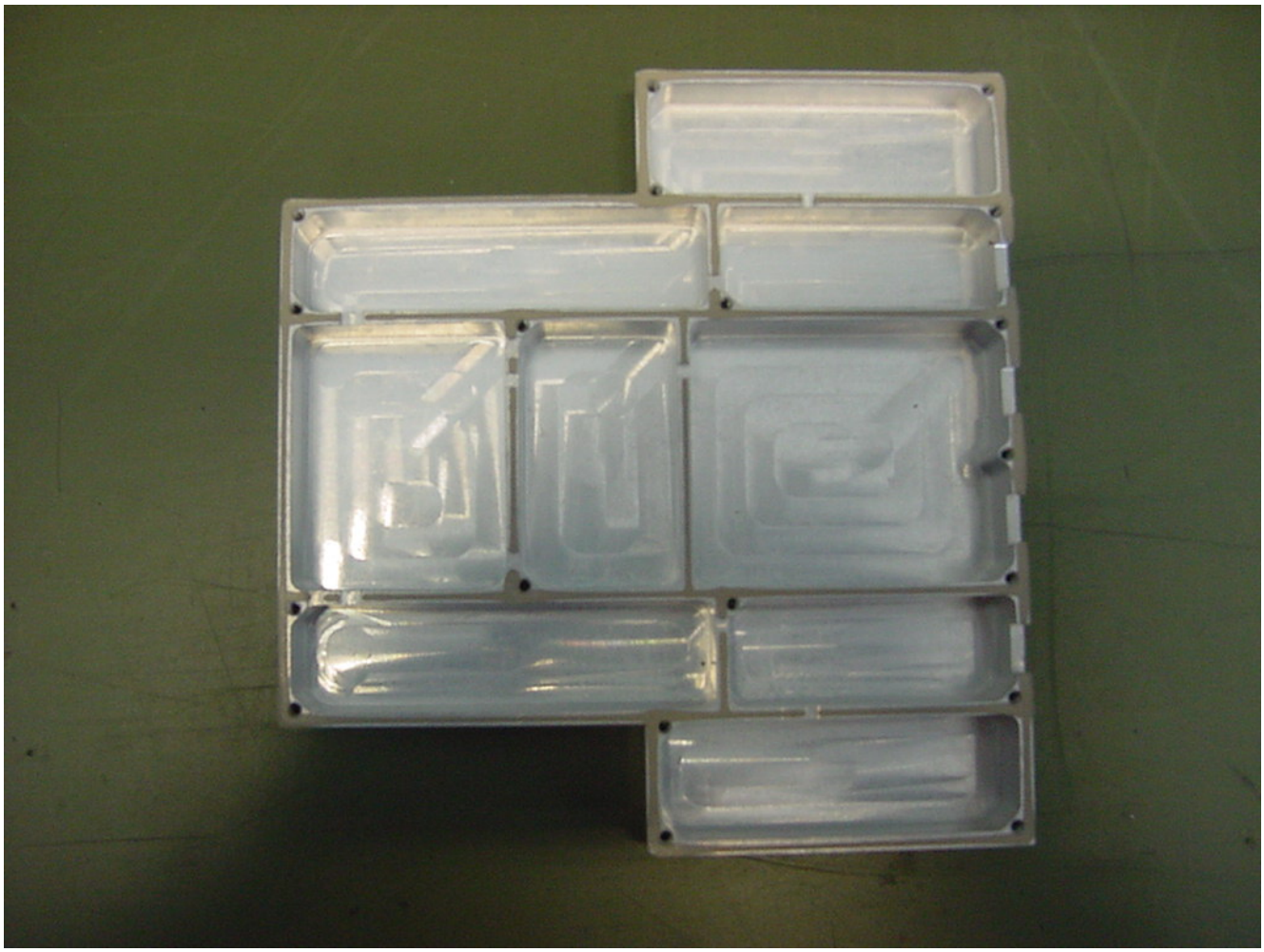
Here 115V AC version



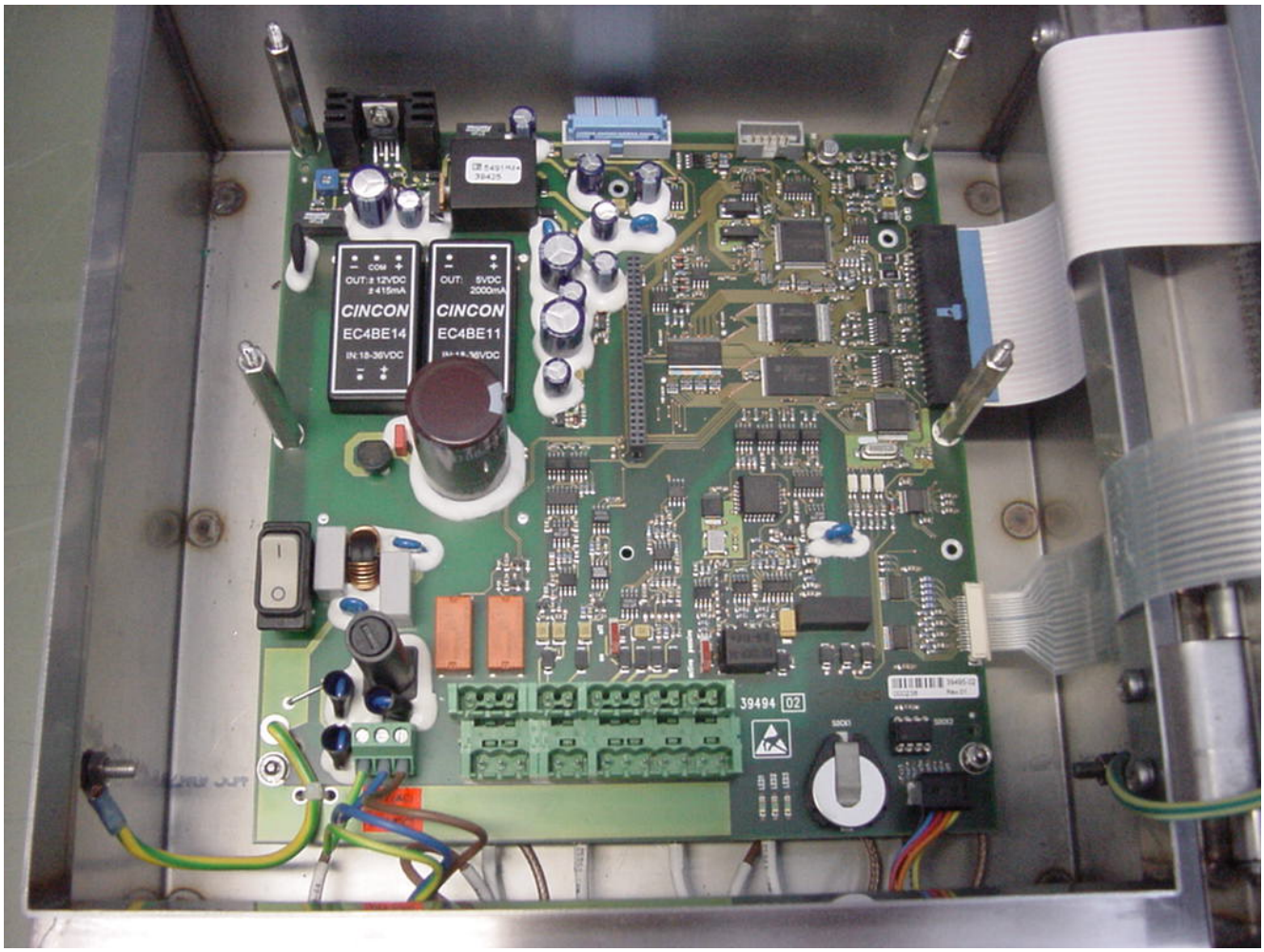
Here 115V AC version



Here 115V AC version, RF-part without shield



Here 115V AC version, cover of the RF-part



Here DC version, only difference to the AC version is the power supply.