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.: IC 3463A-1
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. 2-4478-02-02/06
Applicant: InnoSenT GmbH
Type: IPQ-05
Test standard: FCC Part 15.245
FCC ID: USX-IPQ05
IC: 6902A-IPQ05

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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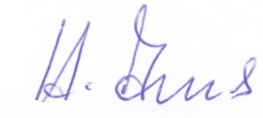
Tester :

Date	Name	Signature
2007-01-10	Manfred Paschwitz	

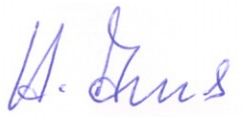
Technical responsibility for area of testing:

Date	Name	Signature
2007-01-10	Harro Ames	

Certification Number:	6902A-IPQ05
Model Number:	IPQ-05
Manufacturer:	InnoSenT GmbH Am Rödertor 30 97499 Donnersdorf Germany +49 (0) 9528 9518-0 +49 (0) 9528 9518-99
Tested to Radio Standards Specification (RSS) No.:	RSS-210 Issue 6
Open Area Test Site Industry Canada Number:	3463A-1
Frequency Range (or fixed frequency) [MHz]:	24075 – 24175 MHz (24122 MHz carrier)
RF: Field strength (max):	Rad. 104.5 dBµV/m@3m Conducted : not performed
Antenna Type:	Patch antenna
Occupied Bandwidth (99% BW) [kHz]:	1.0
Type of Modulation:	N0N
Emission Designator (TRC-43):	1K00N0N (single carrier)
Transmitter Spurious (worst case) [µV/m in 3m]:	< 500 µV/m @ 3m
Receiver Spurious (worst case) [µV/m in 3m]:	

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: 2007-01-10

Test engineer: Harro Ames

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
D-66004 Saarbrücken
Germany

Telephone : + 49 (0) 681 598–0
Fax : + 49 (0) 681 598–9075
e-mail : info@ict.cetecom.de
Internet : http://www.cetecom.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	IC 3463A-1

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

1.3 Details of applicant

Name : InnoSenT GmbH
Street : Am Rödertor 30
Town : 97499 Donnersdorf
Country : Germany
Phone : +49 (0) 9528 9518-0
Fax : +49 (0) 9528 9518-99

Contact person
Name : Stefan Bäuerlein
Phone : +49 (0) 9528 9518-71
Fax : +49 (0) 9528 9518-99
E–Mail : stefan.baeuerlein@innosent.de

1.4 Application details

Date of receipt of application : 2006-12-19
Date of receipt of test item : 2007-01-09
Date of test : 2007-01-09 and 2007-01-10
Person(s) who have been present during the test : Mr. Stefan Bäuerlein
Mr. Thilo Lenhard

1.5 Test item (EUT)

Description	:	Field disturbance sensor
Type designation	:	IPQ-05
Manufacturer		
Name	:	InnoSenT GmbH
Street	:	Am Rödertor 30
Town	:	97499 Donnersdorf
Country	:	Germany

1.6 Technical data

Frequency range	:	24.075 GHz to 24.175 GHz
Operational frequency	:	24.122 GHz
Field strength PEP	:	104.5 dBµV/m @ 3 m
Type of modulation	:	N0N
Antenna	:	Patch antenna (see photo)
Pulse periode	:	CW carrier
Microwave modules	:	TX / RX – Module with integral antenna (patch antenna)
Normal power supply (U nom)	:	5.0 V DC
Extreme DC power supply	:	5.25 V DC 4.75 V DC

1.6.1 Operation conditions

Operation	:	As soon as the equipment is powered up, TX and RX start operating

1.6.2 Equipment under test

IPQ-05

1.7 Test standards

	Code of Federal Regulations (CFR 47) Federal Communications Commission (FCC)
FCC Part 15	Radio Frequency Devices
	SECTION 15.245 Operation within the band 24.075 GHz to 24.175 GHz
	SECTION 15.205 Restricted bands of operation.
	SECTION 15.209 Radiation emission limits, general requirements

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

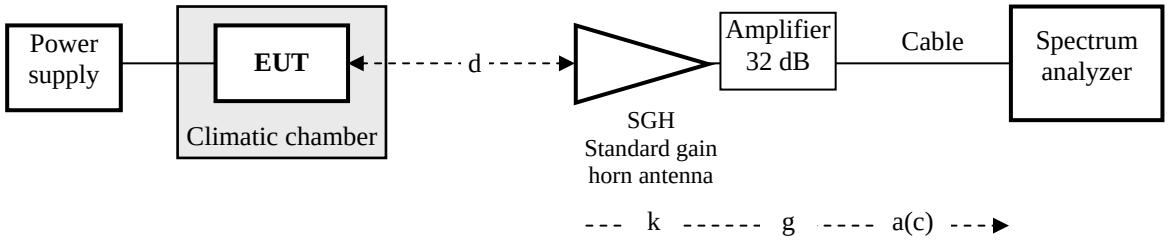
The measurement and test set-up is defined in the technical specification.

2.4 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

2.5 Test equipment utilized and test set-up

2.5.1 Field strength measurement of fundamental and spurious radiation in the frequency range 0.9 GHz to 33 GHz



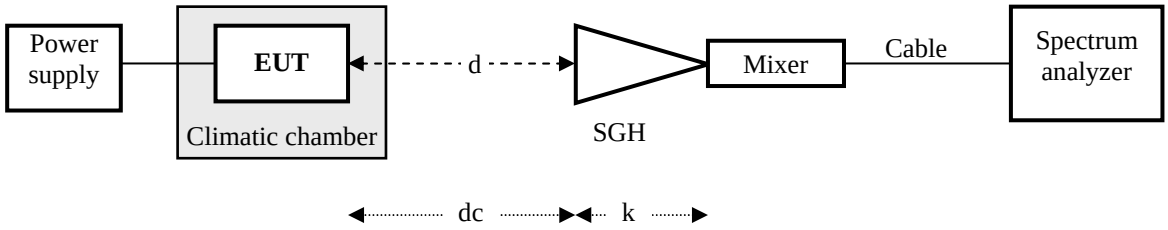
Frequency f [GHz]	Distance d [m]	Antenna factor k [dB(1/m)]	Amp.gain g [dB]	Cable loss a(c) [dB]
12.0 to 18.0	3.0	33.97	32.0	2.0 ... 2.7
18.0 to 26.5	3.0	36.73	32.0	2.7 ... 3.0
26.5 to 33.0	3.0	40.29	32.0 to 28.0	3.0 ... 3.2

Calculation :

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

Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyzer	HP	HP 8565E	300000916
SGH 12.0 to 18.0 GHz	narda	639	300000787
SGH 18.0 to 26.5 GHz	flann	2024-20	300001968
SHG 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

2.5.2 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/Xm) [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

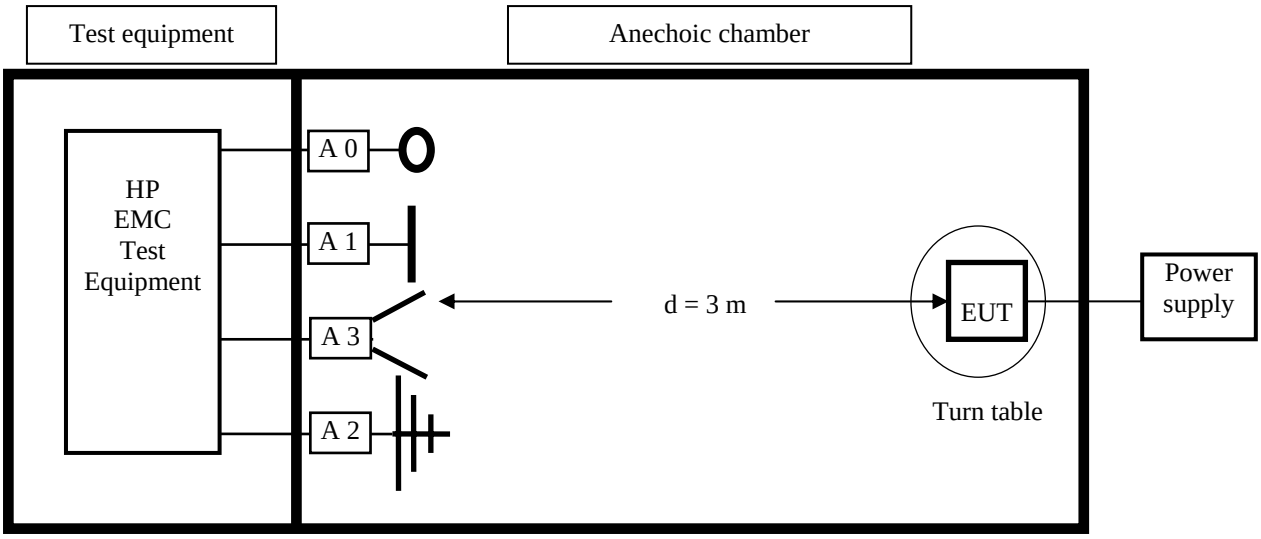
Calculation : Field strength = analyser reading + antenna factor - distance correction
e [dB(µV/m)] = u [dB(µV)] + k [dB(1/m)] - d [dB]

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

Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyzer	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

2.5.3 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 analyzer	HP	HP 85660B	2478A05306
Analyzer 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

2.6 Test results

2.6.1 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

2.6.2 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 and fully-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 are conform with specifications ANSI C63.2-1996 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 1000 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 1000 MHz to 4 GHz are carried out in a shielded 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.

2.6.3 Test results in details

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

TRANSMITTER PARAMETERS SECTION 15.245

Fundamental frequency

Microwave module : IPQ-05

Test condition t = 23.0 ° C	TRANSMITTER FIELD STRENGTH			
EUT operating: TX on and RX on DC power supply	Frequency f [GHz]	S.A. e [dBµV/m] @ 3 m	Field strength e [dBµV/m] @ 3 m	See plot no.:
U DC = 5.0	24.122	104.5 Included correction factor (see page 8)	104.5	1

REFERENCE OF TEST EQUIPMENT USED : see test set-up on page 9-11

LIMITS: SECTION 15.245

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

Verdict:	Fundamental frequency e.i.r.p. 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 15.205 / 15.209

Microwave module : IPQ-05

Test condition t = 23.0 ° C	TRANSMITTER SPURIOUS FIELD STRENGTH			
Frequency range [GHz]	Spurious frequencies [GHz]	S A u [dBµV/m]	E [µV/m]	See plot no.:
0.009 to 30.0 MHz (h + v) horizontal and vertical plane	noise	n.a.	< Limit	2
0.030 to 4.0 (h + v)	noise	37.2	< Limit	3
4.0 to 12.0 (h + v)	noise	38.5	< Limit	4
12.0 to 18.0 (h + v)	noise	37.6	< Limit	5
18.0 to 24.075 (h + v)	noise	40.0	< Limit	6
24.175 to 26.0 (h +v)	noise	41.5	< Limit	7
26.0 to 33.0 (h + v)	noise	39.6	< Limit	8
33.0 to 50.0 (h + v)	noise	39.6	< Limit	9
50.0 to 75.0 (h + v)	noise	43.1	< Limit	10
75.0 to 110.0 (h + v)	noise	44.4	< Limit	11

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
> 960.0	3	54.0 (AV)	500
> 960.0	3	74.0 (PK)	5,000
Harmonics	3	68.0	2,500
Harmonics >17,700	3	77.5	7,500

Verdict:	Field strength limits are kept

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

TRANSMITTER PARAMETERS

SECTION 15.245
SECTION 15.207 / 15.107

Microwave module : IPQ-05

Test measurement:

Frequency Range	Spurious frequency	SA u [dBmV]	E [µV/m]	See Plot No.:
150.0 kHz – 30.000 MHz	noise	< limit	< limit	12

LIMITS:

FCC SECTION 15.207 / 15.107
ICRSS 210, Issue 4 Section 6.6, 7.4
CISPR 22

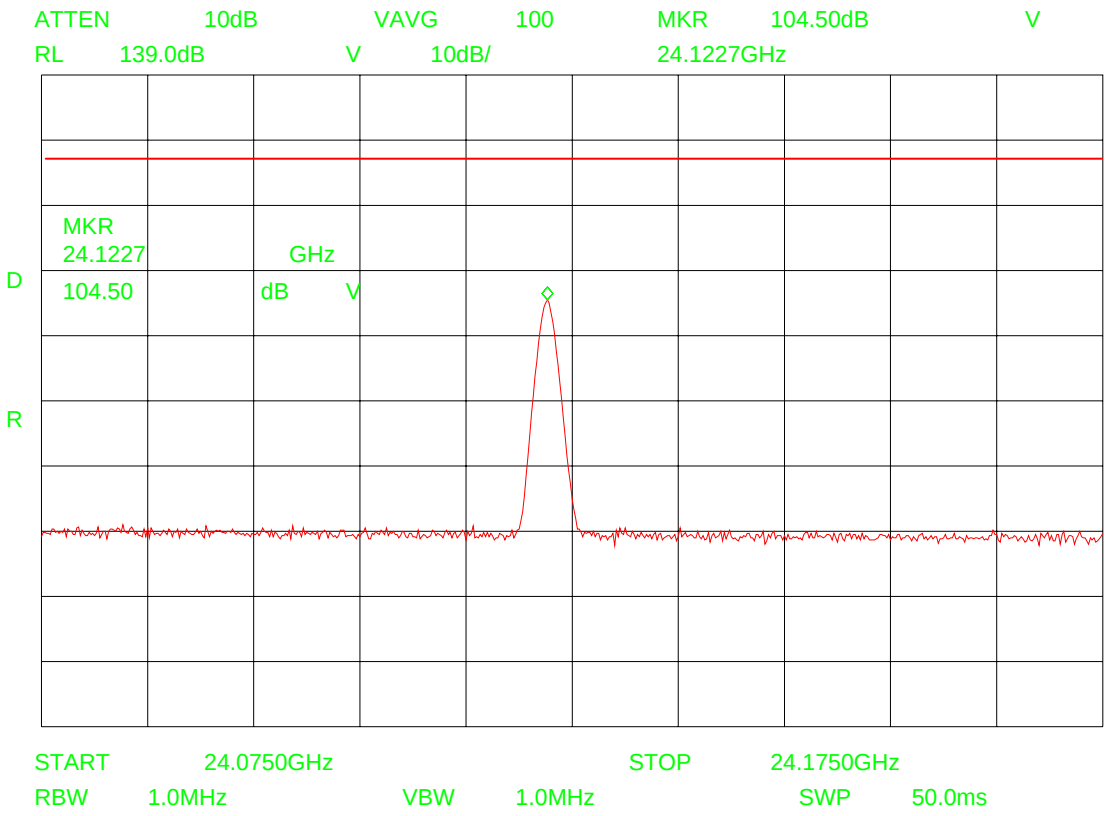
Frequenca of Emissions [MHz]	Conducted Limit [dBµV]	
	Qusi peak	Average
0.150 – 0.500	66 to 56 *	56 to 46 *
0.500 – 5.000	56	46
5.000 – 30.000	60	50

* Decreases with the logarithm of the frequency

Verdict:	AC conducted limits are kept

3 Plots, graphs and data sheets: Measurement result no. 1 (12)

Plot no.: 1



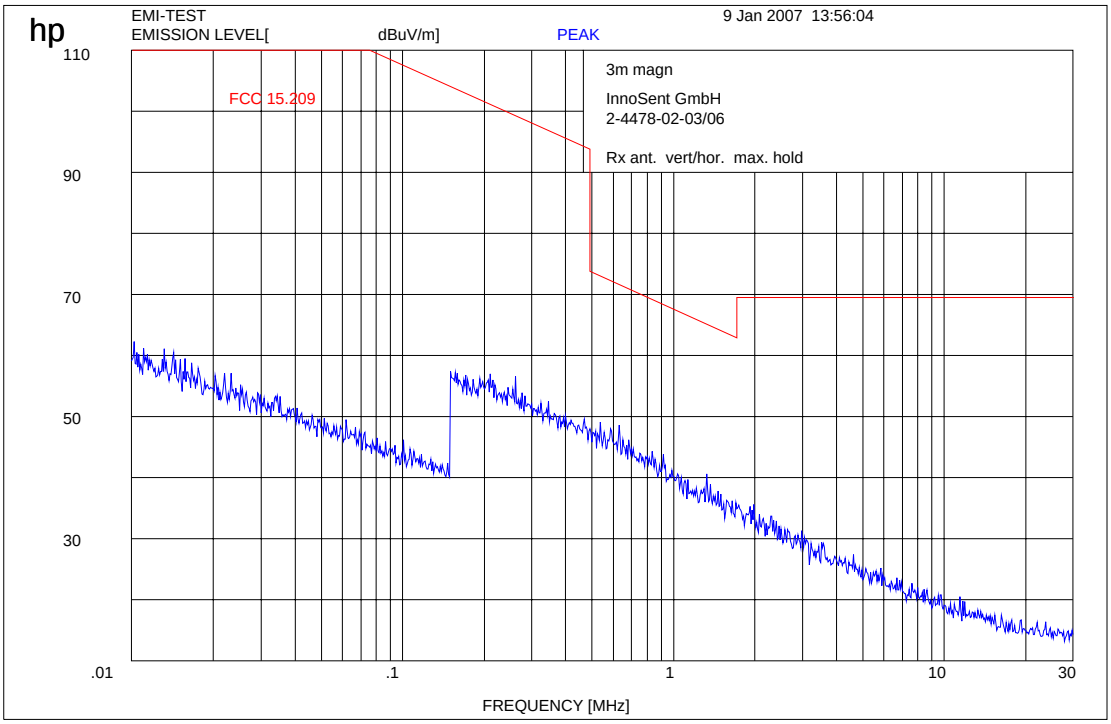
Calculation:

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

see page 9-11

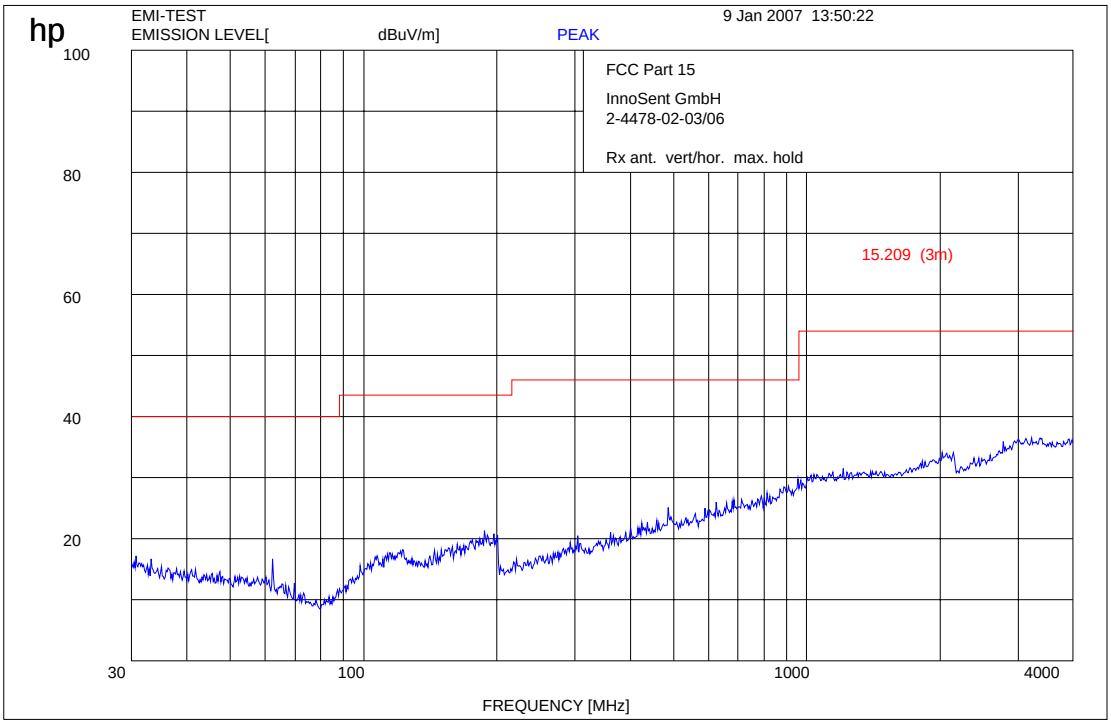
The offset (cable loss - amplifier gain + antenna factor) is calculated in the analyzer reading.

Plot no.: 2



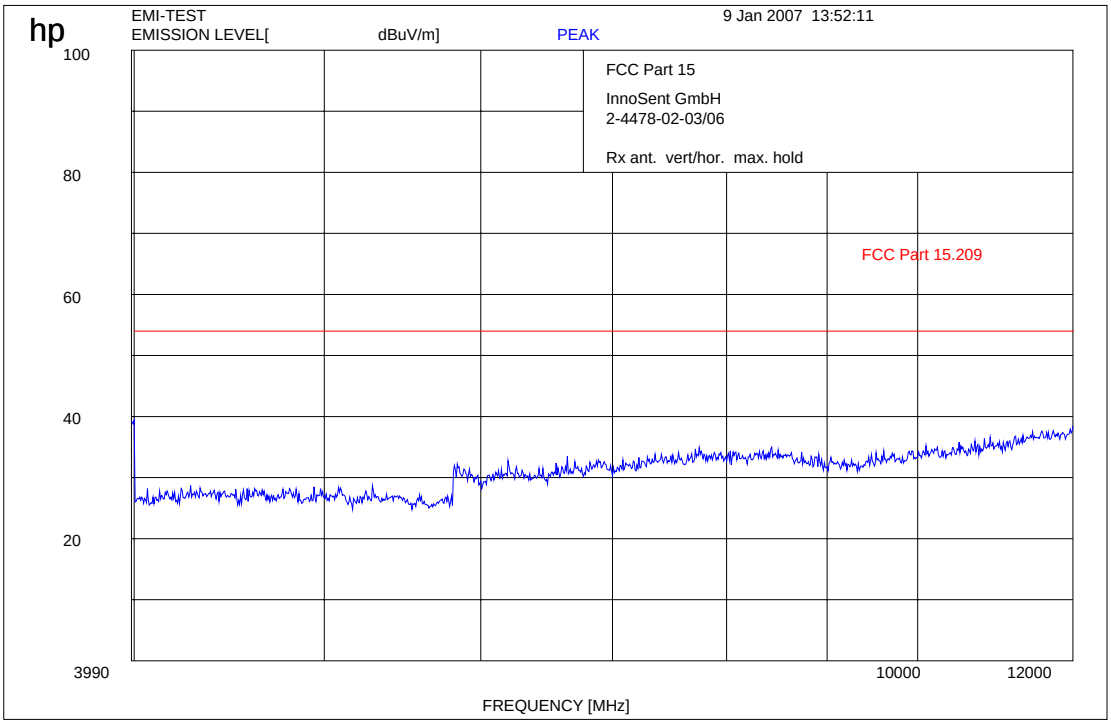
RBW / VBW: 200 Hz up to 150 kHz
9 kHz up to 30 MHz
120 kHz up to 1 GHz

Plot no.: 3



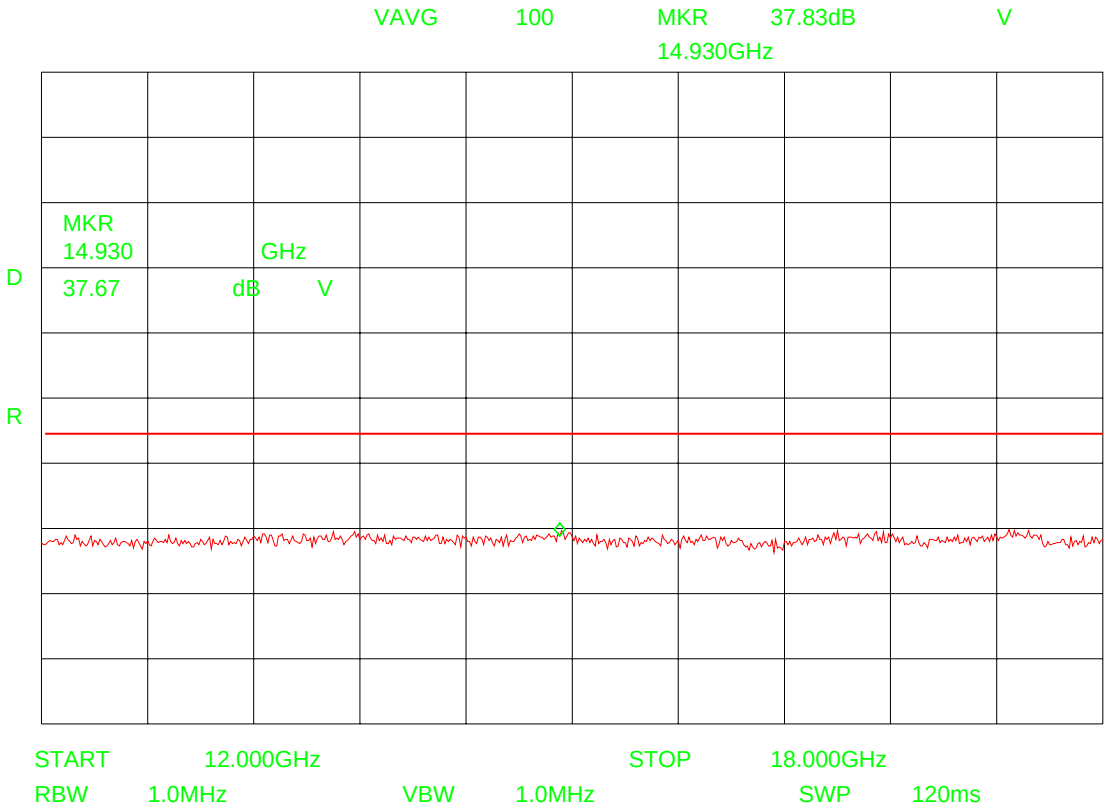
RBW / VBW: 120 kHz up to 1 GHz
1 MHz above 1 GHz

Plot no.: 4



RBW / VBW: 1 MHz above 1 GHz

Plot no.: 5



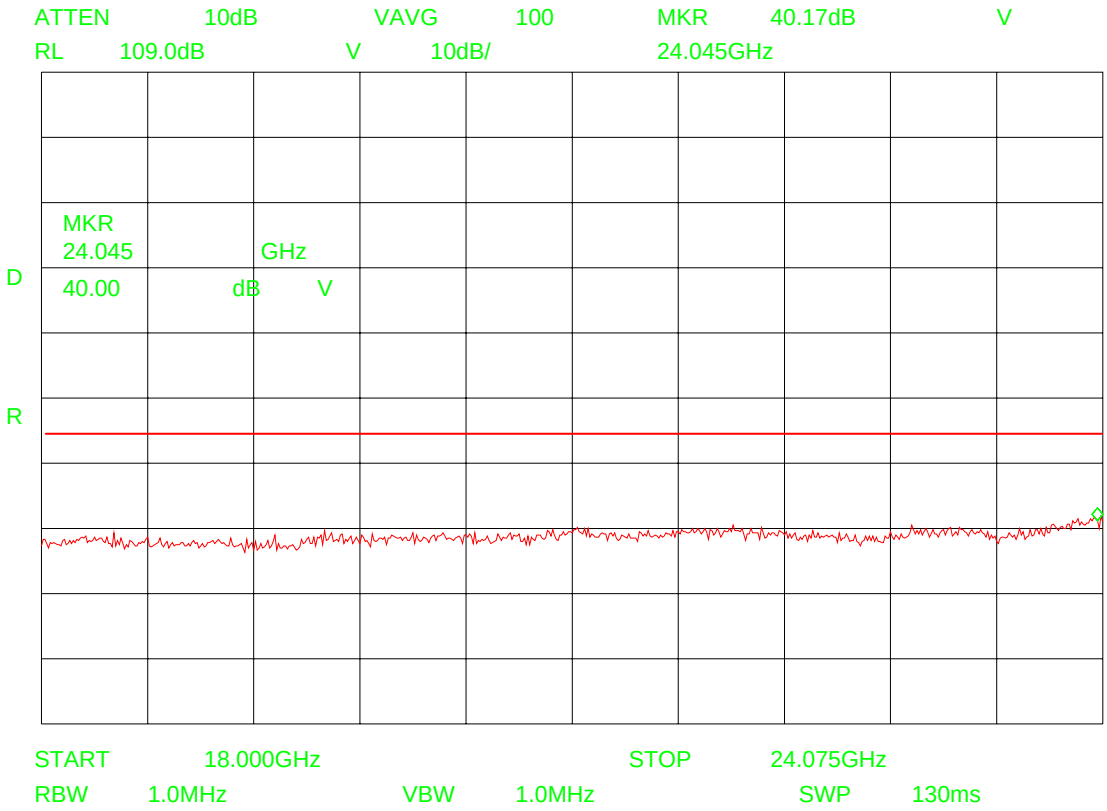
Calculation:

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

see page 9-11

The offset (cable loss - amplifier gain + antenna factor) is calculated in the analyzer reading.

Plot no.: 6



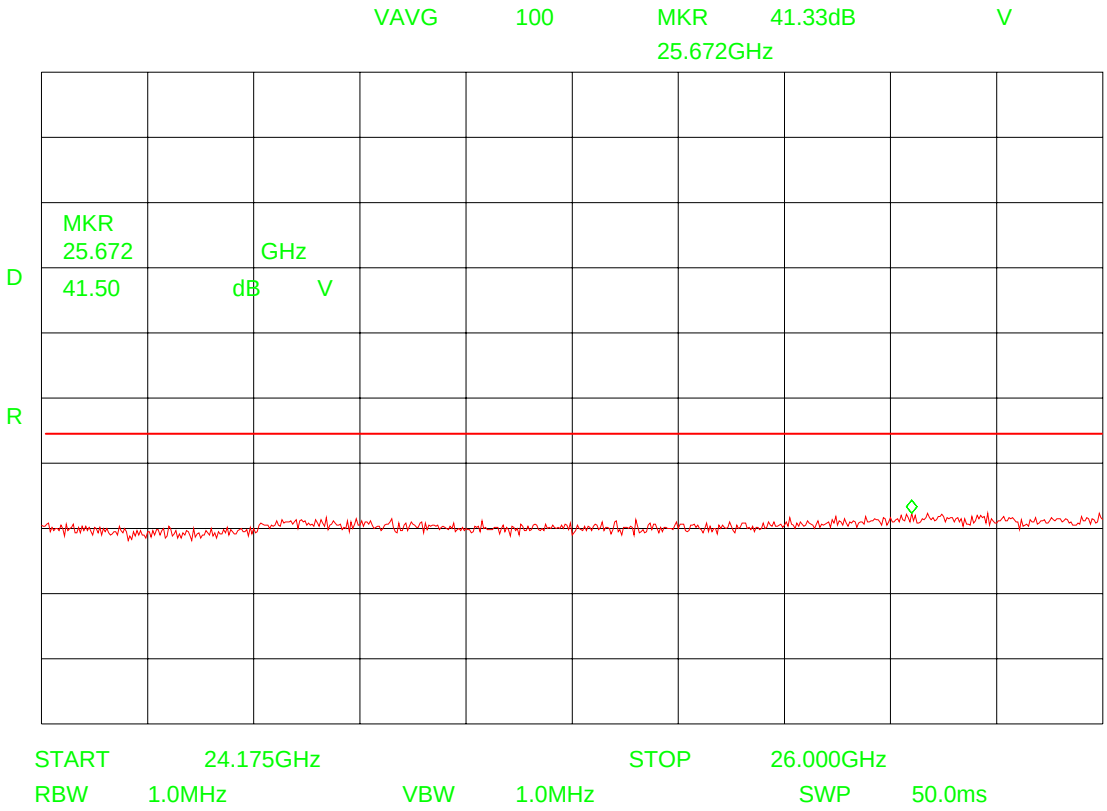
Calculation:

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

see page 9-11

The offset (cable loss - amplifier gain + antenna factor) is calculated in the analyzer reading.

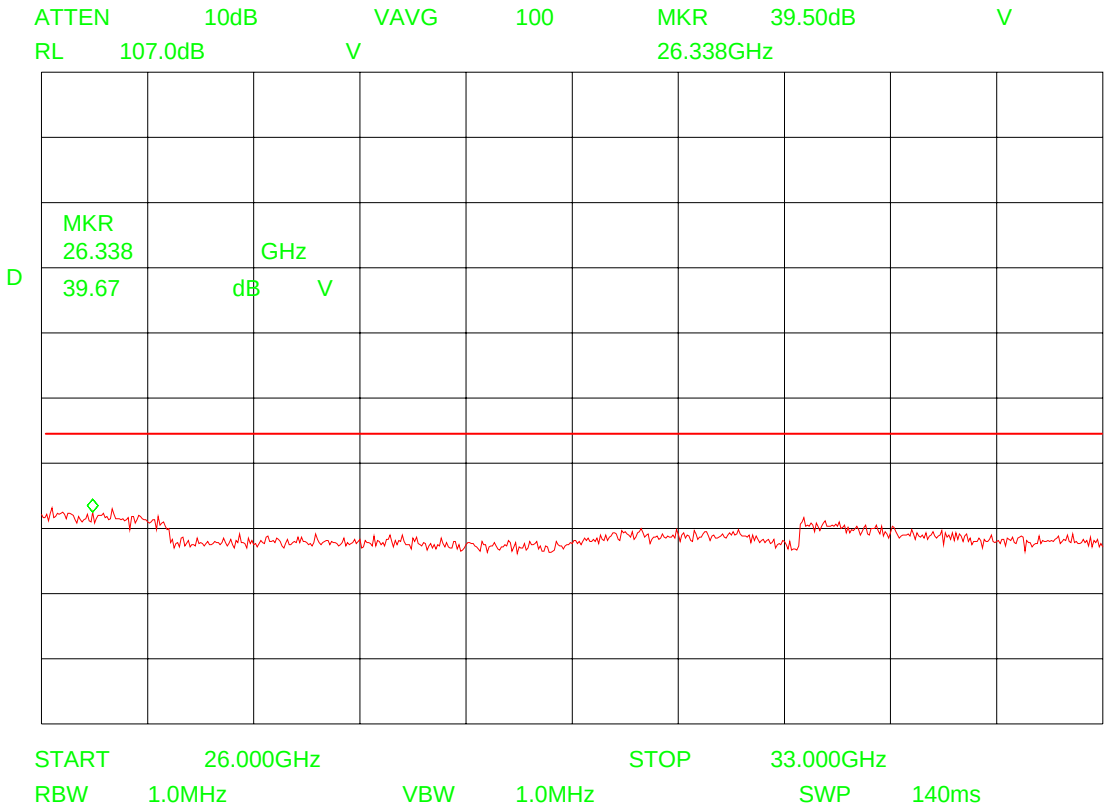
Plot no.: 7



Calculation: Field strength = analyzer reading + cable loss - amplifier gain + antenna factor
e [dB(µV/m)] = u [dB(µV)] + a [dB] - g [dB] + k [dB(1/m)]
see page 9-11

The offset (cable loss - amplifier gain + antenna factor) is calculated in the analyzer reading.

Plot no.: 8



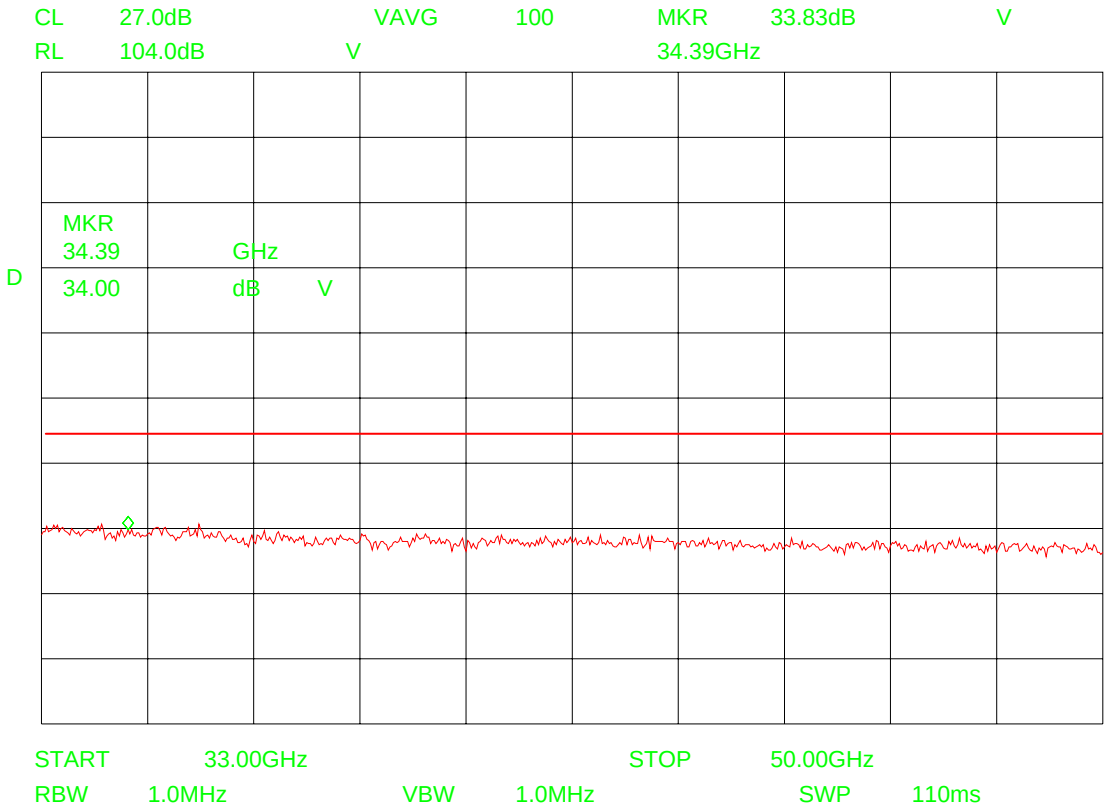
Calculation:

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

see page 9-11

The offset (cable loss - amplifier gain + antenna factor) is calculated in the analyzer reading.

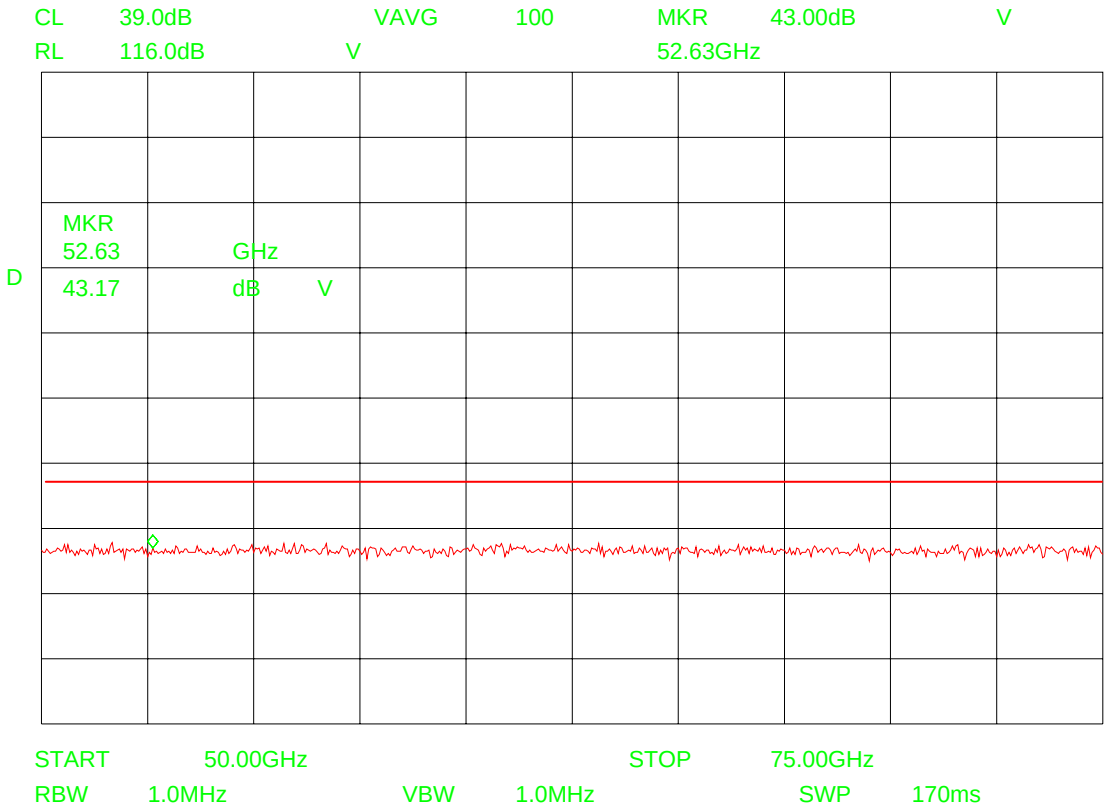
Plot no.: 9



Calculation : Field strength = analyser reading + antenna factor - distance correction
e [dB(µV/m)] = u [dB(µV)] + k [dB(1/m)] - d [dB]
see page 9-11

The offset (antenna factor - distance correction) is calculated in the analyzer reading.

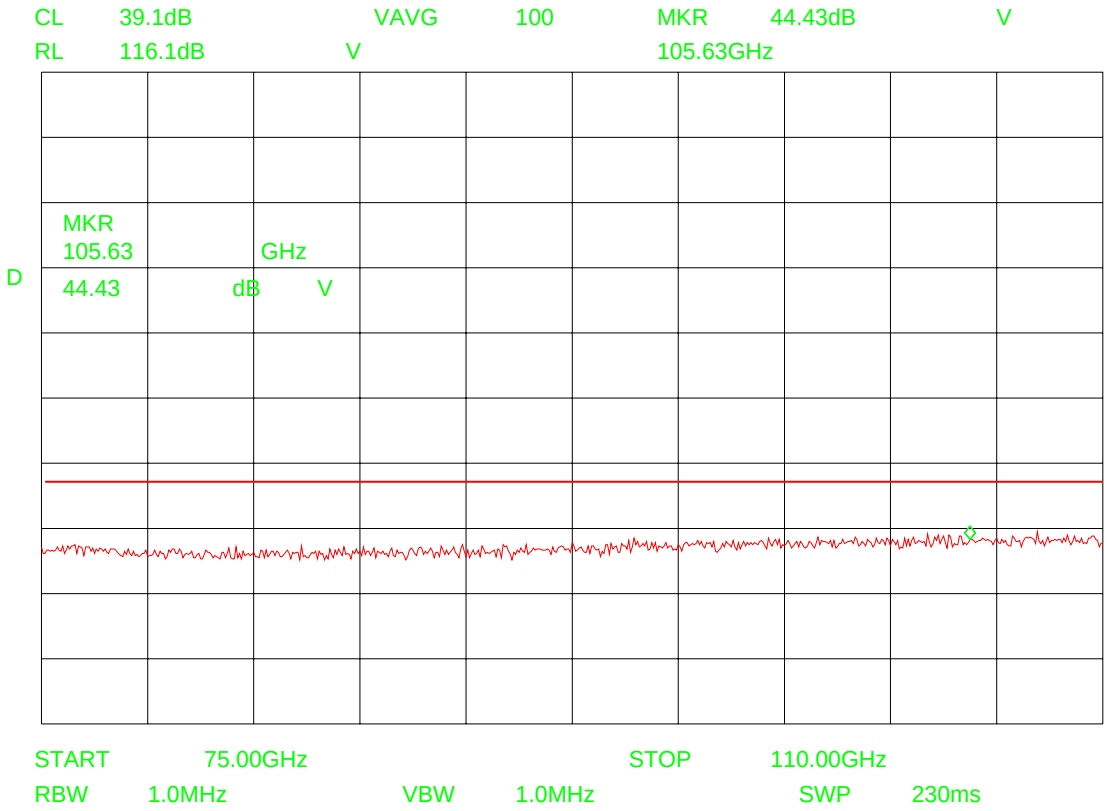
Plot no.: 10



Calculation : Field strength = analyser reading + antenna factor - distance correction
e [dB(µV/m)] = u [dB(µV)] + k [dB(1/m)] - d [dB]
see page 9-11

The offset (antenna factor - distance correction) is calculated in the analyzer reading.

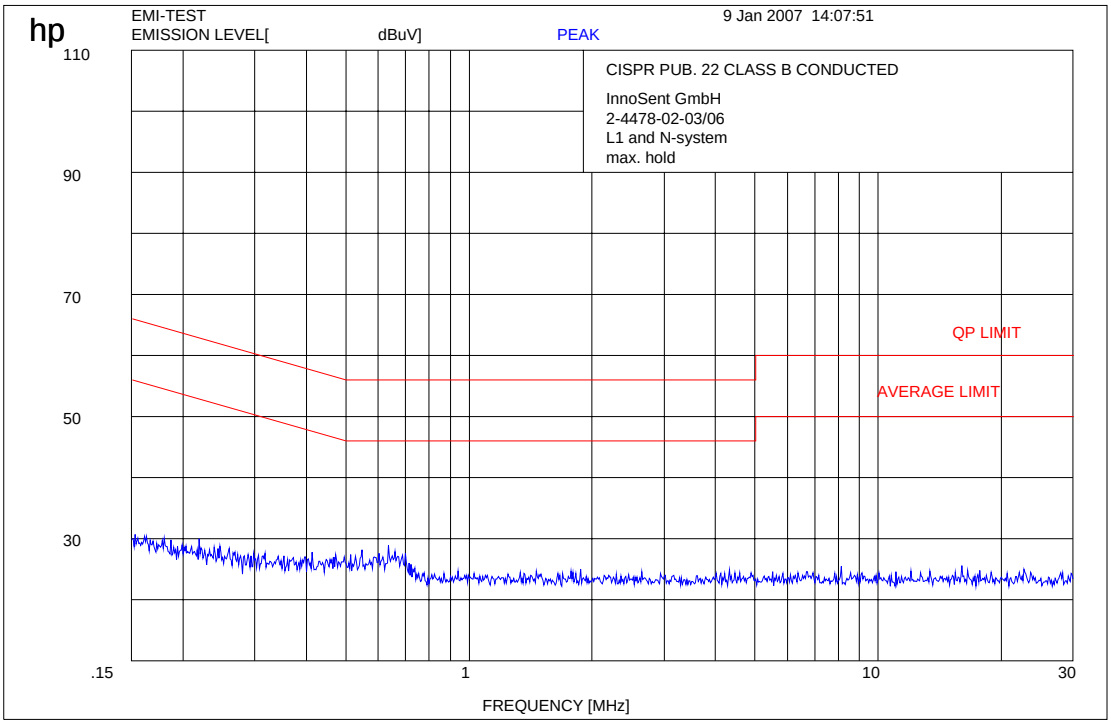
Plot no.: 11



Calculation : Field strength = analyser reading + antenna factor - distance correction
e [dB(µV/m)] = u [dB(µV)] + k [dB(1/m)] - d [dB]
see page 9-11

The offset (antenna factor - distance correction) is calculated in the analyzer reading.

Plot no.: 12


hp
EMI-TEST
9 Jan 2007 14:07:51
EMISSION LEVEL[dBuV]
PEAK
CISPR PUB. 22 CLASS B CONDUCTED
InnoSent GmbH
2-4478-02-03/06
L1 and N-system
max. hold
QP LIMIT
AVERAGE LIMIT
110
90
70
50
30
.15
1
10
30
FREQUENCY [MHz]

4 Photographs

Photo no.: 1

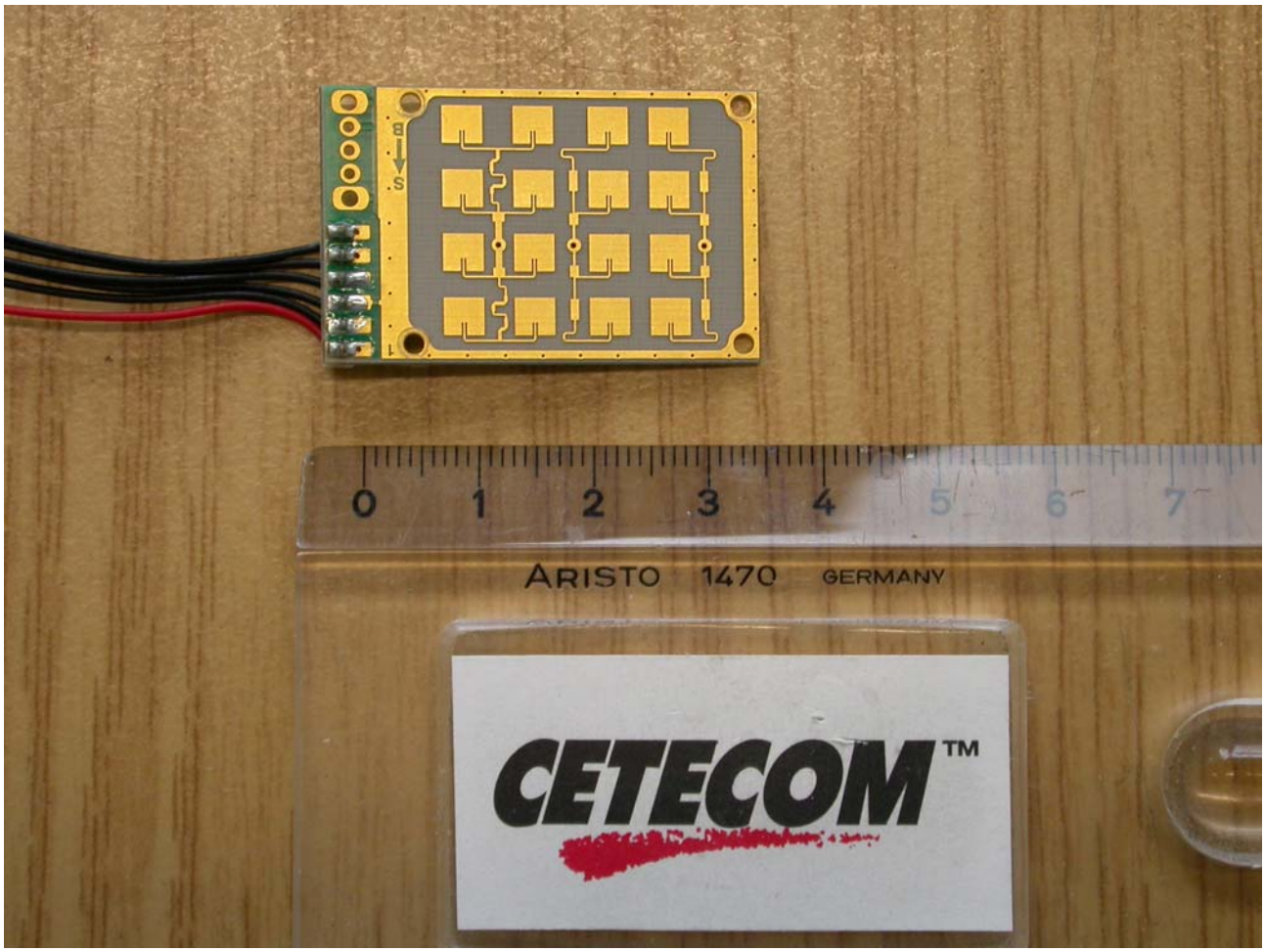
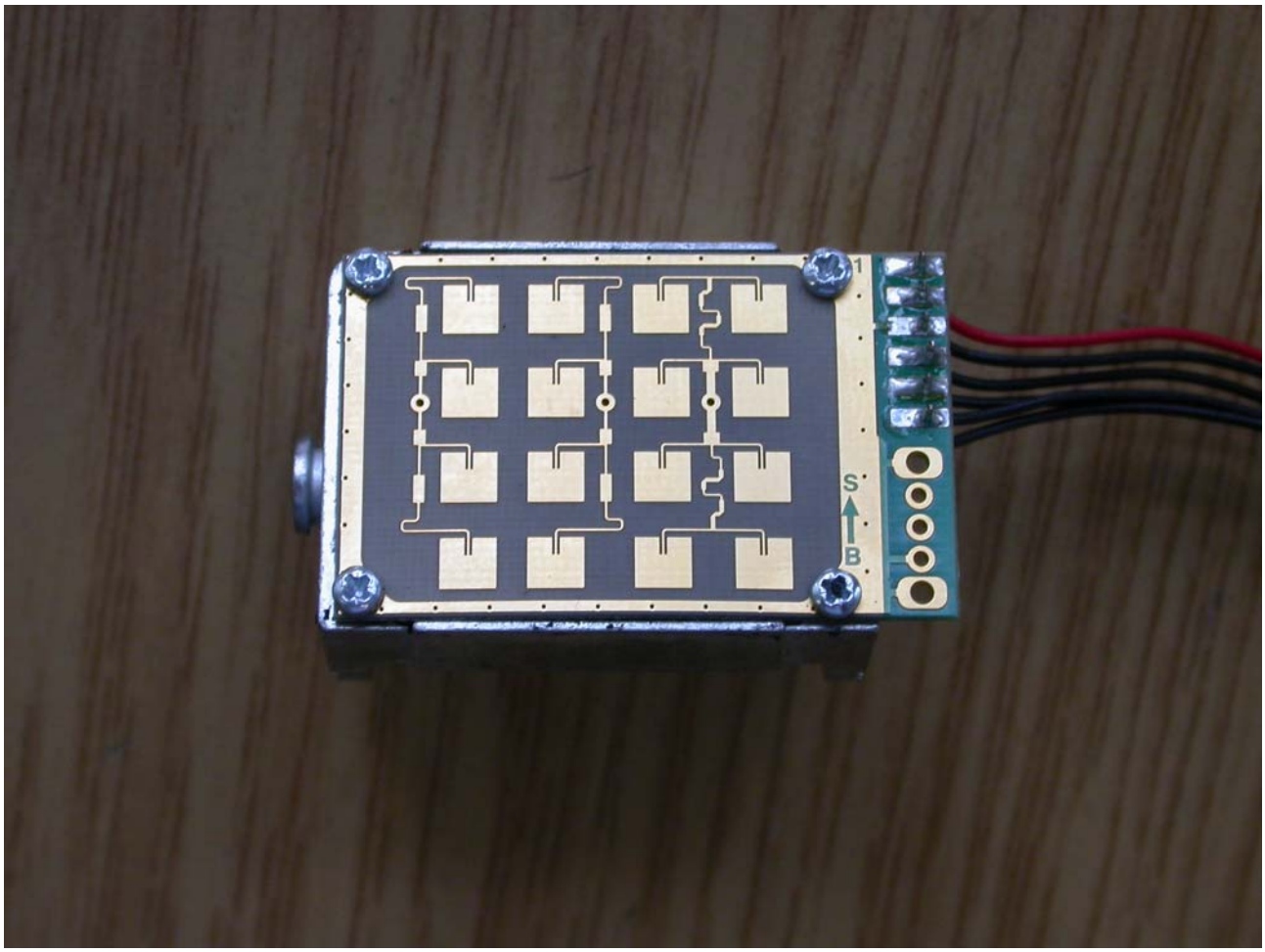


Photo no.: 2



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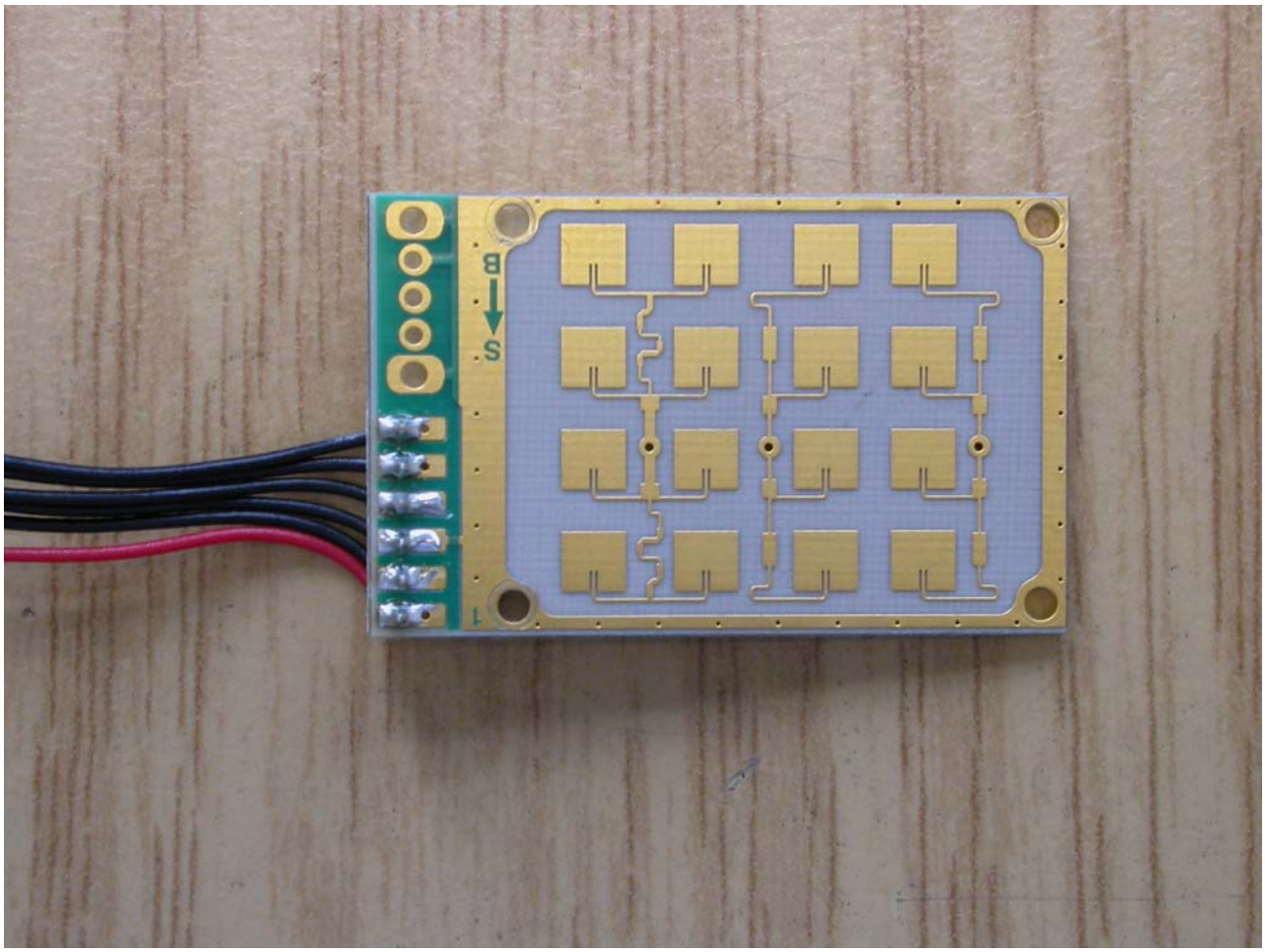

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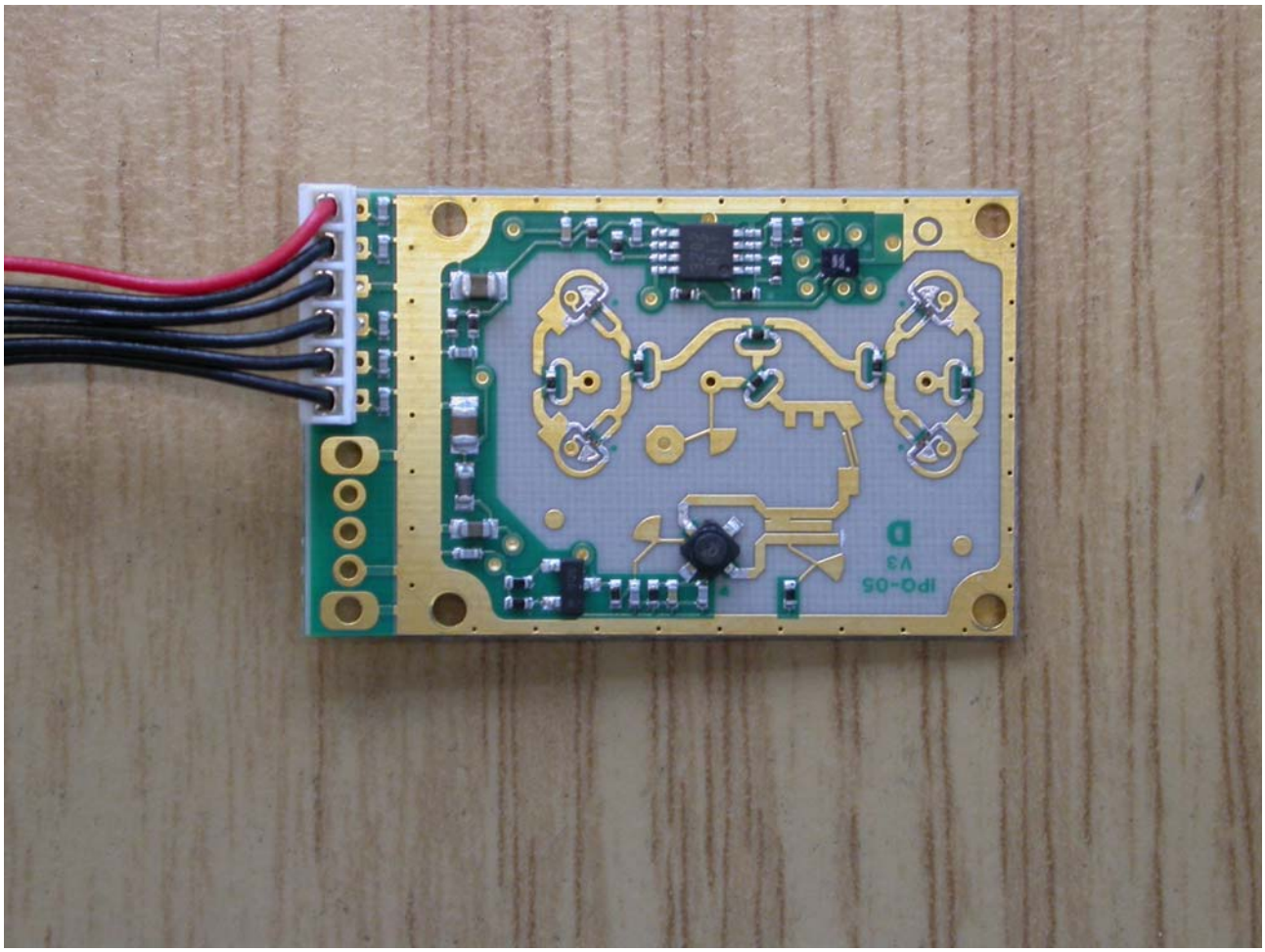
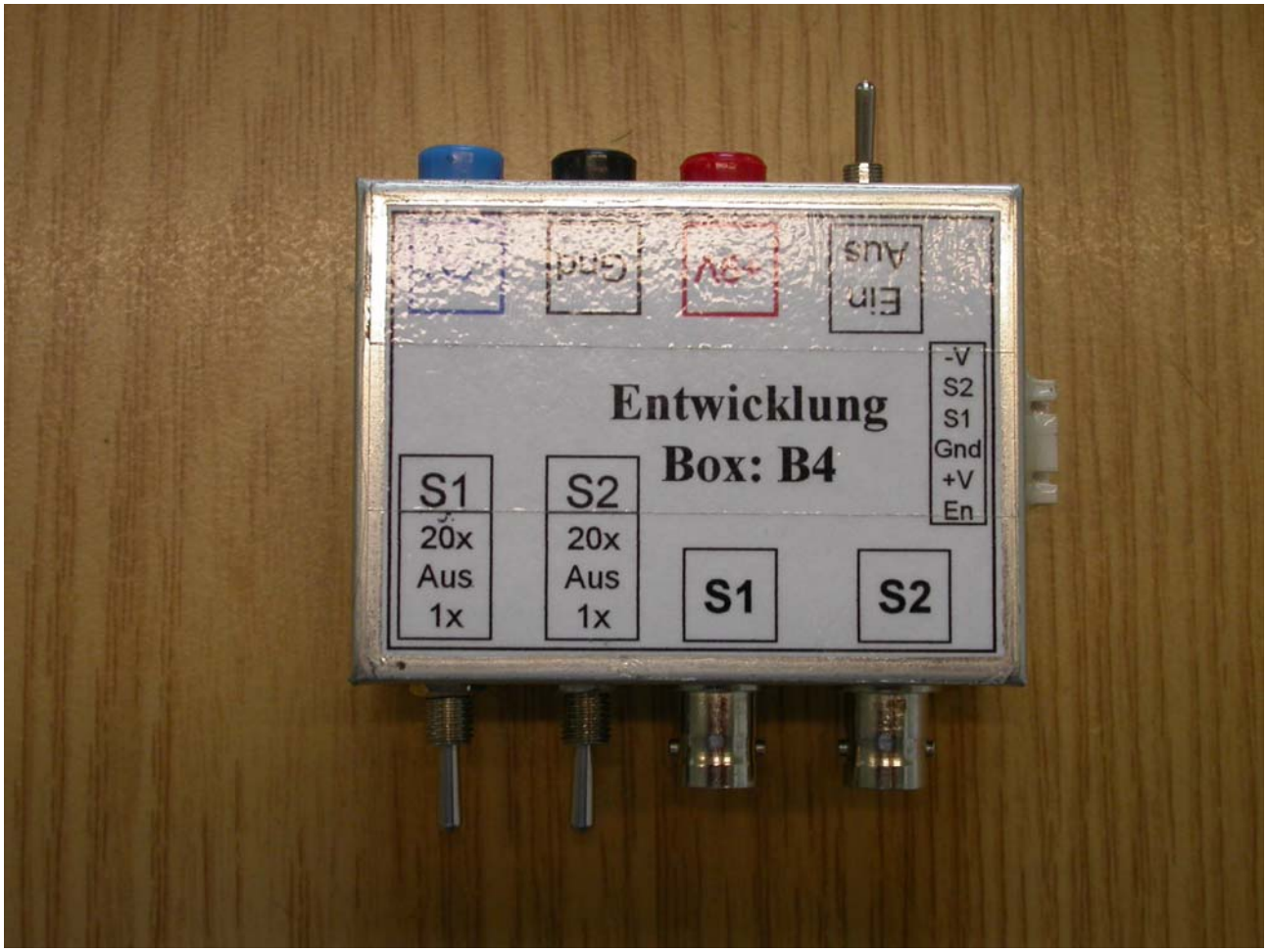


Photo no.: 5

Photo no.: 6

Box for power supply



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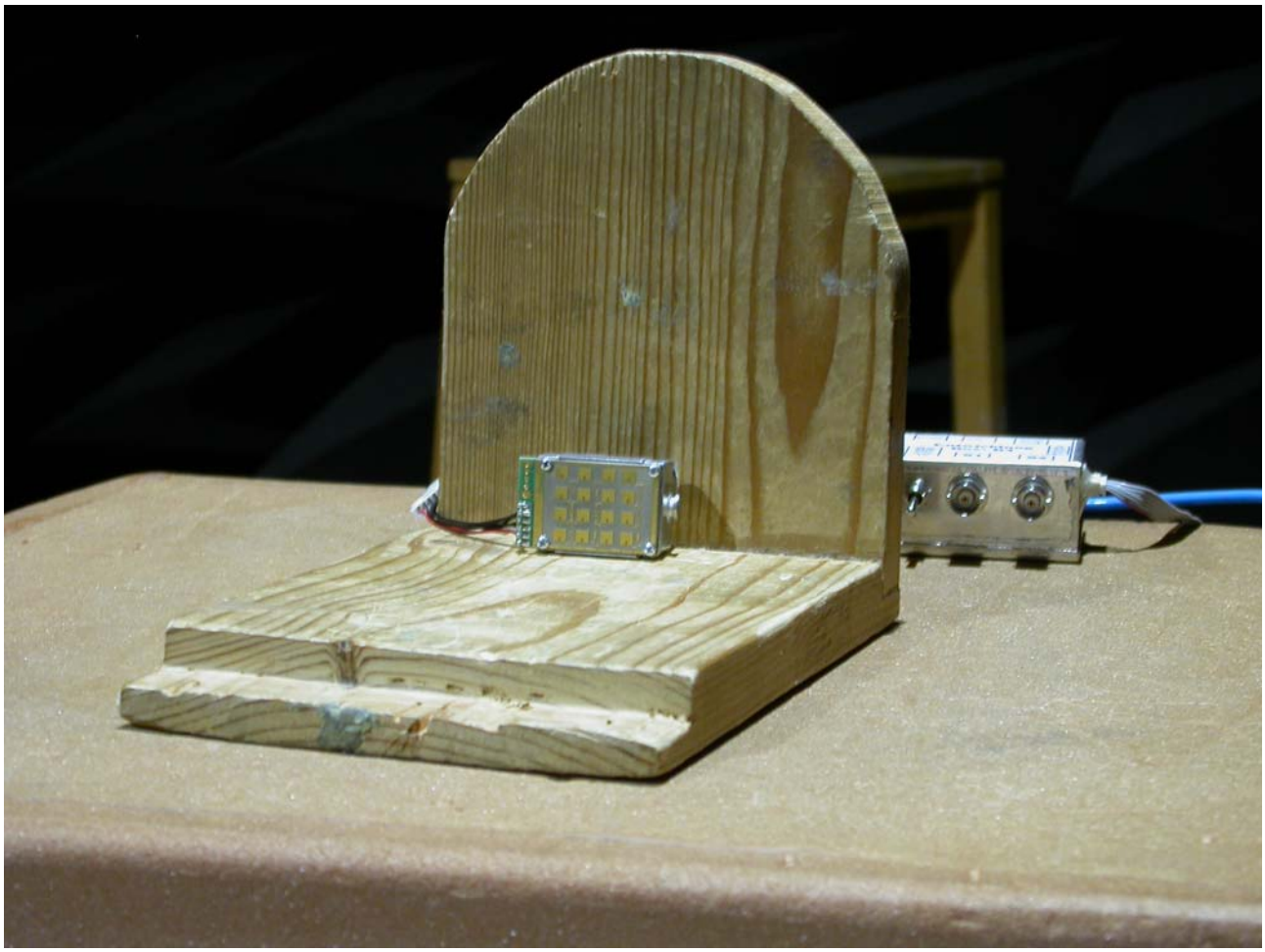

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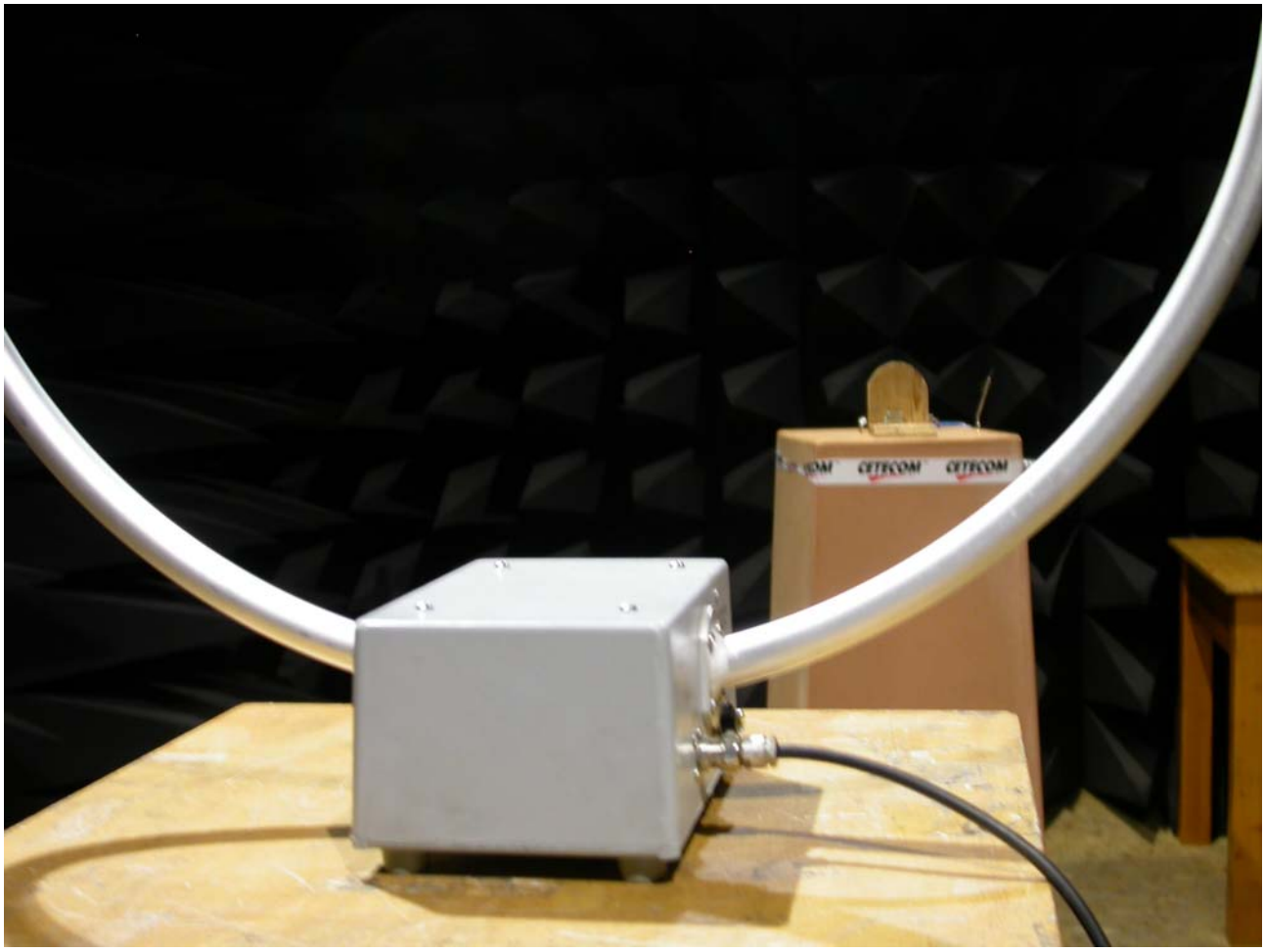

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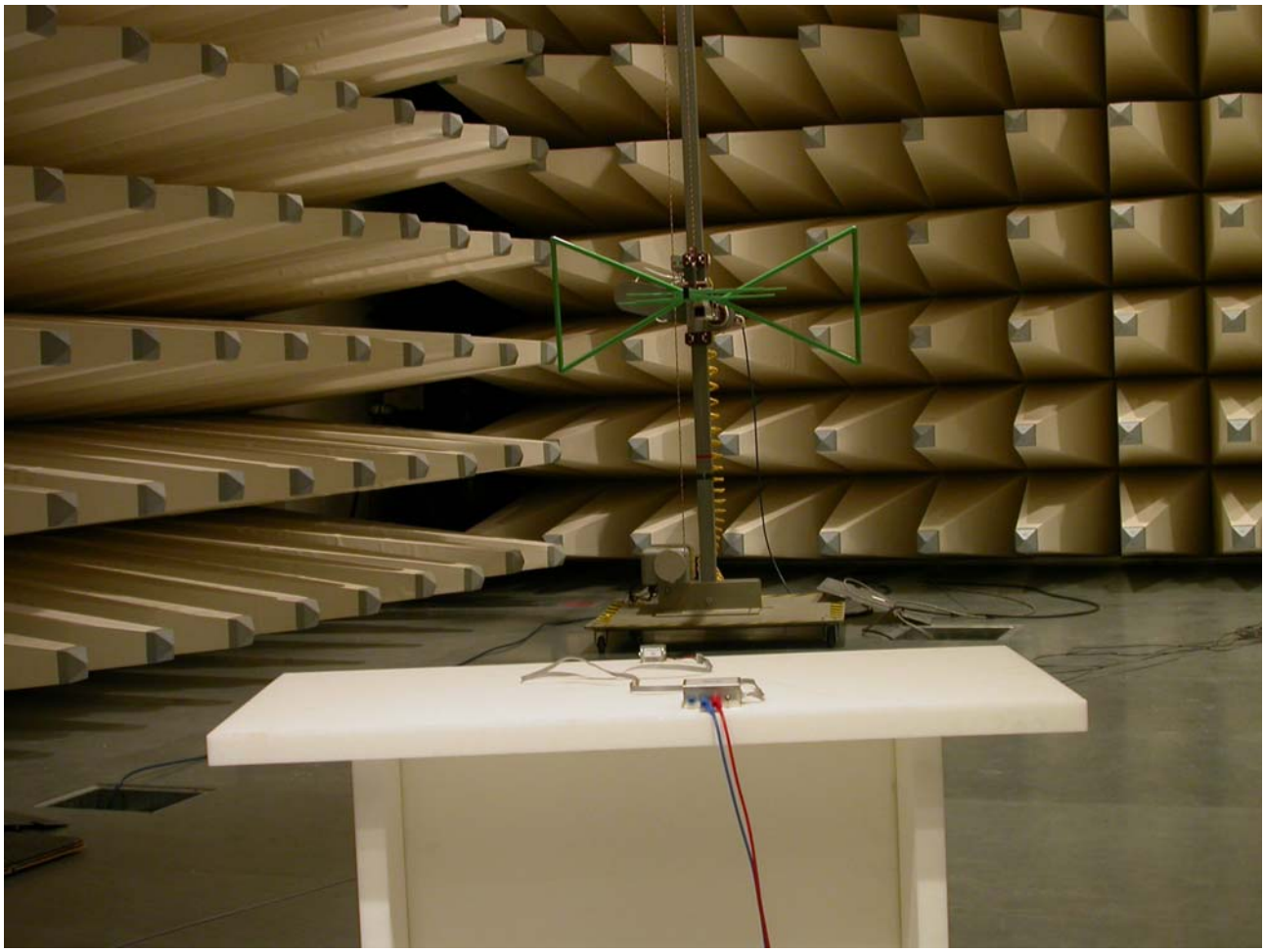

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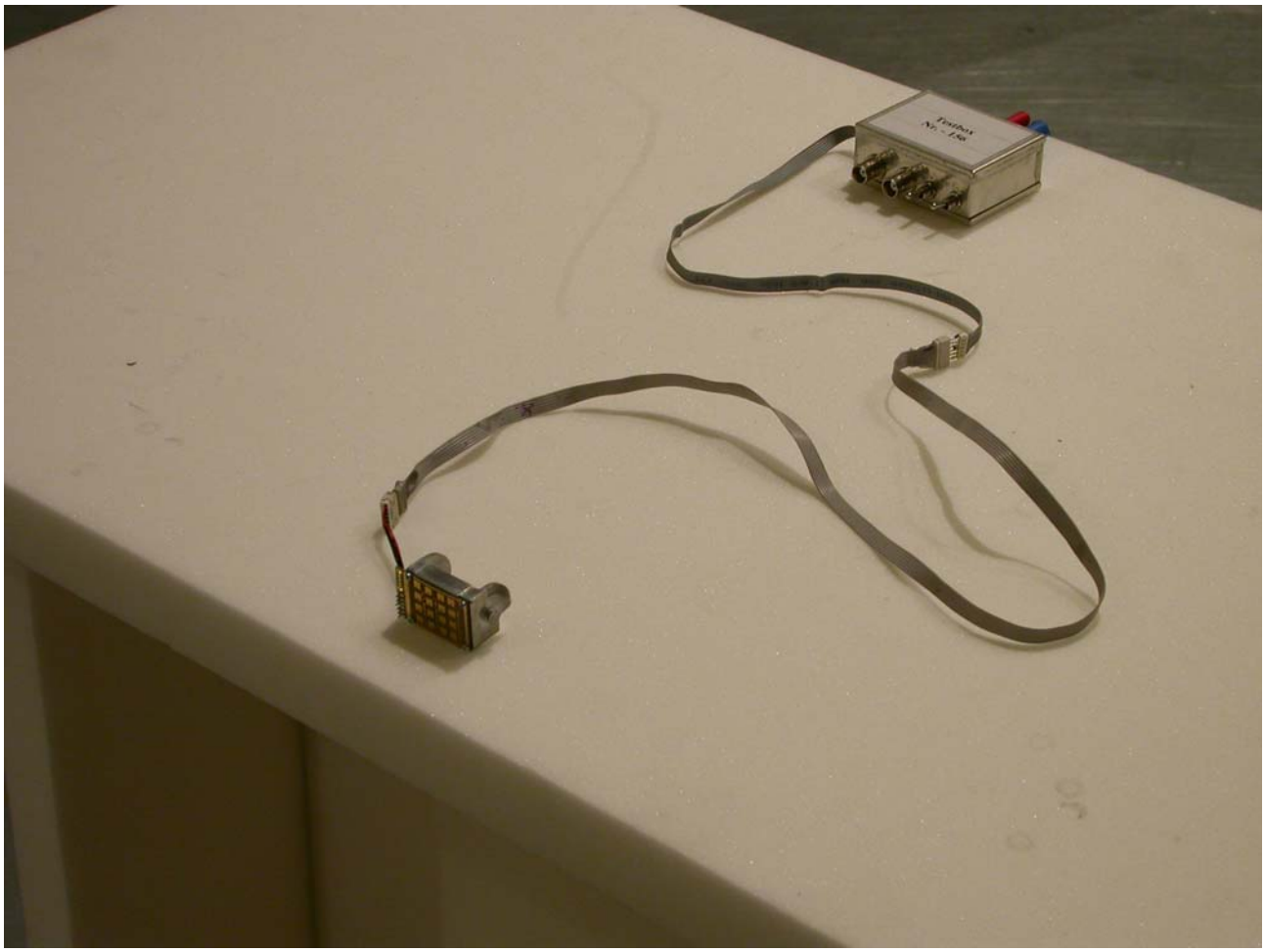

Photo no.: 11

Photo no.: 12

Photo no.: 13