

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-176/94-D1



Independent ETSI
compliance test house



Test report No. 2-4236-01-04/06

Applicant: Bircher Reglomat AG

Type: Mars DR / 31, Impulse ES

FCC ID: TBZ-RAD01

IC: 5904A-RAD01

Test standard: FCC Part 15, IC, RSS-210, Issue 6, Annex 7

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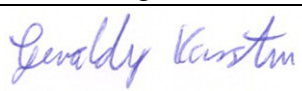
1 General information

1.1 Notes

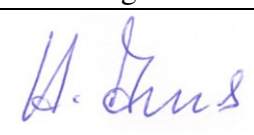
The test results of this test report relate exclusively to the test item specified in 1.5. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by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

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Tester:

Date	Name	Signature
2006-05-23	Karsten Gerald	
2006-11-10	Manfred Paschwitz	

Technical responsibility for area of testing:

Date	Name	Signature
2006-11-10	Harro Ames	



1.2 Testing laboratory

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

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e-mail : info@ict.cetecom.de
Internet : <http://www.cetecom-ict.de>

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 : Bircher Reglomat AG
Street : Hauptstrasse 22
Town : 9042 Speicher
Country : Switzerland
Phone : +41-71-343-83 83
Fax : +41-71-343-83 80

Contact person

Name : Mr. François Cosandey
Phone : +41-71-343-83 77
Fax : +41-71-343-83 10
E-Mail : francois.cosandey@bircher.com

1.4 Application details

Date of receipt of application : 2006-04-19
Date of receipt of test item : 2006-05-09
Date of test : 2006-05-16 and 22
Person(s) who have been present during the tests : -/-

1.5 Test item (EUT)

Description : Field disturbance Sensor
Type designation : Mars DR / 31, Impulse ES

Manufacturer
Name : Bircher Reglomat AG
Street : Hauptstrasse 22
Town : 9042 Speicher
Country : Switzerland

1.6 Technical data

Frequency range : 24.075 GHz ... 24.175 GHz
Operational frequency : 24.125 GHz
Field strength : 275 mV/m @ 3m
Type of modulation : 149KN0N
Microwave modules : Tx/Rx-Module with integral horn antenna
Power supply range (U nom) : 12 - 36 VDC / 12 - 28 VAC

1.7 Operation conditions

Operation : As soon as the equipment is powered on, Tx and Rx start operating
Purpose of operation : Microwave Motion Detector with direction recognition for door openers

1.8 Equipment under test

Mars DR / 31, Serial Number 027909

Mars DR / 31 and Impulse ES are exactly the same microwave motion detectors. They differ in labels and user manual.

1.9 Test standards

Industrie Canada
Code of Federal Regulations (CFR 47)

FCC Part 15 Radio Frequency Devices (08/2006)

SECTION 15.209
Radiation emission limits, general requirements

SECTION 15.245
Operation within the band 24.075 GHz to 24.175 GHz

Industrie Canada RSS-210, Issue 6, Annex 7

Test Report Cover Sheet/Performance Test Data

TEST REPORT NUMBER: **2-4236-01-04/06**

EQUIPMENT MODEL NUMBER: **Mars DR / 31, Impulse ES**

CERTIFICATION NO:

MANUFACTURER : **Bircher Reglomat AG
Hauptstrasse 22
9042 Speicher
Switzerland
Mr. Francois Cosandey
+41 71 343 8377
Francois.cosandey@reglomat.com**

TESTED TO RADIO STANDARDS SPECIFICATION NO. : **RSS210 Issue 6**

OPEN AREA TEST SITE INDUSTRY CANADA NUMBER: **3463**

FREQUENCY RANGE (or fixed frequency): **24.125 GHz**

FIELD STRENGTH: **275 mV/m @ 3m**

OCCUPIED BANDWIDTH (99% BW): **149 kHz (CW carrier)
depending on RBW, here 3 kHz**

TYPE OF MODULATION: **CW**

EMISSION DESIGNATOR (TRC-43): **149KN0N**

TRANSMITTER SPURIOUS (worst case): **7.5 mV/m @ 3m (1. Harmonics)**

RECEIVER SPURIOUS (worst case): **not applicable**

ANTENNA TYPE: **horn antenna**

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: 2006-11-10

Manfred Paschwitz



2 Technical test

2.1 Summary of test results

- ☒ 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:

- ☒ 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

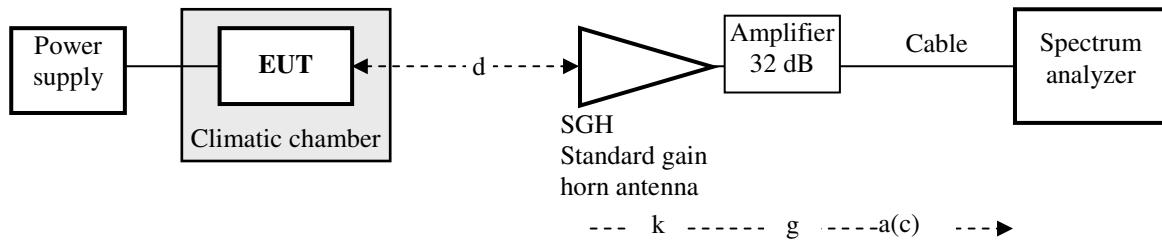
The environmental conditions are documented especially for each test.

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 in the frequency range 0.9 GHz to 33 GHz



Frequency f [GHz]	Distance d [m]	Antenna factor k [dB(1/m)]	Amp. gain g [dB]	Cable loss a(c) [dB]
0.9 to 2.0	3.0	23.45	32.0	0.5 ... 0.7
2.0 to 4.0	3.0	23.68	32.0	0.7 ... 0.8
4.0 to 6.0	3.0	27.31	32.0	0.8 ... 1.2
6.0 to 8.0	3.0	30.06	32.0	1.2 ... 1.6
8.0 to 12.0	3.0	33.70	32.0	1.6 ... 2.0
12.0 to 18.0	3.0	33.97	32.0	2.0 ... 2.7
18.0 to 26.5	3.0	36.73	32.0	2.7 ... 3.0
26.5 to 33.0	3.0	40.29	32.0 to 28.0	3.0 ... 3.2

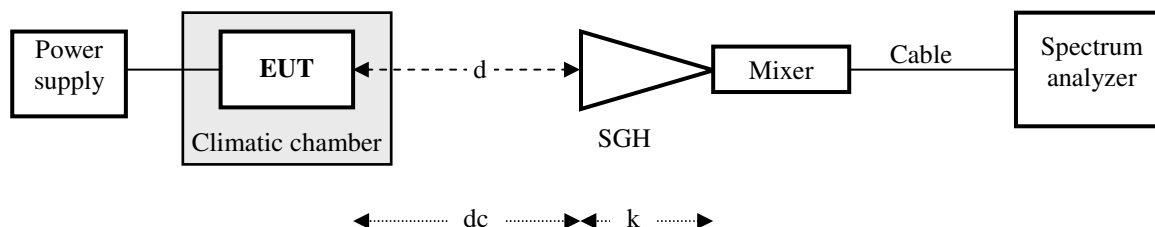
Calculation: Field strength = analyser reading + cable loss - amplifier gain + antenna factor
 $e \text{ [dB(}\mu\text{V/m)]} = u \text{ [dB(}\mu\text{V)]} + a \text{ [dB]} - g \text{ [dB]} + k \text{ [dB(1/m)]}$

Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300000916
SGH 1.0 to 2.0 GHz	flann	0624-10	300000225
SGH 2.0 to 4.0 GHz	narda	644	300000769
SGH 4.0 to 6.0 GHz	narda	643	300002447
SGH 6.0 to 8.0 GHz	narda	642	300000767
SGH 8.0 to 12.5 GHz	narda	640	300000784
SGH 12.0 to 18.0 GHz	narda	639	300000787
SGH 18.0 to 26.5 GHz	flann	2024-20	300001968
SGH 26.5 to 40.0 GHz	flann	2224-20	300001973
Amplifier 0.1 to 26.5 GHz	HP	HP 83017A	300002267
Climatic chamber	Vötsch	VUK 04/500	300000297
DC Power supply	HP	HP 6038A	300001174
RF-cable	Insulated Wire Inc.	KPS-1533-590	300002290

Measurement uncertainty

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

2.4.2 Field strength and spurious radiation in the frequency range 33 GHz to 110 GHz



Frequency range [GHz]	Distance d [m]	Distance correction dc (3 m/X m) [dB]	Antenna factor k [dB 1/m]
33.0 50.0	0.250	-21.60	39.00
50.0 75.0	0.125	-27.60	40.70
75.0 ... 110.0	0.125	-27.60	45.10

Calculation: Field strength = analyser reading + antenna factor - distance correction
 $e \text{ [dB}(\mu\text{V/m)}] = u \text{ [dB}(\mu\text{V)}] + k \text{ [dB(1/m)}] - d \text{ [dB]}$

Remark: Cable loss is automatically taken into account if the S.A. is operating with external mixers.

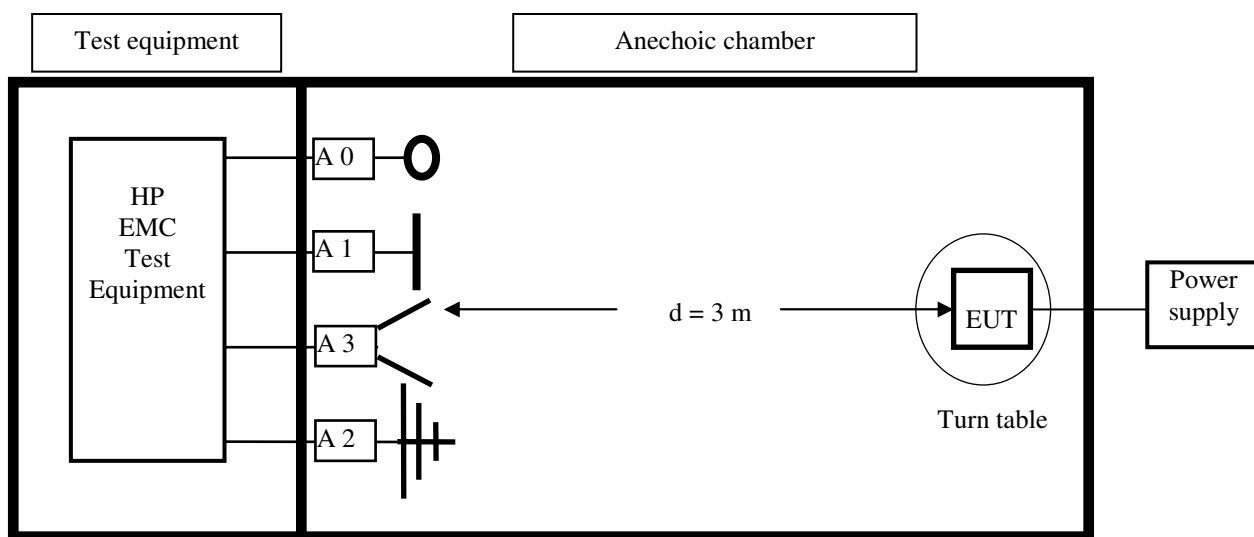
Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300000916
Power supply	HP	HP 6038A	300001174
SGH 33 ... 50 GHz	Thomson	COR 33_50	300000812
Mixer 33 ... 50 GHz	HP	11970Q	300000781j
SGH 50 ... 75 GHz	Thomson	COR 50_75	300000789k
Mixer 50 ... 75 GHz	HP	11970V	300000871o
SGH 75 ... 110 GHz	Thomson	COR 75_110	300000789m
Mixer 75 ... 110 GHz	HP	11970W	300000871v

Measurement uncertainty

Test parameter	Measurement uncertainty
Power supply	±0.1 VDC
Temperature	±0.2 °C
Frequency	±0.01 ppm
Field strength <50 GHz	±1.0 dB
Field strength >50 GHz	±3.0 dB

2.4.3 Field strength 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
DC Power supply	HP	HP 6038A	300001174
RF-cable	HP	5061-5359	P36303

Measurement uncertainty

Test parameter	Measurement uncertainty
Power supply	$\pm 0.5 \text{ V}$
Temperature	$\pm 0.2 \text{ }^{\circ}\text{C}$
Frequency	$\pm 0.01 \text{ ppm}$
RF-power	$\pm 1.5 \text{ dB}$
Field strength >50 GHz	$\pm 3.0 \text{ dB}$

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 is positioned in a non-conductive test fixture and can be rotated and tilted in all angles and in all planes.

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 110 GHz in semi-anechoic chambers. 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 conform with specifications ANSI C63.2-1987 clause 15 and ANSI C63.4-1992 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 analysers where the detector modes and resolution bandwidths (RBW) over various frequency ranges are set according to requirement ANSI C63.4-1992 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 960 MHz. Where possible, the measurement distance shall be 3 m. If other distances are used, the distance correction is added to the test result.

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 960 MHz to 4 GHz are carried out in a shielded semi-anechoic test chamber. The measurement distance is 3.0 m.

In the frequency range 4 GHz to 40 GHz, spurious EIRP measurements are performed in a shielded fully anechoic chamber with rectangular SGHs. The measurement distances are indicated underneath each plot, and a calculation for field strength is added, where all relevant factors like cable losses, antenna factors, etc are taken into account.

2.5.3 Test results in details

Equipment under test (EUT): see page 5
 Ambient temperature: 21 °C
 Relative humidity: 45 %

TRANSMITTER PARAMETERS
 Fundamental frequency and harmonics

SECTION 15.245

Microwave module: Mars DR / 31 operating in N0N

Test condition t = 21 °C	TRANSMITTER FIELD STRENGTH			
EUT operating: TX / RX on DC power supply	Frequency f [GHz]	S.A. e [dBμV] @ 0.3 m	Field strength e [dBμV/m] @ 3 m	See plot no.:
U = 24.0 VDC (CW-mode)	24.124	88.8	108.8	1
	48.246	57.5	77.5	2
	72.366	56.3	76.3	3
	96.25	noise	noise	4

Note:

The values are recalculated from a test distance of 0.3 m to 3 m with 20 dB/decade according to the FCC requirements.

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

LIMITS: SECTION 15.245

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBμV/m] @ 3 m	Field strength E [mV/m]
24,075 to 24,175	3	128.0	2,500
Harmonics	3	88.0	25

Verdict: Field strength limits are kept

Equipment under test (EUT): see page 5
 Ambient temperature: 21 °C
 Relative humidity: 45 %

TRANSMITTER PARAMETERS
 Spurious Frequencies

SECTION 15.245
 SECTION 15.209

Microwave module: Mars DR / 31 operating in N0N

Test condition t = 21 °C	TRANSMITTER SPURIOUS FIELD STRENGTH			
Frequency range [GHz]	Spurious frequencies [GHz]	SA u [dBμ V/m]	E [μ V/m]	See plot no.:
0.009 to 30.0 MHz (h + v) horizontal and vertical plane	noise	n.a.	< limit	5
0.030 to 4.0 (h + v)	noise	n.a.	< limit	6
4.0 to 12.0 (h + v)	noise	n.a.	< limit	7
12.0 to 24.0 (h + v)	noise	n.a.	< limit	8
> 24.0	fundamental and harmonics		< limit	1 - 4
25.0 to 50.0 (h + v)	noise	n.a.	< limit	9
50.0 to 75.0 (h + v)	noise	n.a.	< limit	10
75.0 to 110.0 (h + v)	noise	n.a.	< limit	11

Note:

9 kHz to 150 kHz : 200 Hz ResBw/VideoBw
 150 kHz to 30 MHz : 9 kHz ResBw/VideoBw
 30 MHz to 1 GHz : 100 kHz ResBw/VideoBw
 above 1 GHz : 1 MHz ResBw/VideoBw

LIMITS:

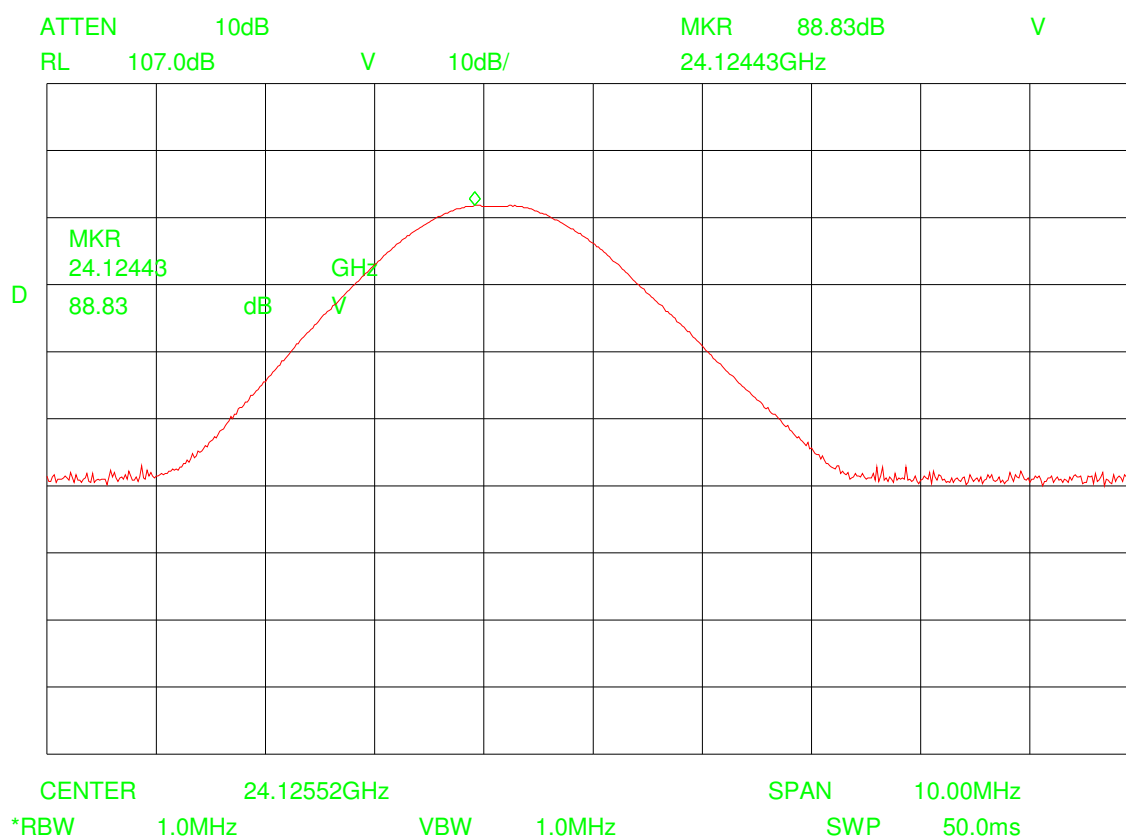
SECTION 15.209 / 15.245

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBμ V/m] @ 3 m	Field strength E [μ V/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
> 960.0	3	54.0 (AV)	500
> 960.0	3	74.0 (PK)	5,000
2nr/rd harmonic	3	88.0	25,000

Verdict: Field strength limits are kept.

3 Measurement results

Plot no. 1:



Note:

The values are recalculated from a test distance of 0.3 m to 3 m with 20 dB/decade according to the FCC requirements.

$P_{\text{Analyser}} = -88.8 \text{ dB}\mu\text{V}$ (The 20 dB/decade according is not calculated in the analyser reading)

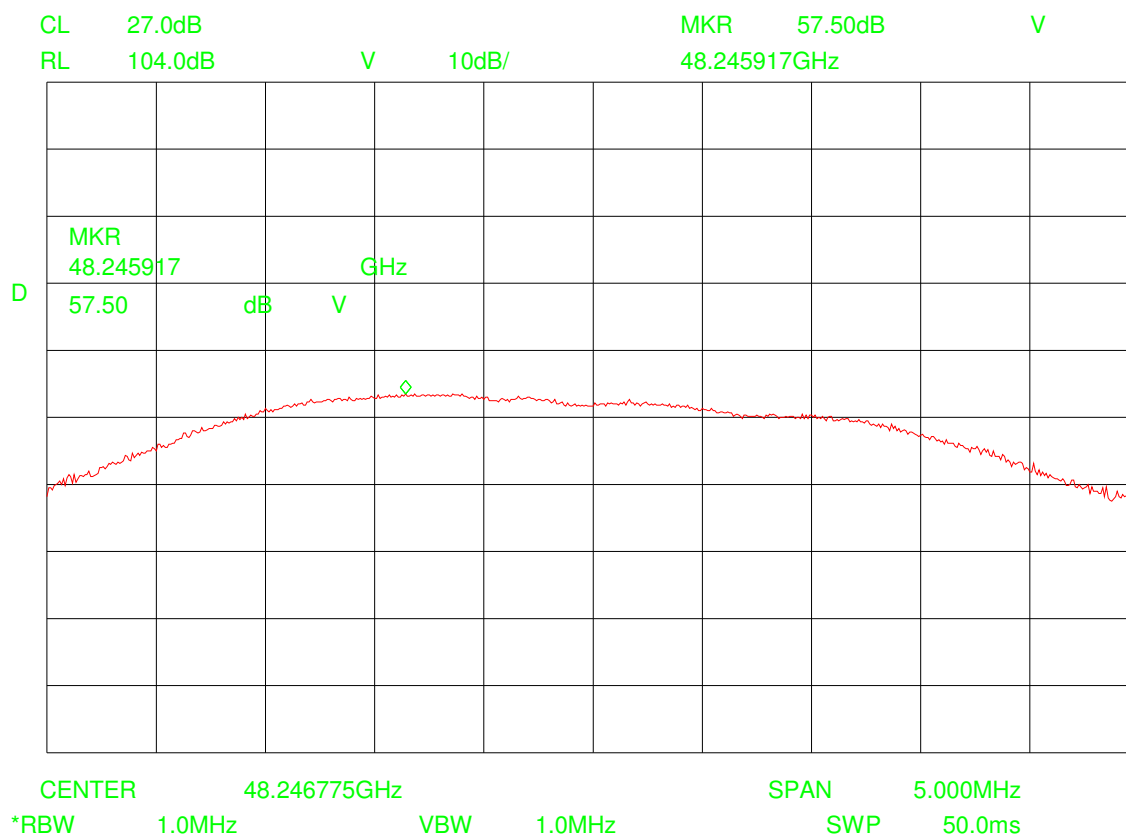
$P_{\text{Spurious Emission}} = -108.8 \text{ dB}\mu\text{V}$

LIMITS:

SECTION 15.209 / 15.245

Frequency range (MHz)	Measurement distance [m]	Field strength e [dB μ V/m] @ 3 m	Field strength E [μ V/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
> 960.0	3	54.0 (AV)	500
> 960.0	3	74.0 (PK)	5,000
2nr/rd harmonic	3	88.0	25,000

Plot no. 2:



Note:

The values are recalculated from a test distance of 0.3 m to 3 m with 20 dB/decade according to the FCC requirements.

$P_{\text{Analyser}} = -57.5 \text{ dB}\mu\text{V}$ (The 20 dB/decade according is not calculated in the analyser reading)

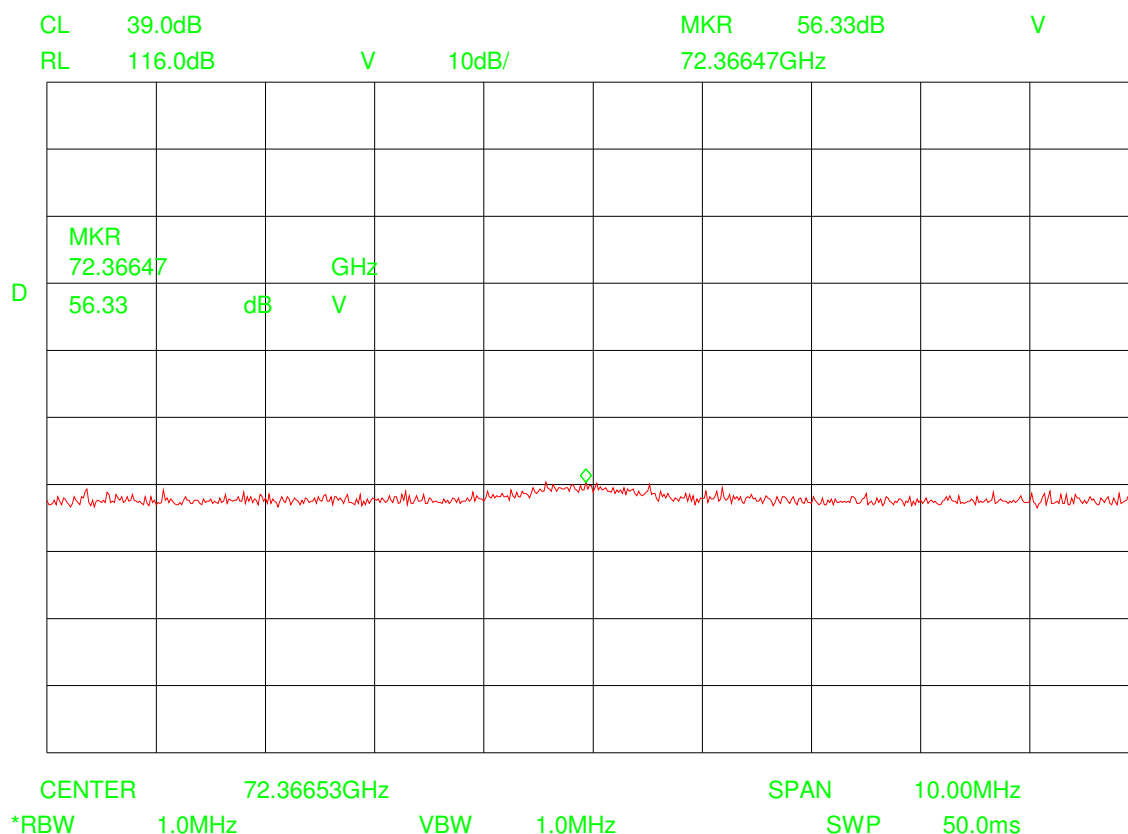
$P_{\text{Spurious Emission}} = -77.5 \text{ dB}\mu\text{V}$

LIMITS:

SECTION 15.209 / 15.245

Frequency range (MHz)	Measurement distance [m]	Field strength e [dB μ V/m] @ 3 m	Field strength E [μ V/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
> 960.0	3	54.0 (AV)	500
> 960.0	3	74.0 (PK)	5,000
2nr/rd harmonic	3	88.0	25,000

Plot no. 3:



Note:

The values are recalculated from a test distance of 0.3 m to 3 m with 20 dB/decade according to the FCC requirements.

 $P_{\text{Analyser}} = -56.3 \text{ dB}\mu\text{V}$ (The 20 dB/decade according is not calculated in the analyser reading)

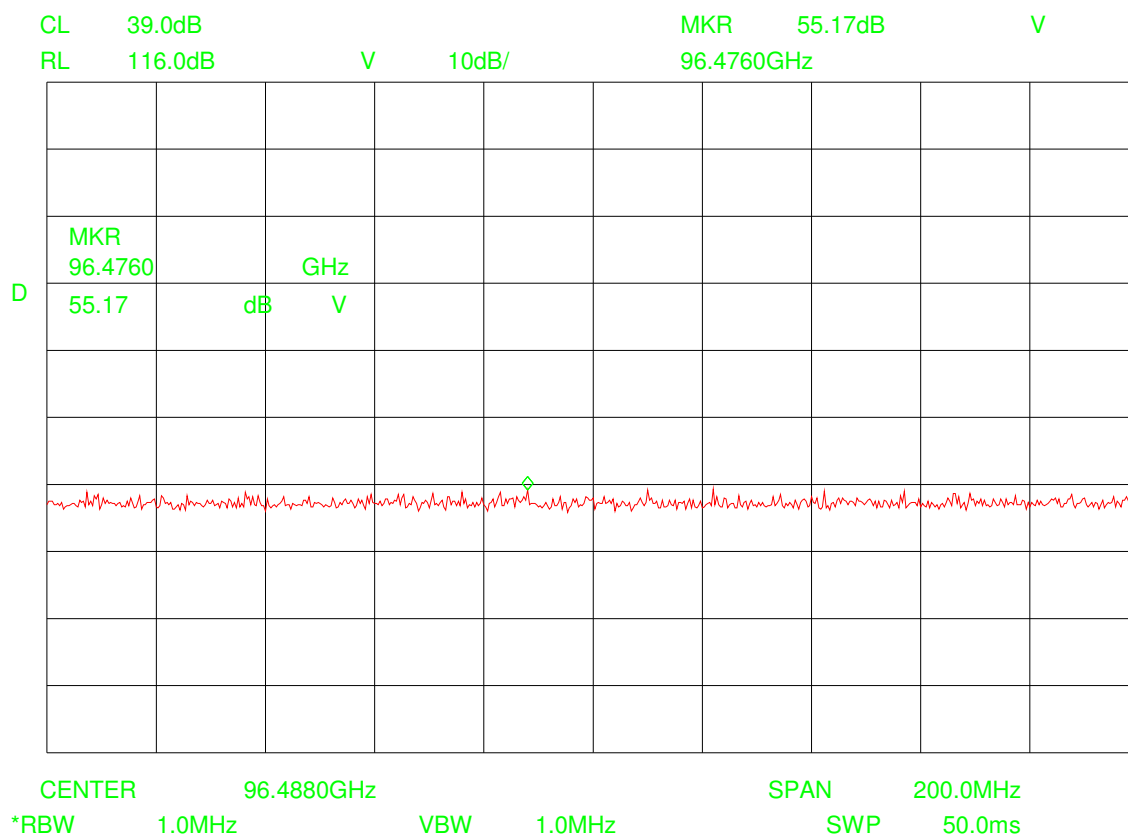
 $P_{\text{Spurious Emission}} = -76.3 \text{ dB}\mu\text{V}$

LIMITS:

SECTION 15.209 / 15.245

Frequency range (MHz)	Measurement distance [m]	Field strength e [dB μ V/m] @ 3 m	Field strength E [μ V/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
> 960.0	3	54.0 (AV)	500
> 960.0	3	74.0 (PK)	5,000
2nr/rd harmonic	3	88.0	25,000

Plot no. 4:

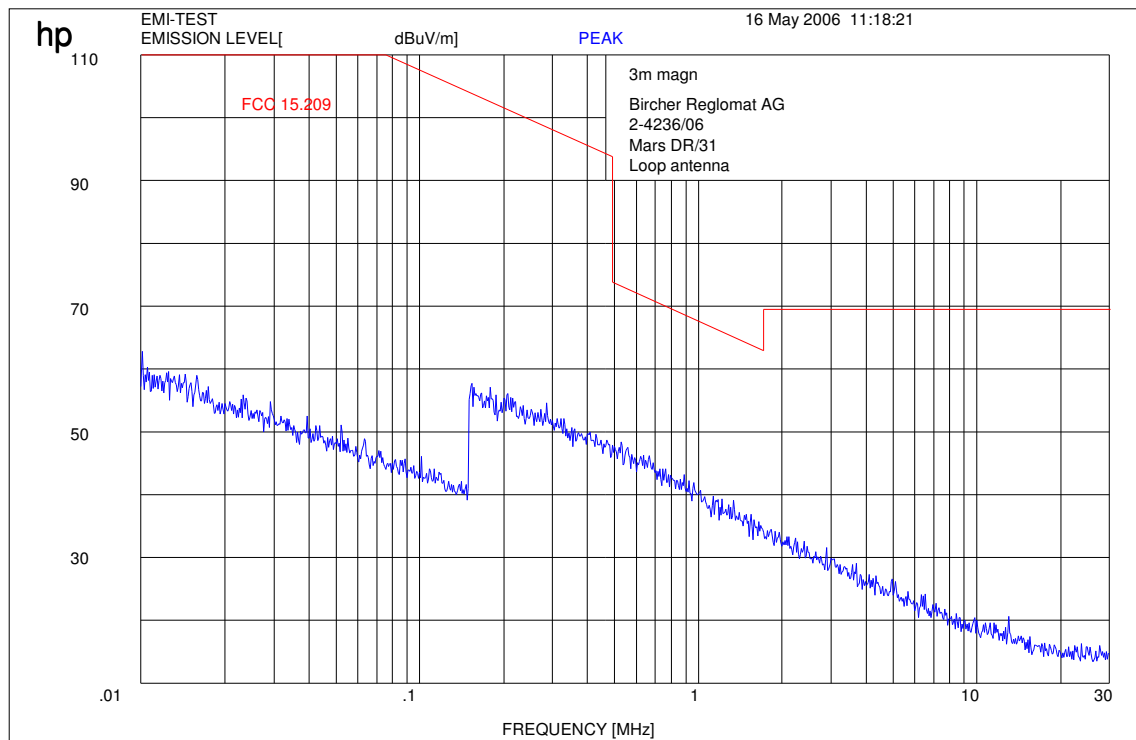


LIMITS:

SECTION 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
> 960.0	3	54.0 (AV)	500
> 960.0	3	74.0 (PK)	5,000
2nr/rd harmonic	3	88.0	25,000

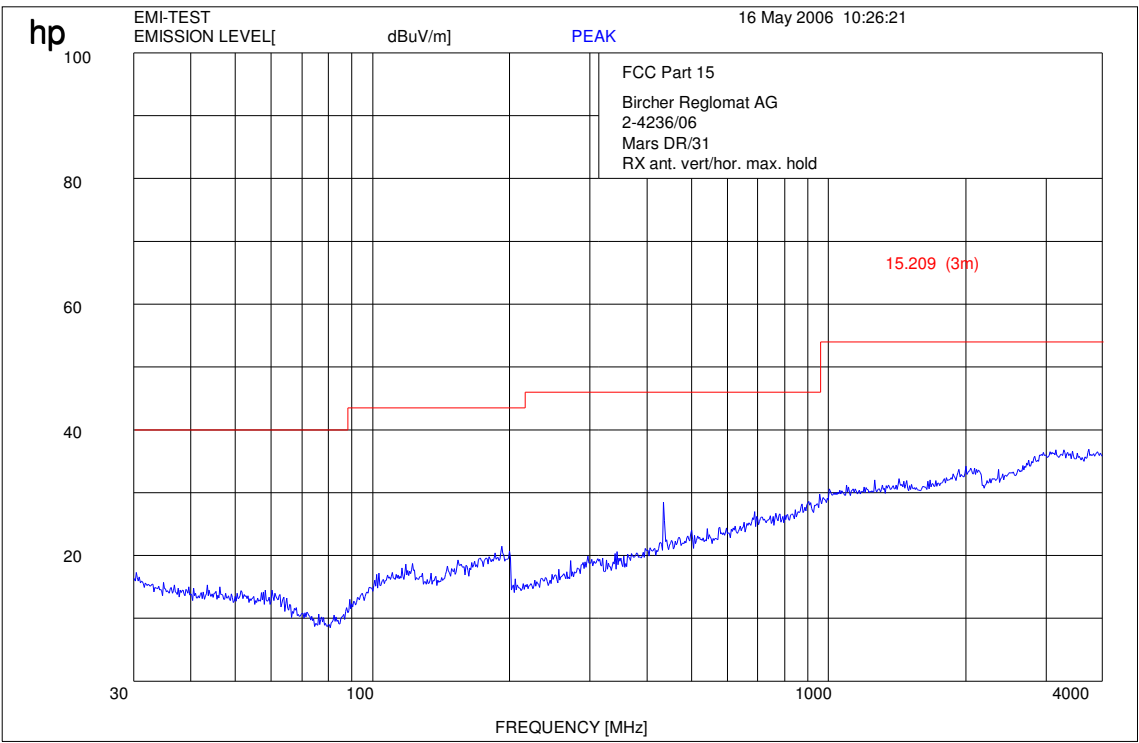
Plot no. 5:



Note:

The limit lines were recalculated from a test distance of 300 m/30 m to 3 m with 40 dB/decade according to the FCC requirements.

Plot no. 6:



EMI-TEST
EMISSION LEVEL[

hp

dBuV/m]

PEAK

16 May 2006 10:24:47

FCC Part 15
Bircher Reglomat AG
2-4236/06
Mars DR/31
RX ant. vert/hor. max. hold

FCC Part 15.209

100

80

60

40

20

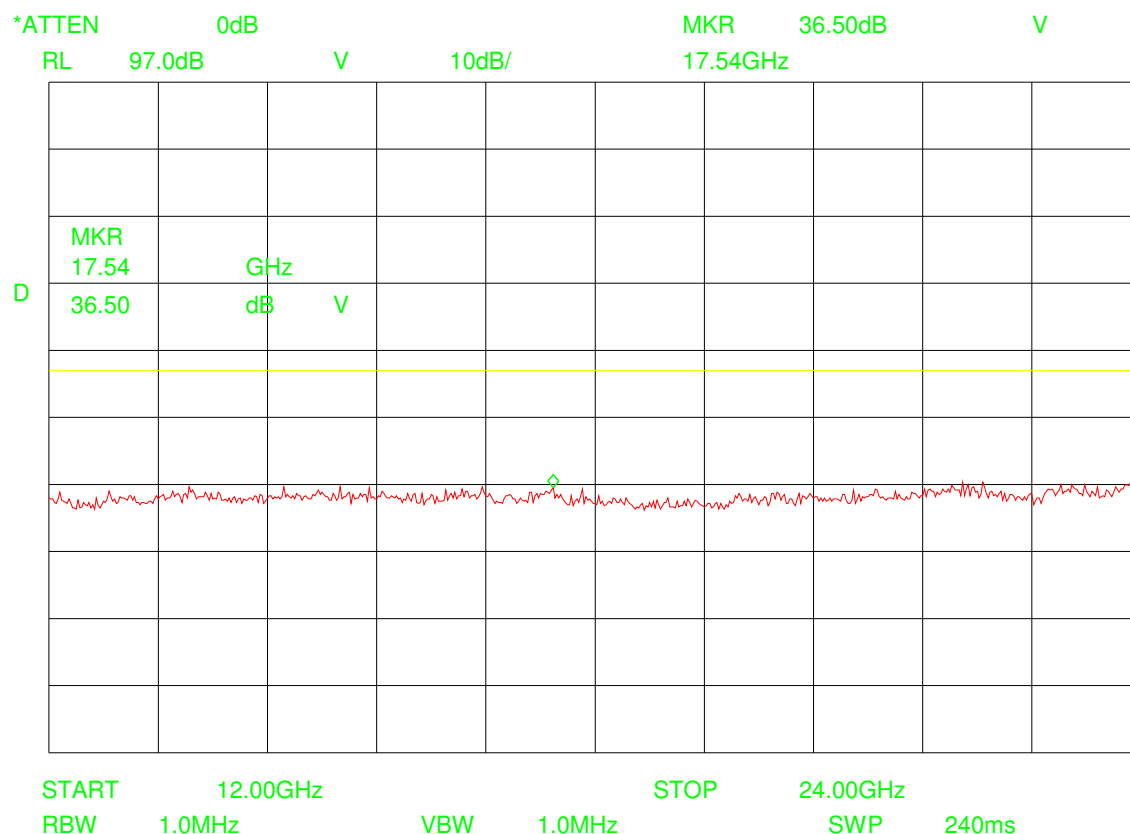
3990

10000

12000

FREQUENCY [MHz]

Plot no. 8:

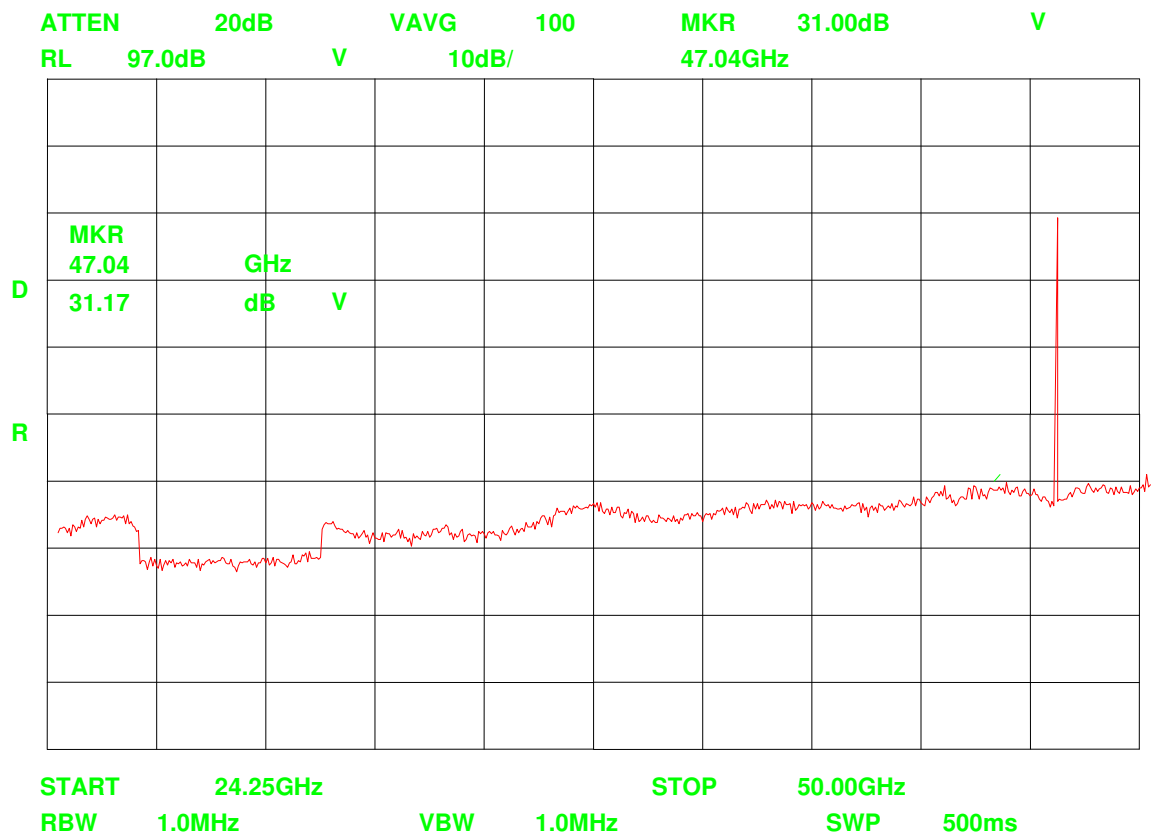


LIMITS:

SECTION 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
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88.0 – 216.0	3	43.5	150
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> 960.0	3	54.0 (AV)	500
> 960.0	3	74.0 (PK)	5,000
2nr/rd harmonic	3	88.0	25,000

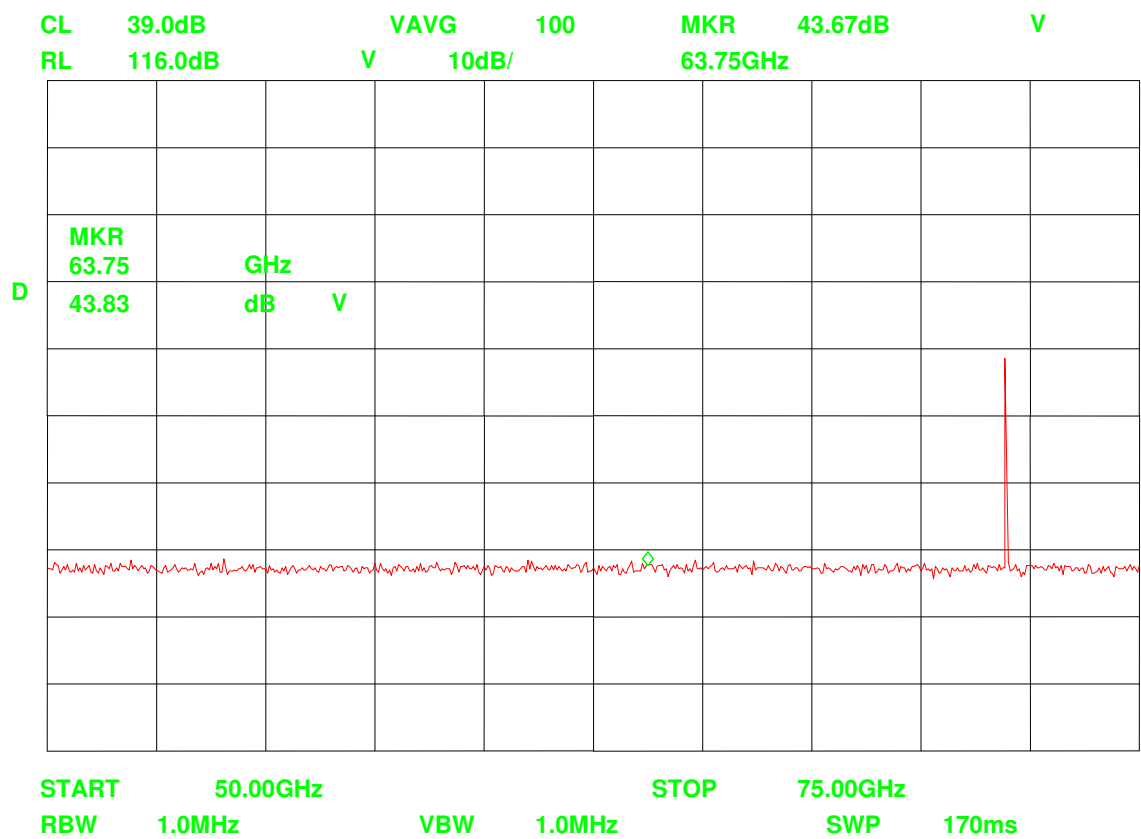
Plot no. 9: 25 to 50 GHz



Measured at 0.3 m

To recalculate to 3.0 m we add 20dB / decade according to FCC requirement.
The maximum value is 51.1 dBμV/m at 3m.

Plot no. 10: 50 to 75 GHz



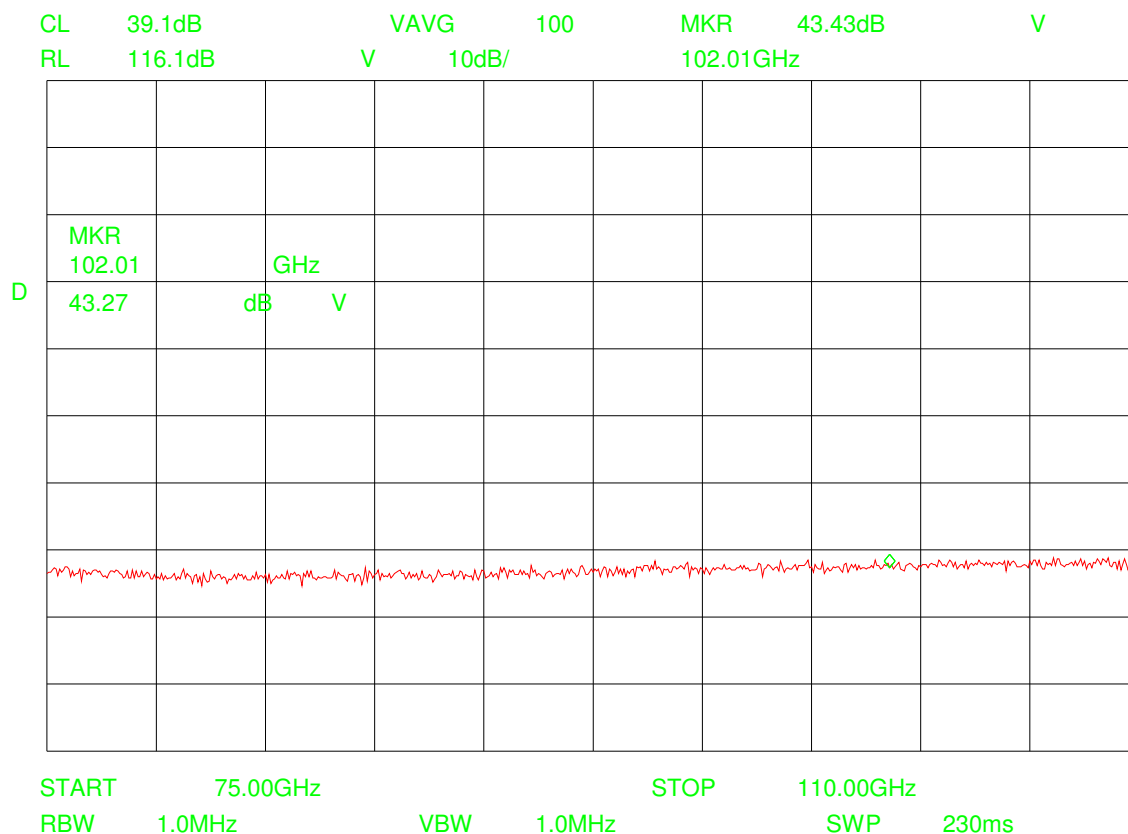
Tested with ext. Mixer

Measured at 0.3 m

Note:
The values are recalculated from a test distance of 0.3 m to 3 m with 20 dB/decade according to the FCC requirements.

$P_{\text{Analyser}} = 42.83 \text{ dB}\mu\text{V}$ (The 20 dB/decade according is calculated in the analyser reading)

Plot no. 11: 75 to 110 GHz



Tested with ext. Mixer

Measured at 0.3 m

Note:

The values are recalculated from a test distance of 0.3 m to 3 m with 20 dB/decade according to the FCC requirements.

$P_{\text{Analyser}} = 43.27 \text{ dB}\mu\text{V}$ (The 20 dB/decade according is calculated in the analyser reading)

4 Photographs

Photo no. 1



Photo no. 2



Photo no. 3

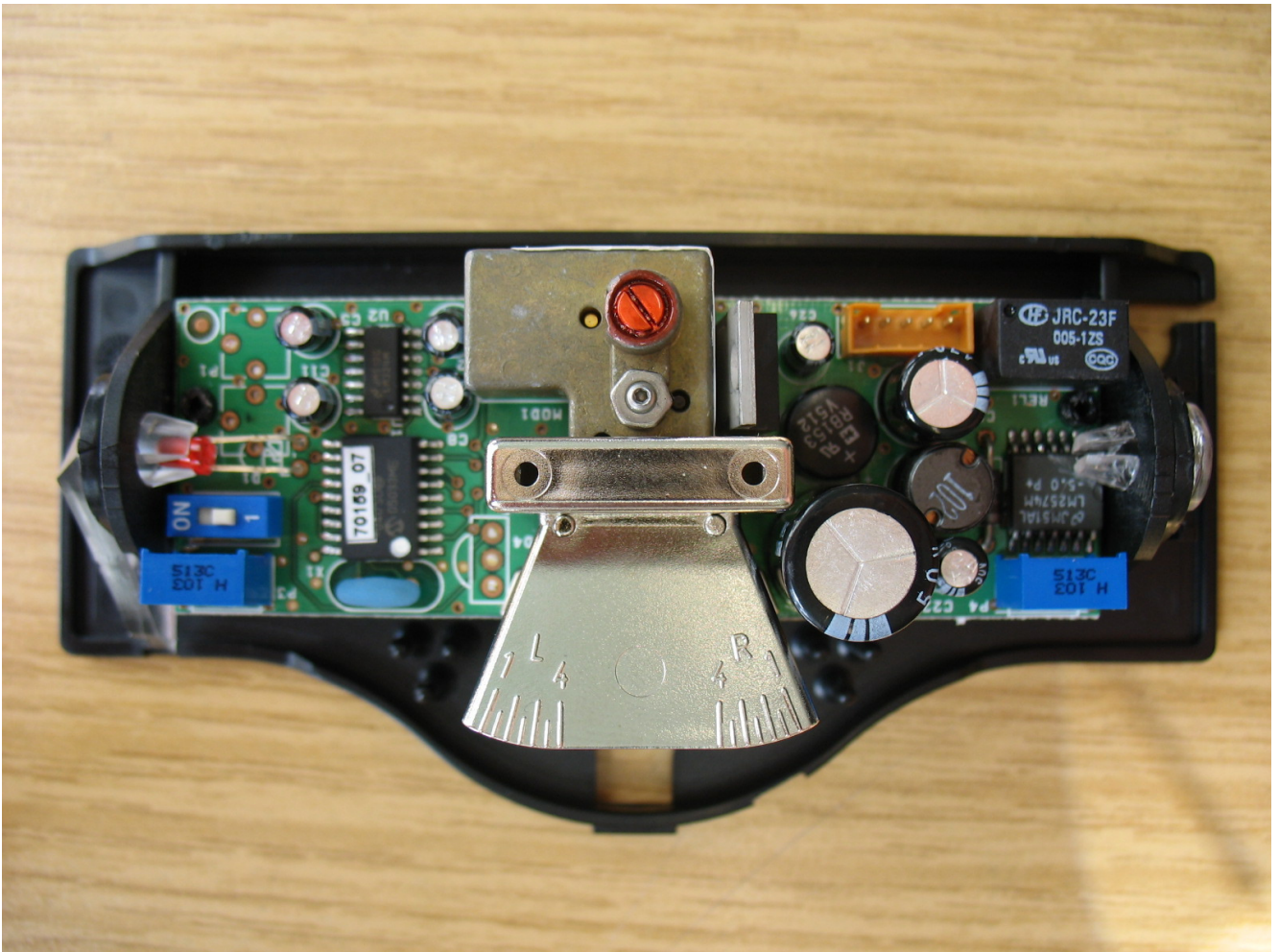


Photo no. 4

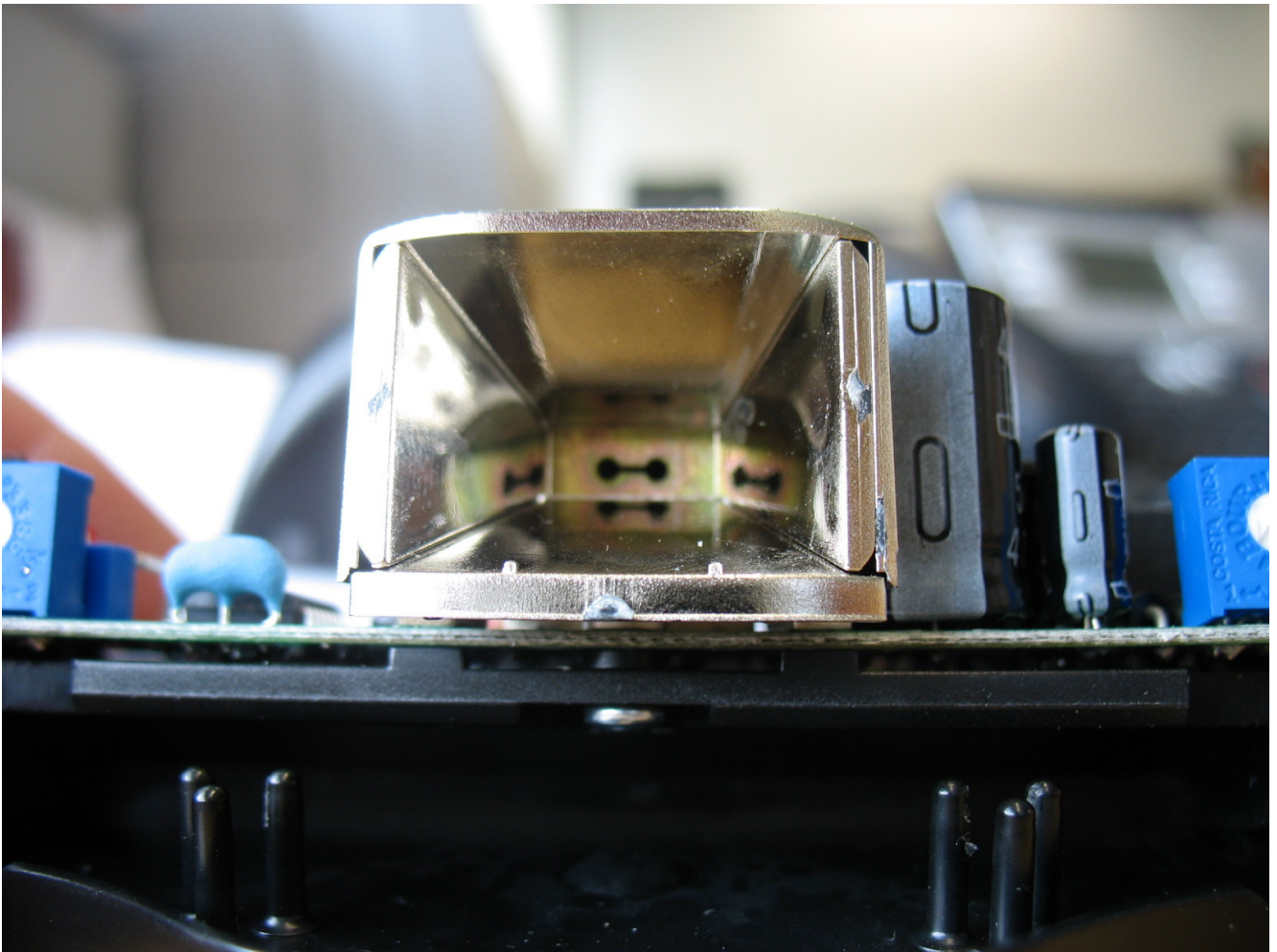


Photo no. 5

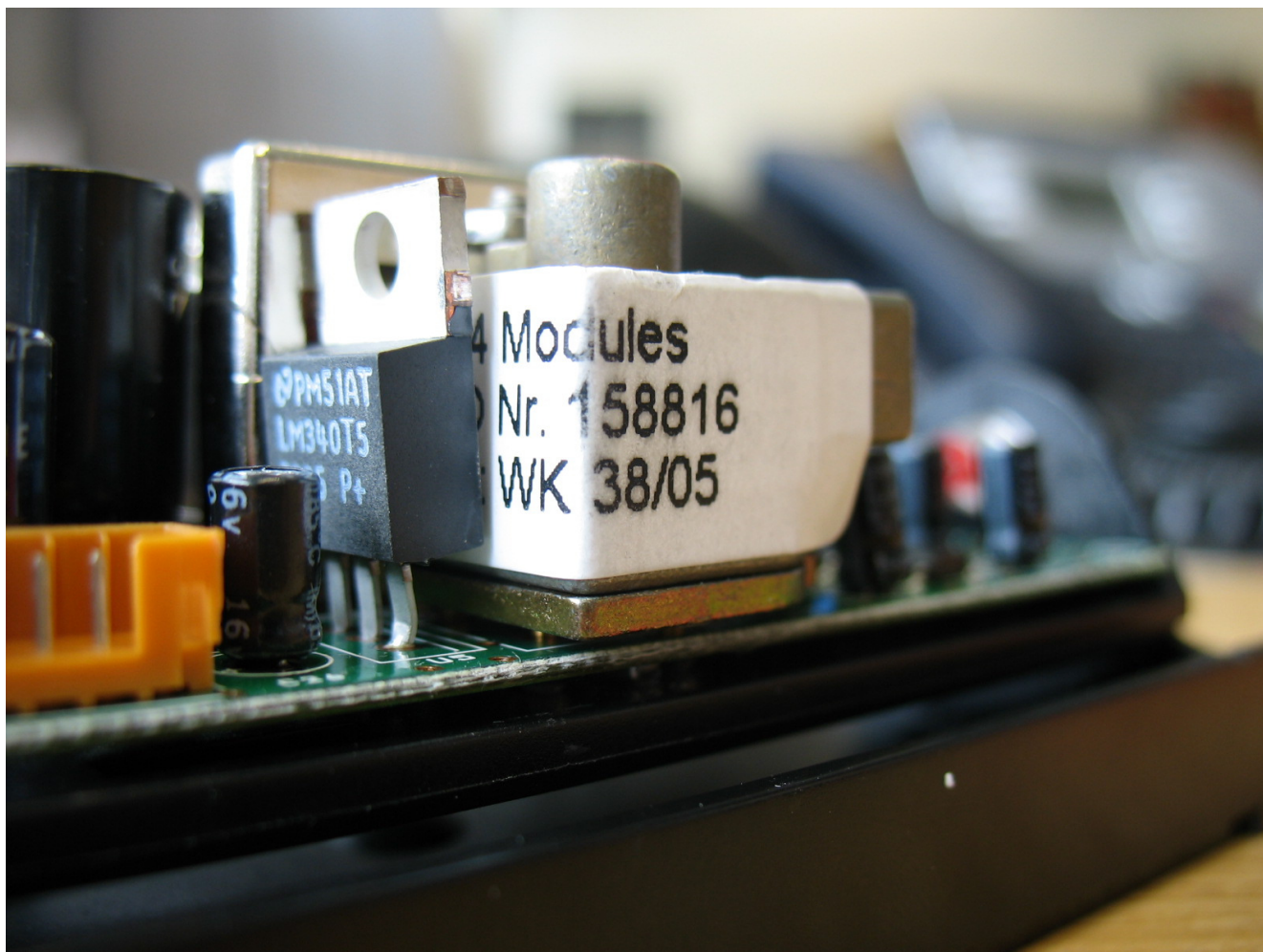


Photo no. 6



Photo no. 7

