

Radio Satellite Communication

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Test report No.: 2-4843-01-02/07

This test report consists of 39 pages

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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



**Test report No. 2-4843-01-02/07**

**Applicant: agtatec ag**

**Type: K-Band Transceiver IPQ-420\_US**

**Test standard: FCC Part 15.245**

**FCC ID: QKR-IPQ420US**

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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

2007-12-20

Nicolas Stamber



*Technical responsibility for area of testing:*

---

Date

Name

Signature

2007-12-20

Paschwitz Manfred



## 1.2 Testing laboratory

CETECOM ICT Services GmbH  
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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 : agtatec ag  
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Town : 8320 Fehrlitorf  
Country : Switzerland  
Phone : +41 (0) 44 954 91 91  
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## Contact person

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E-Mail : richard.buehler@record.ch

## 1.4 Application details

Date of receipt of application : 2007-12-15  
Date of receipt of test item : 2007-12-17  
Date of test : 2007-12-17 and 2007-12-18  
Person(s) who have been present during the test : Mr. Stefan Bäuerlein  
Mr. Andreas Zirk

## 1.5 Equipment under test (EUT)

Description	:	Field disturbance sensor
Type designation	:	K-Band Transceiver IPQ-420_US
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	:	24.127 GHz
Field strength PEP	:	105.7 dB $\mu$ V/m @ 3 m
Type of modulation	:	NON
Antenna	:	Patch antenna (see photo)
Pulse period	:	CW carrier
Microwave modules	:	TX / RX – Module with integral antenna (patch antenna)
Normal power supply (U nom)	:	8.0 V DC
Extreme DC power supply	:	8.8 V DC 7.2 V DC

### 1.6.1 Operation conditions

Operation	:	As soon as the equipment is powered up, TX and RX start operating
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### 1.6.2 Equipment under test

K-Band Transceiver IPQ-420\_US

## 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

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

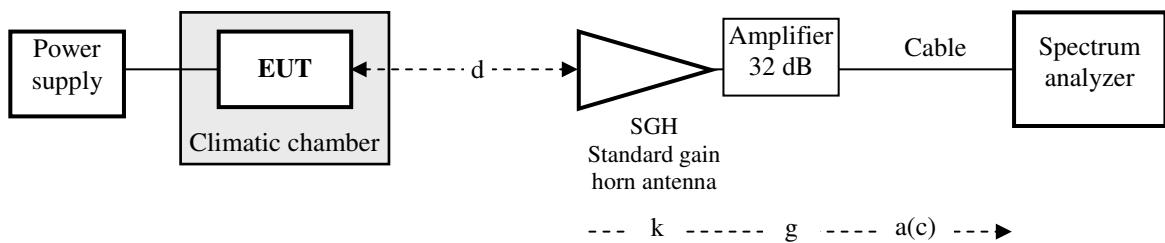
The measurement and test set-up is defined in the technical specification.

### 2.4 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 12 GHz to 33 GHz

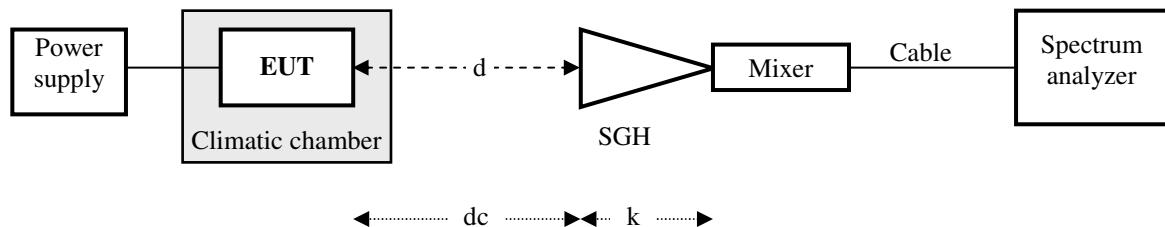


Frequency f [GHz]	Distance d [m]	Antenna factor k [dB(1/m)]	Amp.gain g [dB]	Cable loss a(c) [dB]
12.0 to 18.0	3.0	33.97	32.0	2.0 ... 2.7
18.0 to 26.0	3.0	40.22	32.0	2.7 ... 3.0
26.0 to 33.0	3.0	44.00	32.0 to 28.0	3.0 ... 3.2

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

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 26.0 GHz	narda	638	300002442
SGH 26.0 to 33.0 GHz	narda	637	300001751
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 100 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 ... 100.0	0.125	-27.60	45.10

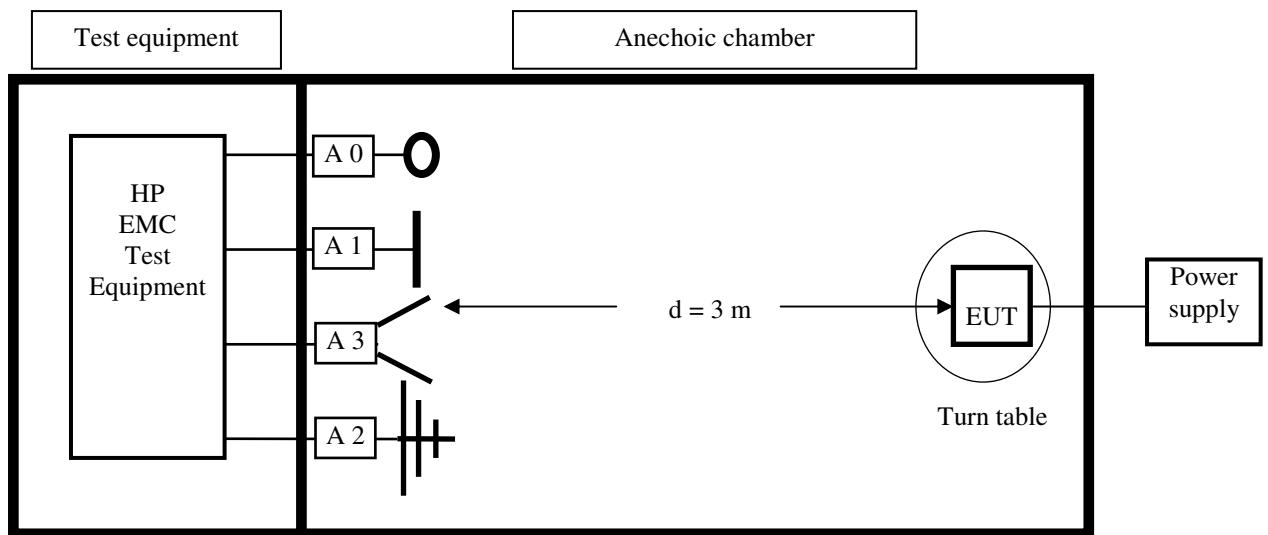
Calculation: Field strength = analyser reading + antenna factor - distance correction  
 $e [\text{dB}(\mu\text{V}/\text{m})] = u [\text{dB}(\mu\text{V})] + k [\text{dB}(1/\text{m})] - d [\text{dB}]$

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

Test equipment	Manufacturer	Type	CETECOM reference
Spectrum 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 C63.4-2003 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 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 11). 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 FUNDAMENTAL FREQUENCY

#### SECTION 15.245

Microwave module: K-Band Transceiver IPQ-420\_US

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 = 8.0	24.127	105.7 Included correction factor (see page 8)	105.7	1

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

LIMITS: SECTION 15.245

Frequency range (GHz)	Measurement distance [m]	Field strength e [dBµV/m] @ 3 m	Field strength E
24.075 to 24.175	3	128.0	2 500 mV/m

Verdict:	Fundamental frequency e.i.r.p. limit is kept
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Equipment under test (EUT): see page 5

Ambient temperature: 23 °C

Relative humidity: 55 %

**TRANSMITTER PARAMETERS**  
**SPURIOUS FREQUENCIES**

 SECTION 15.245  
 SECTION 15.205 / 15.209

Microwave module: K-Band Transceiver IPQ-420\_US

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.:
9 kHz to 30.0 MHz (h + v) horizontal and vertical plane	noise	62.3	< Limit	2
0.030 to 1.0 (h + v)	noise	34.5	< Limit	3
1.0 to 4.0 (h + v)	noise	24.5	< Limit	4
4.0 to 12.0 (h + v)	noise	38.6	< Limit	5
12.0 to 18.0 (h + v)	noise	42.0	< Limit	6
18.0 to 24.075 (h + v)	noise	44.7	< Limit	7
24.175 to 26.0 (h + v)	noise	45.2	< Limit	8
26.0 to 33.0 (h + v)	noise	45.5	< Limit	9
33.0 to 50.0 (h + v)	noise	42.0	< Limit	10
48.245 to 48.265 (h + v)	48.255 GHz Harmonics	55.8	< Limit	11
50.0 to 75.0 (h + v)	noise	42.3	< Limit	12
75.0 to 100.0 (h + v)	noise	43.1	< Limit	13

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 – 30.00	30	29.5	30
30.00 – 88.00	3	40.0	100
88.00 – 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	88.0 (AV)	25,000

Verdict:	Field strength limits are kept
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Equipment under test (EUT): see page 5

Ambient temperature: 23 °C

Relative humidity: 55 %

## TRANSMITTER PARAMETERS

### AC CONDUCTED

SECTION 15.245

SECTION 15.107 / 15.207

Microwave module: K-Band Transceiver IPQ-420\_US

Test measurement:

Frequency Range	Spurious frequency	SA u [dBmV]	E [µV/m]	See Plot No.:
150.0 kHz – 30.0 MHz	noise	< limit	< limit	14

LIMITS:

FCC SECTION 15.107 / 15.207

CISPR 22

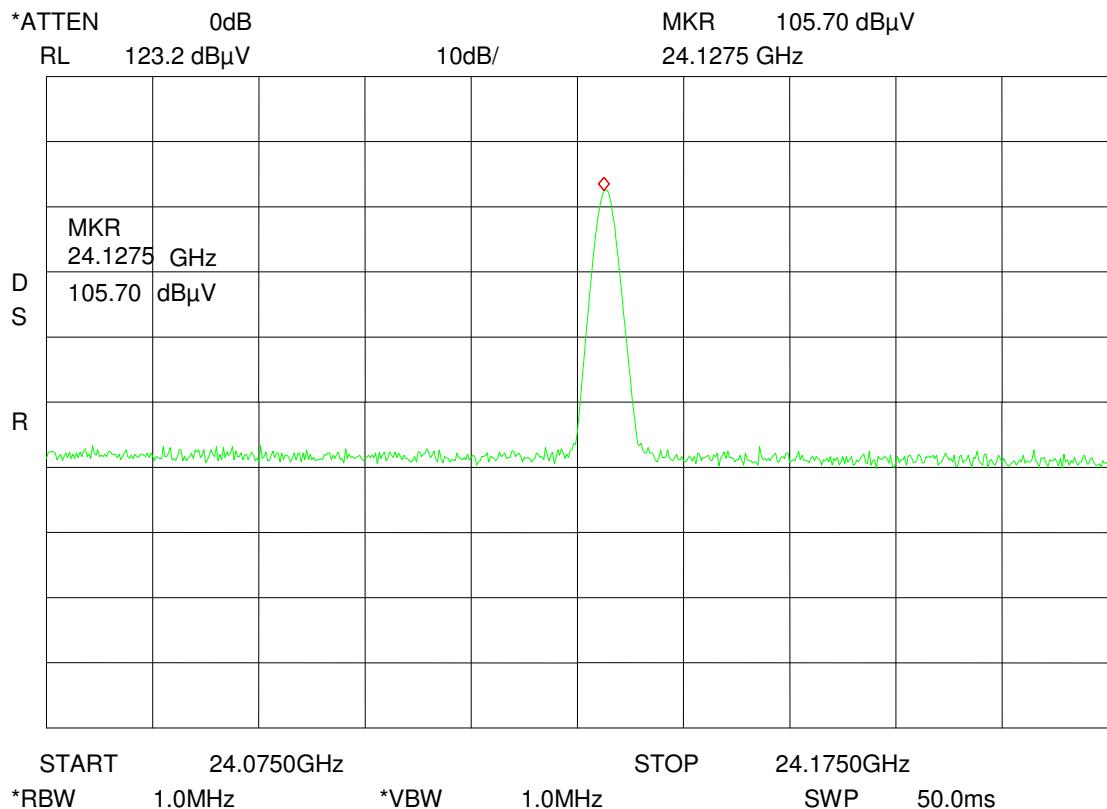
Frequency of Emissions [MHz]	Conducted Limit [dBµV]	
	Quasi peak	Average
0.150 – 0.500	66 to 56 *	56 to 46 *
0.500 – 5.000	56	46
5.000 – 30.000	60	50

\* Decreases with the logarithm of the frequency

Verdict:	AC conducted limits are kept
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### 3 Plots, graphs and data sheets: Measurement result no. 1 ( 14 )

Plot no.: 1

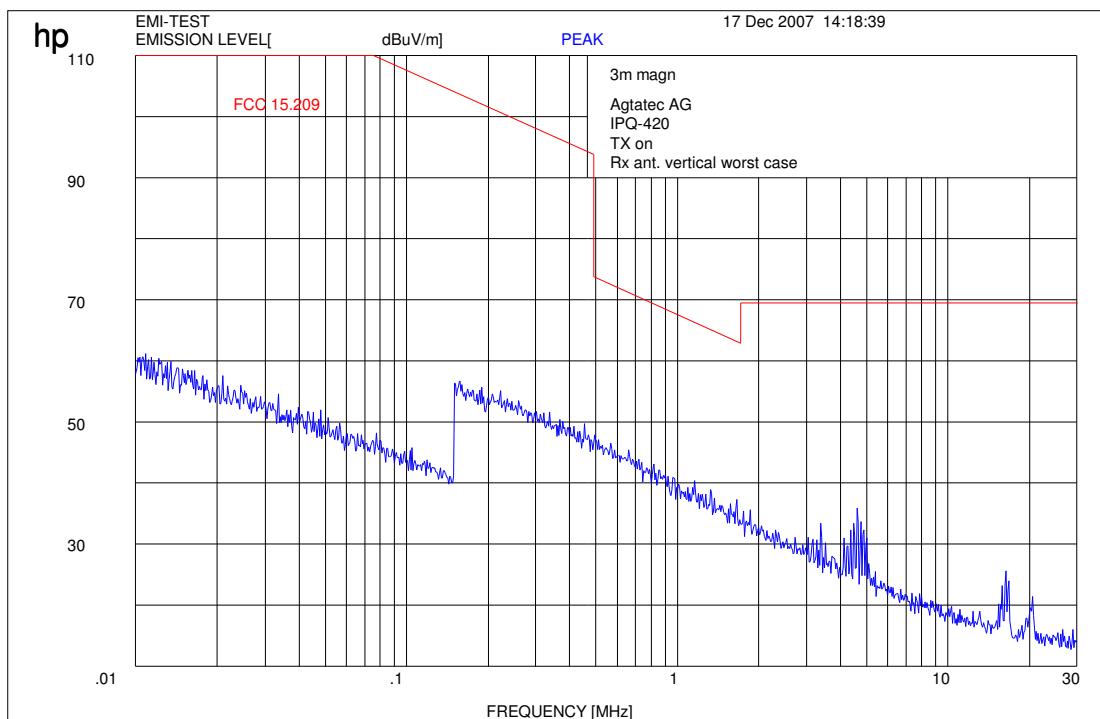


Calculation: Field strength = analyzer reading + cable loss - amplifier gain + antenna factor  
 $e \text{ [dB}(\mu\text{V/m})] = u \text{ [dB}(\mu\text{V})] + a \text{ [dB]} - g \text{ [dB]} + k \text{ [dB}(\text{1/m})]$   
 see page 9-11

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

Limit: see page 13

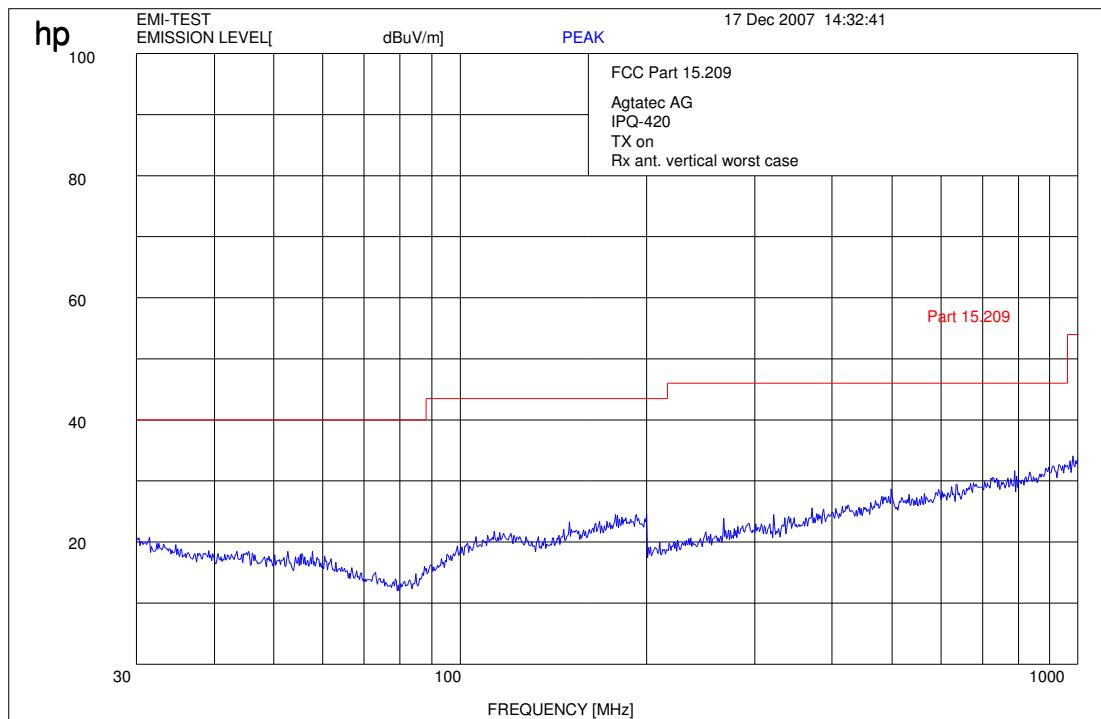
Plot no.: 2



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

Limit: see page 14

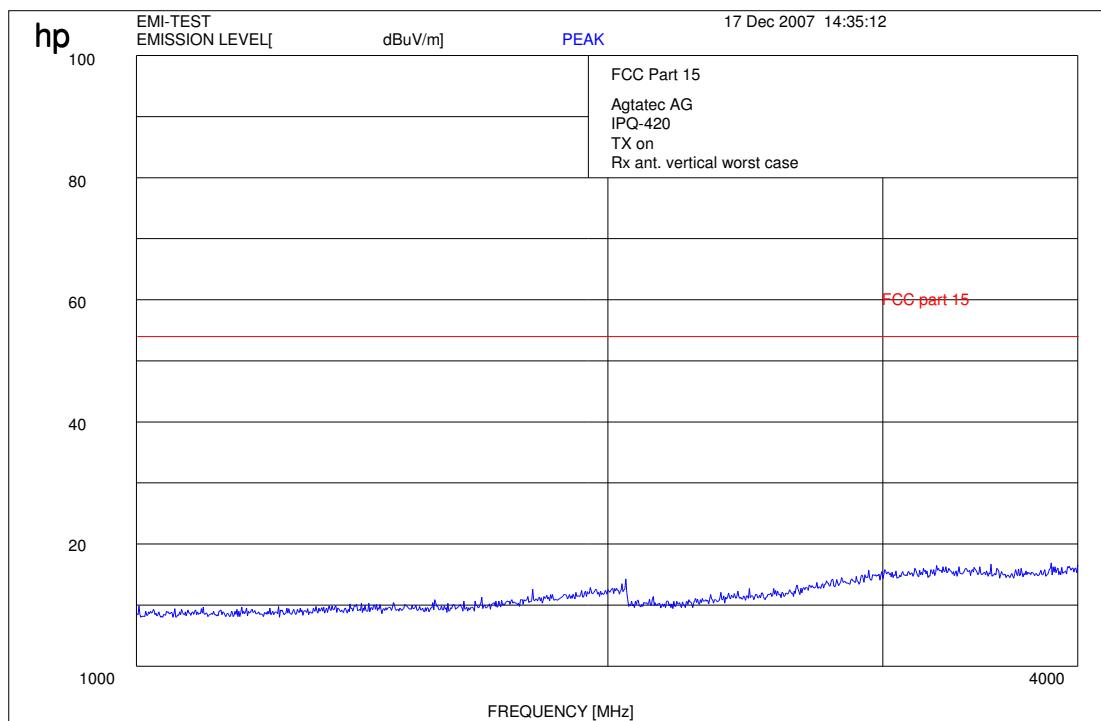
Plot no.: 3



RBW / VBW:      120 kHz up to 1 GHz

Limit:      see page 14

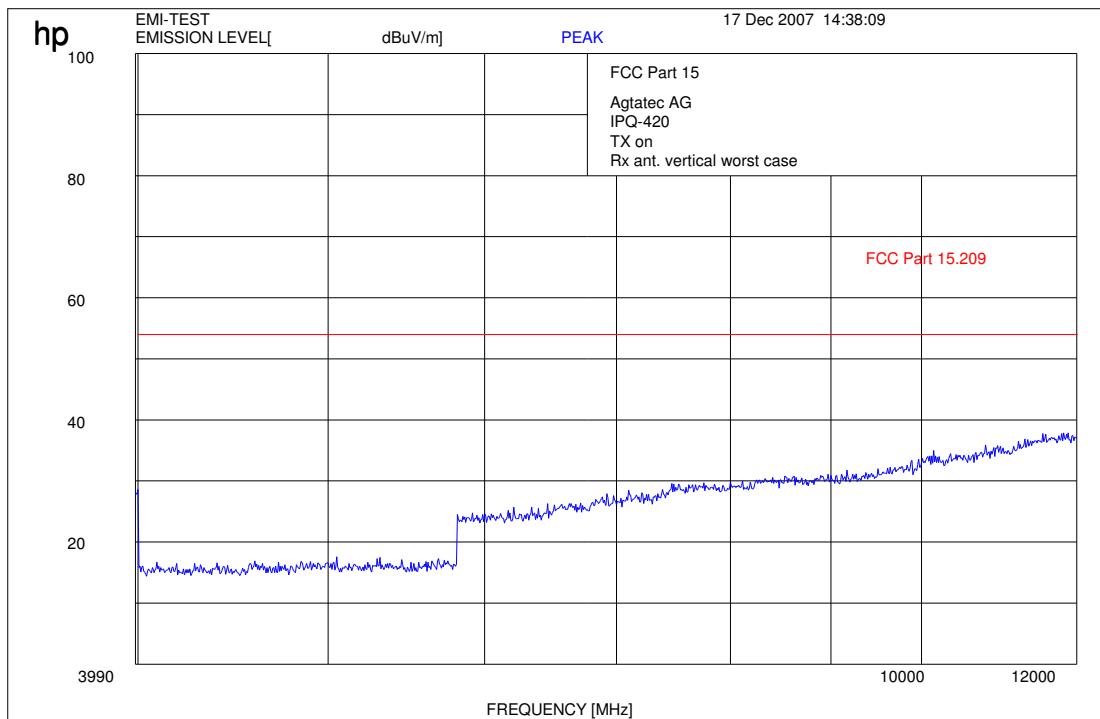
Plot no.: 4



RBW / VBW:      1 MHz above 1 GHz

Limit:      see page 14

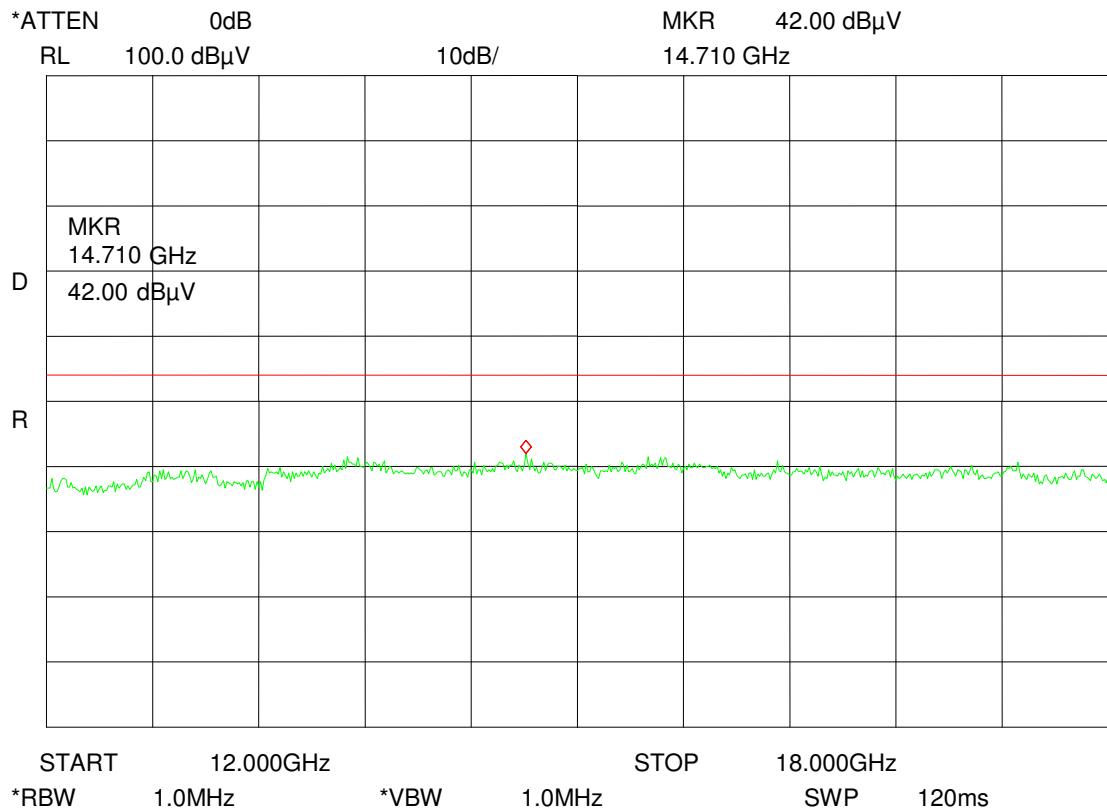
Plot no.: 5



RBW / VBW:        1 MHz above 1 GHz

Limit:        see page 14

Plot no.: 6

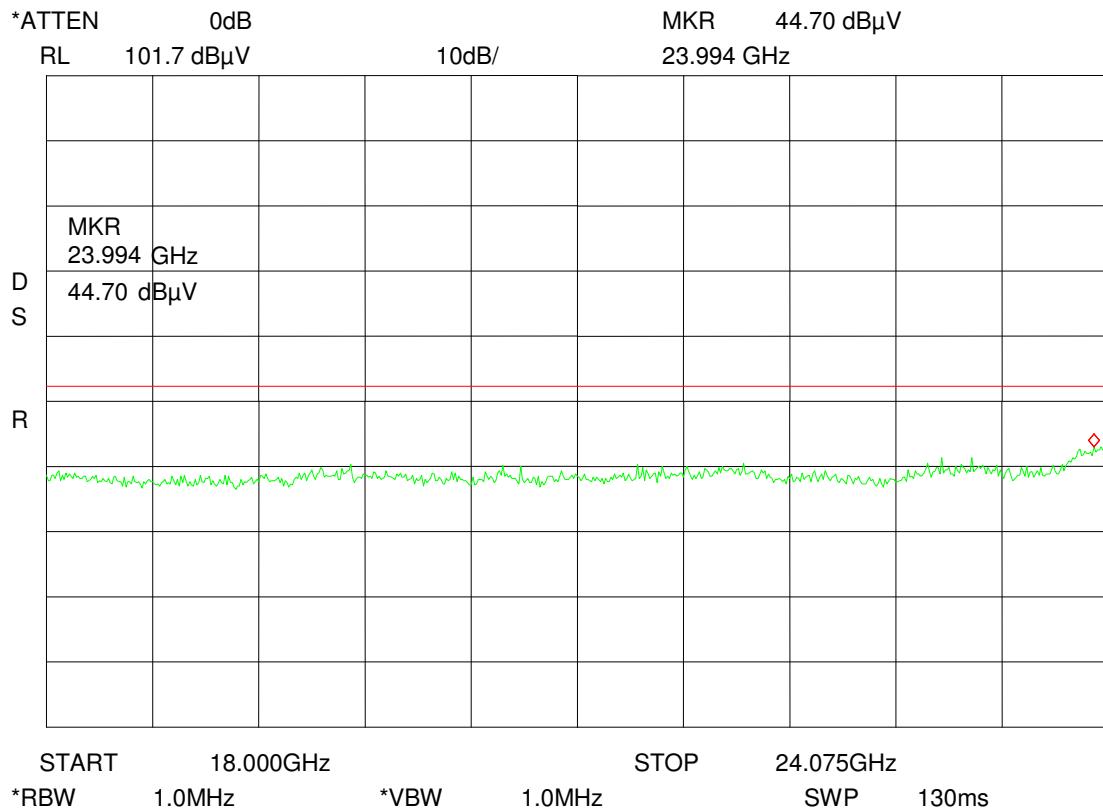


Calculation: Field strength = analyzer reading + cable loss - amplifier gain + antenna factor  
 $e \text{ [dB}(\mu\text{V/m})] = u \text{ [dB}(\mu\text{V})] + a \text{ [dB]} - g \text{ [dB]} + k \text{ [dB}(\text{1/m})]$   
 see page 9-11

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

Limit: see page 14

Plot no.: 7

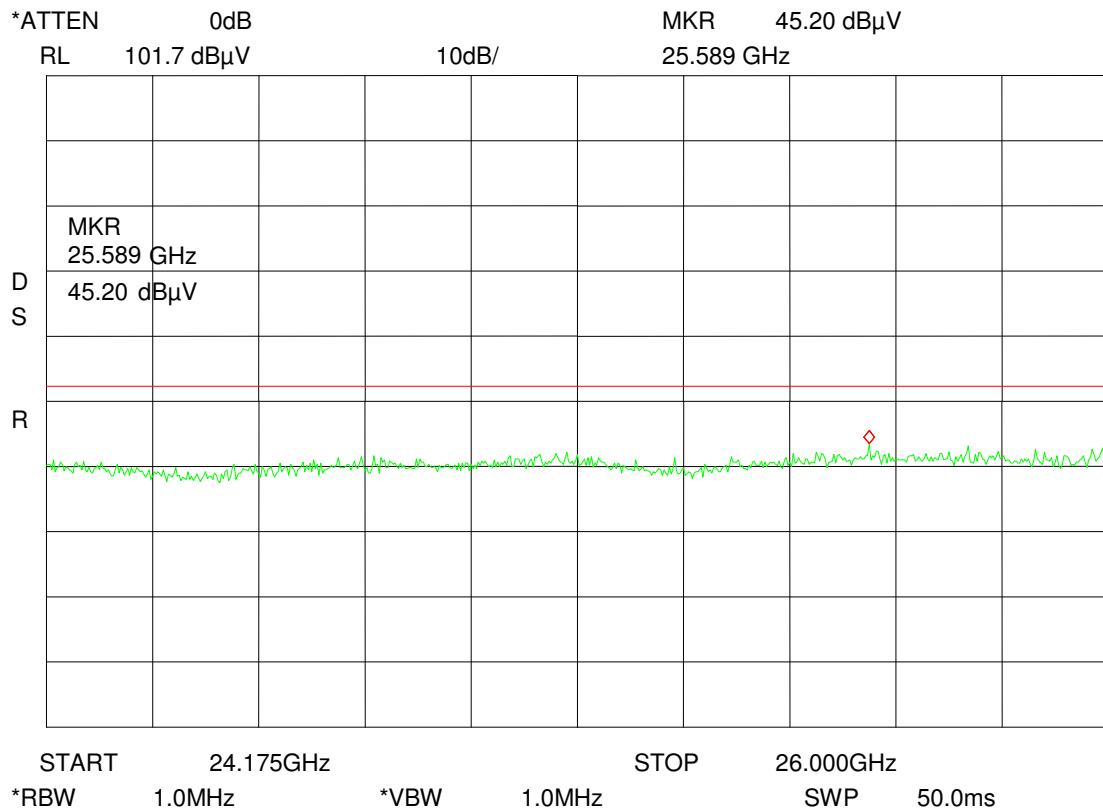


Calculation: Field strength = analyzer reading + cable loss - amplifier gain + antenna factor  
 $e [\text{dB}(\mu\text{V/m})] = u [\text{dB}(\mu\text{V})] + a [\text{dB}] - g [\text{dB}] + k [\text{dB}(1/\text{m})]$   
 see page 9-11

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

Limit: see page 14

Plot no.: 8

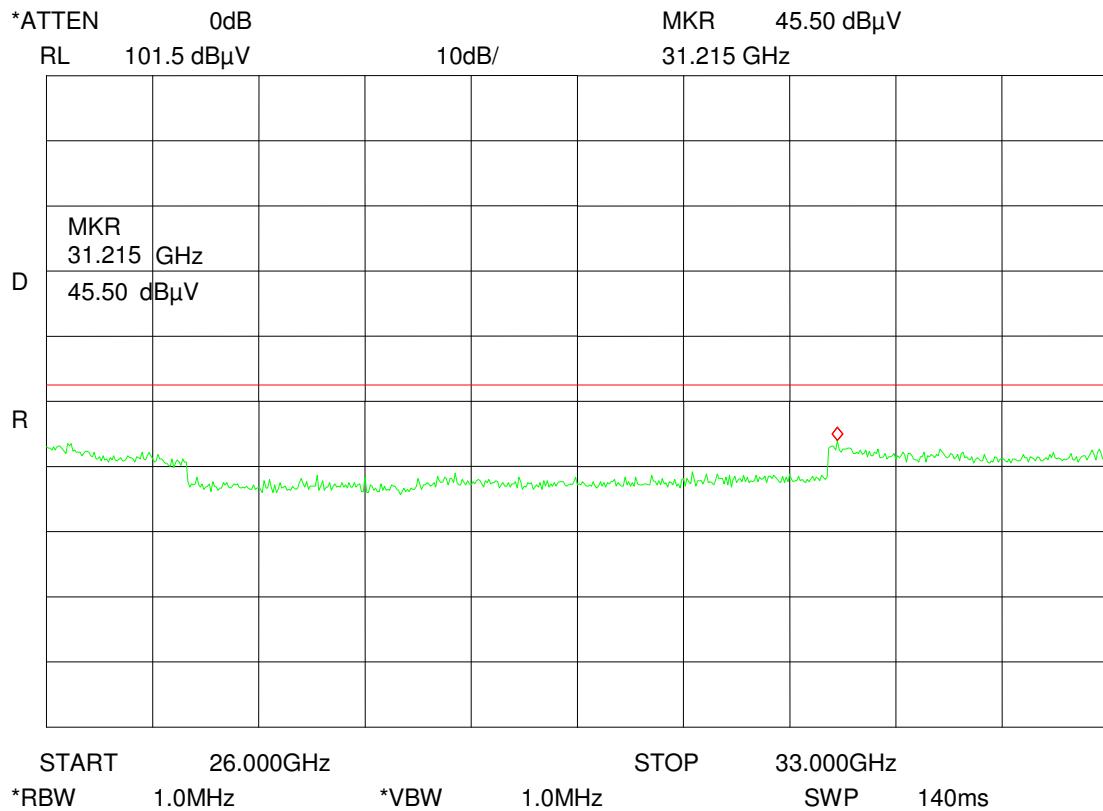


Calculation: Field strength = analyzer reading + cable loss - amplifier gain + antenna factor  
 $e [\text{dB}(\mu\text{V/m})] = u [\text{dB}(\mu\text{V})] + a [\text{dB}] - g [\text{dB}] + k [\text{dB}(1/\text{m})]$   
 see page 9-11

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

Limit: see page 14

Plot no.: 9

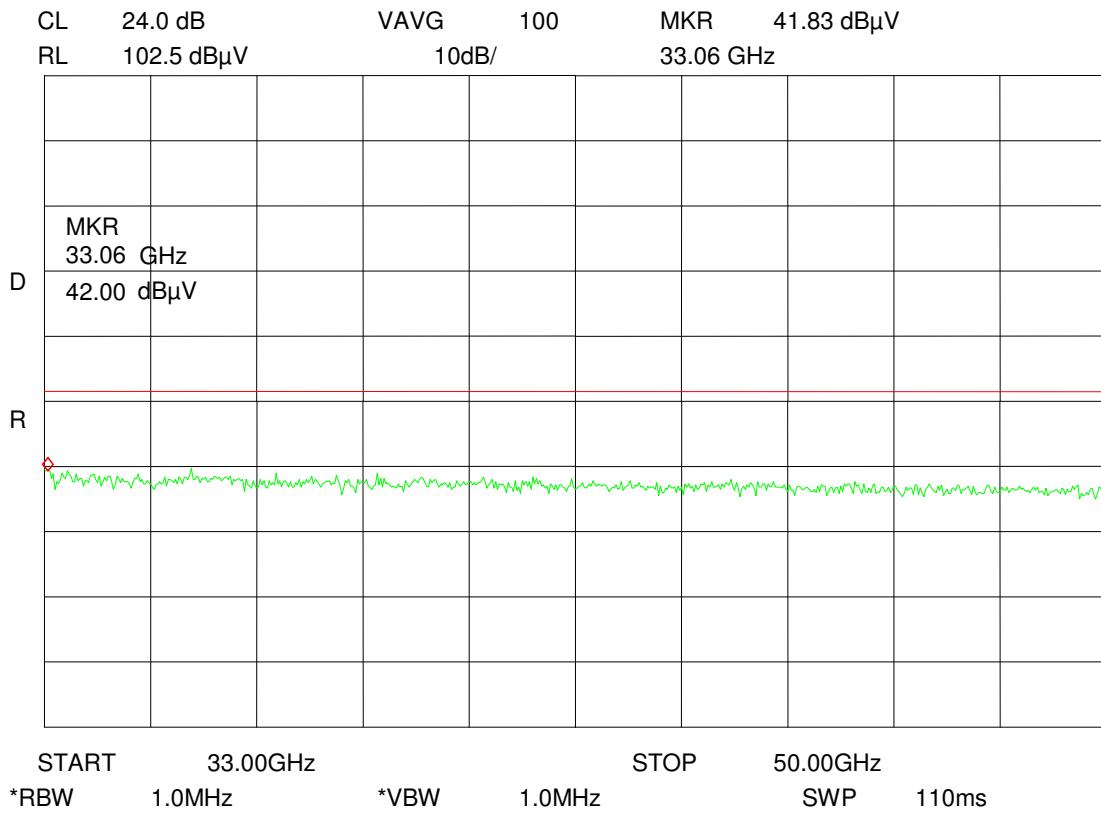


Calculation: Field strength = analyzer reading + cable loss - amplifier gain + antenna factor  
 $e [\text{dB}(\mu\text{V/m})] = u [\text{dB}(\mu\text{V})] + a [\text{dB}] - g [\text{dB}] + k [\text{dB}(1/\text{m})]$   
 see page 9-11

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

Limit: see page 14

Plot no.: 10

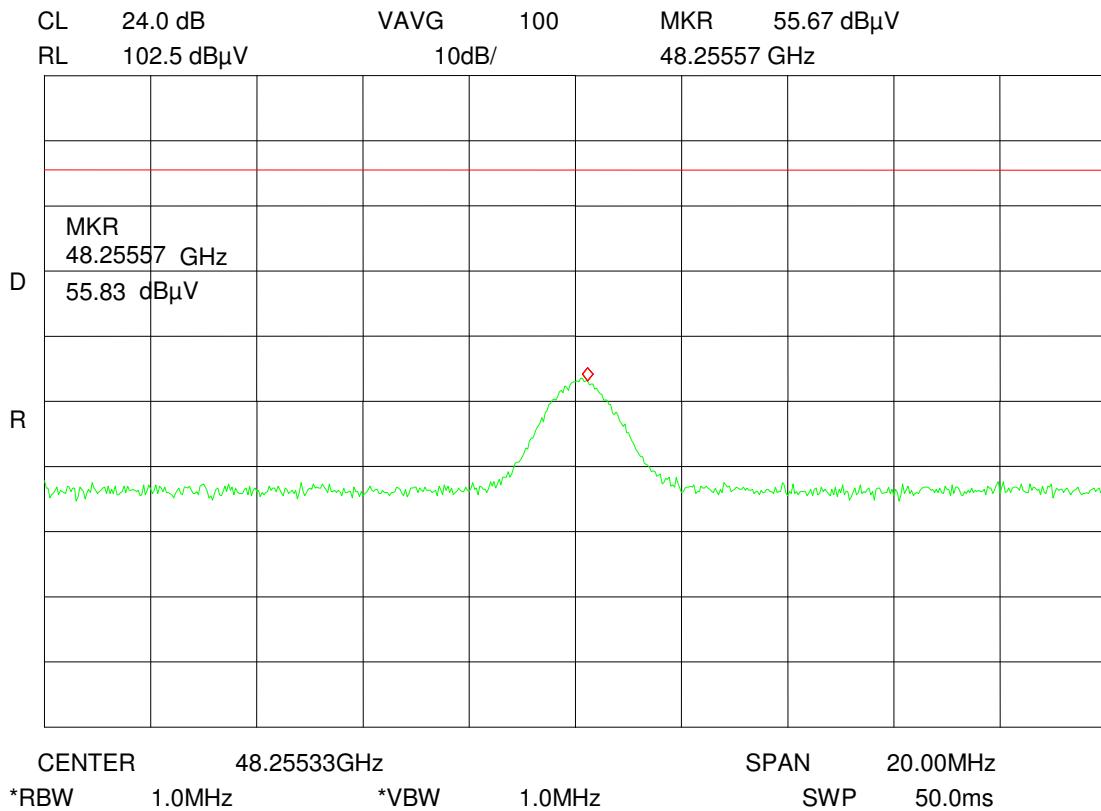


Calculation: Field strength = analyser reading + antenna factor - distance correction  
 $e \text{ [dB}(\mu\text{V/m}]\text{)} = u \text{ [dB}(\mu\text{V}]\text{)} + k \text{ [dB}(\text{1/m}]\text{)} - d \text{ [dB]}$   
 see page 9-11

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

Limit: see page 14

Plot no.: 11

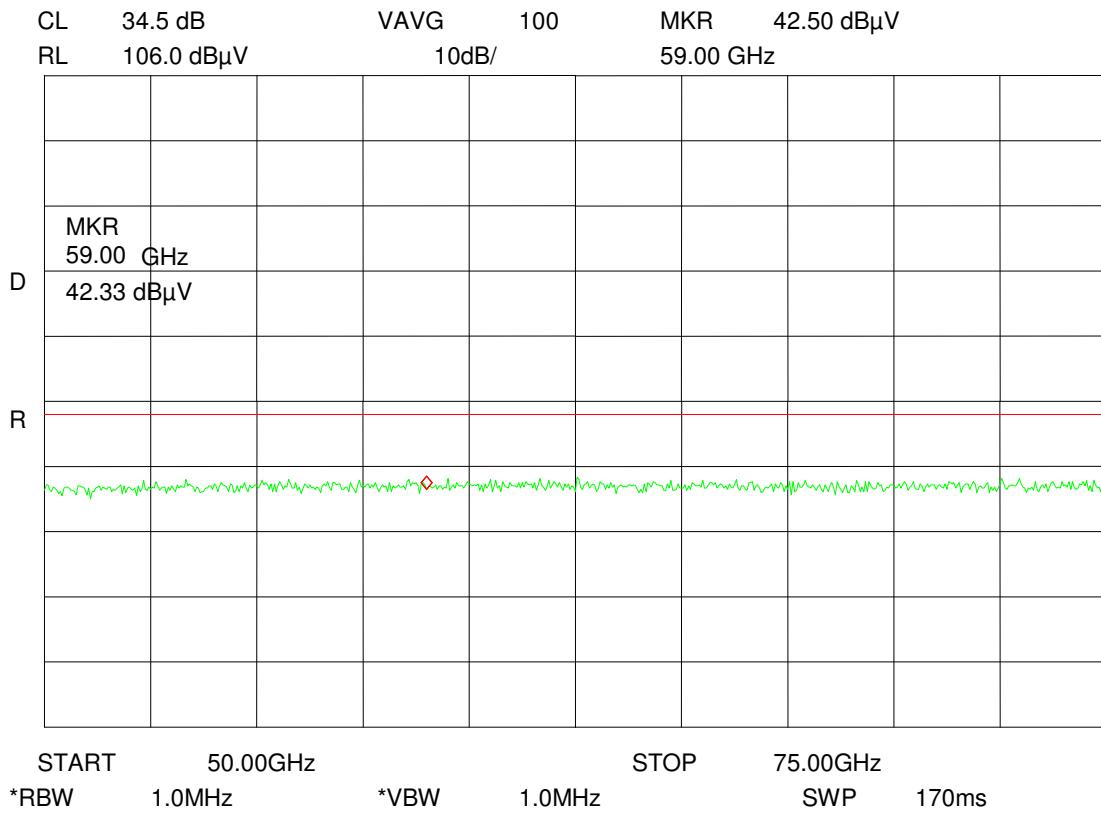


Calculation: Field strength = analyser reading + antenna factor - distance correction  
 $e [\text{dB}(\mu\text{V/m})] = u [\text{dB}(\mu\text{V})] + k [\text{dB}(1/\text{m})] - d [\text{dB}]$   
 see page 9-11

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

Limit: see page 14

Plot no.: 12

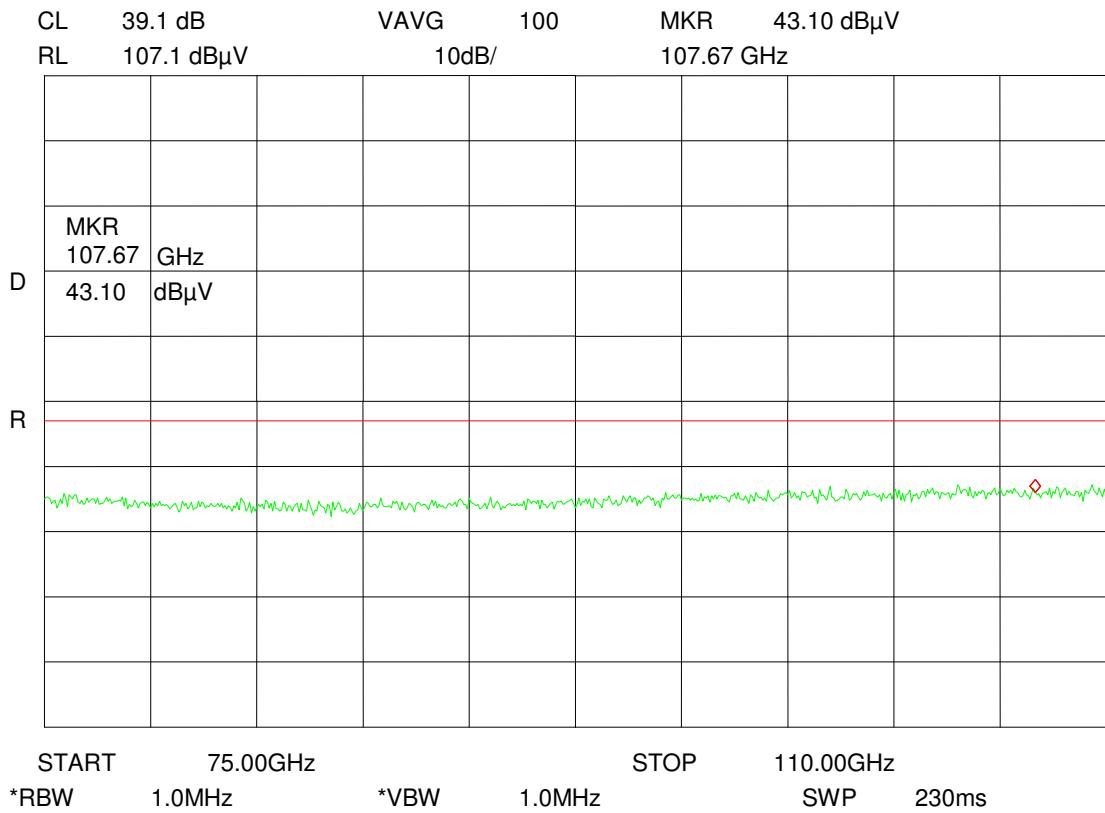


Calculation: 
$$\begin{aligned} \text{Field strength } e [\text{dB}(\mu\text{V/m})] &= \text{analyser reading } u [\text{dB}(\mu\text{V})] + k [\text{dB}(1/\text{m})] - d [\text{dB}] \\ &\quad \text{see page 9-11} \end{aligned}$$

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

Limit: see page 14

Plot no.: 13

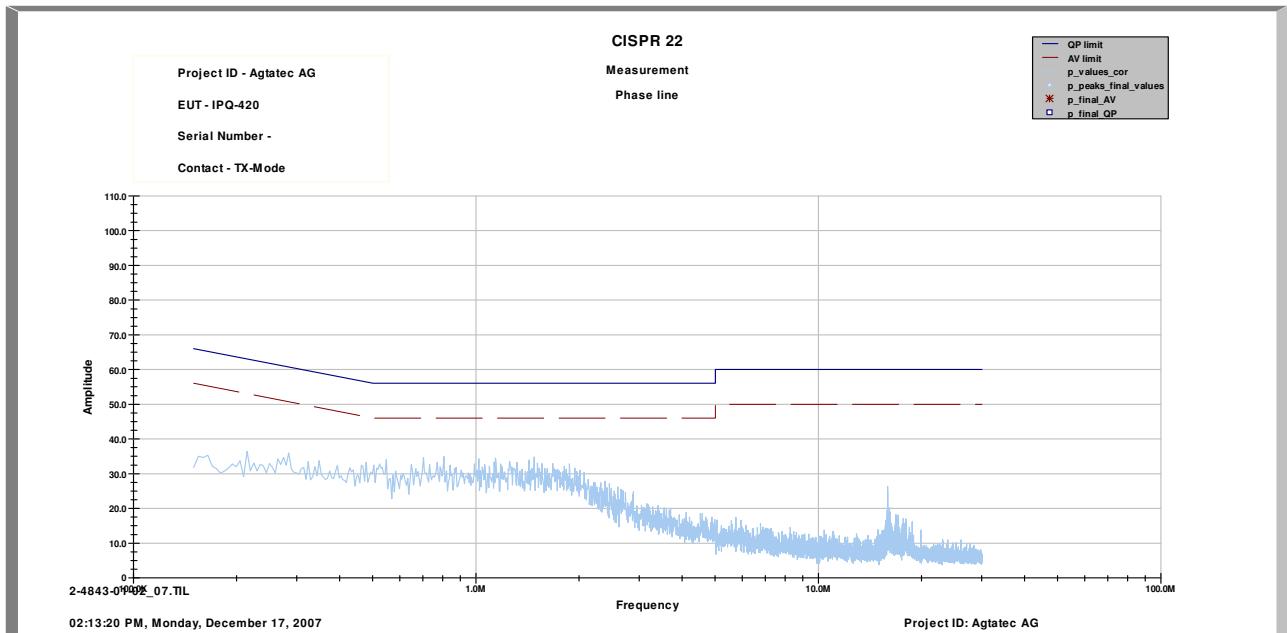
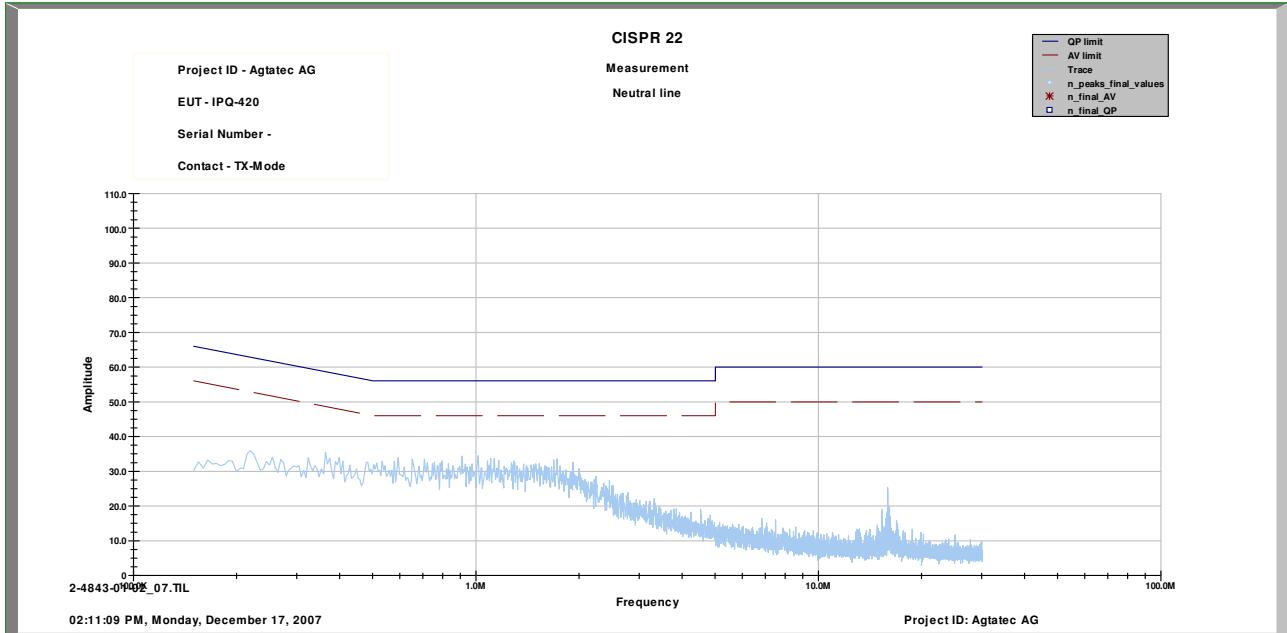


Calculation: 
$$\begin{aligned} \text{Field strength } e [\text{dB}(\mu\text{V/m})] &= \text{analyser reading } u [\text{dB}(\mu\text{V})] + k [\text{dB}(1/\text{m})] - d [\text{dB}] \\ &\quad \text{see page 9-11} \end{aligned}$$

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

Limit: see page 14

Plot no.: 14



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

Limit:      see page 15

## **4      Photographs**

Photo no.: 1

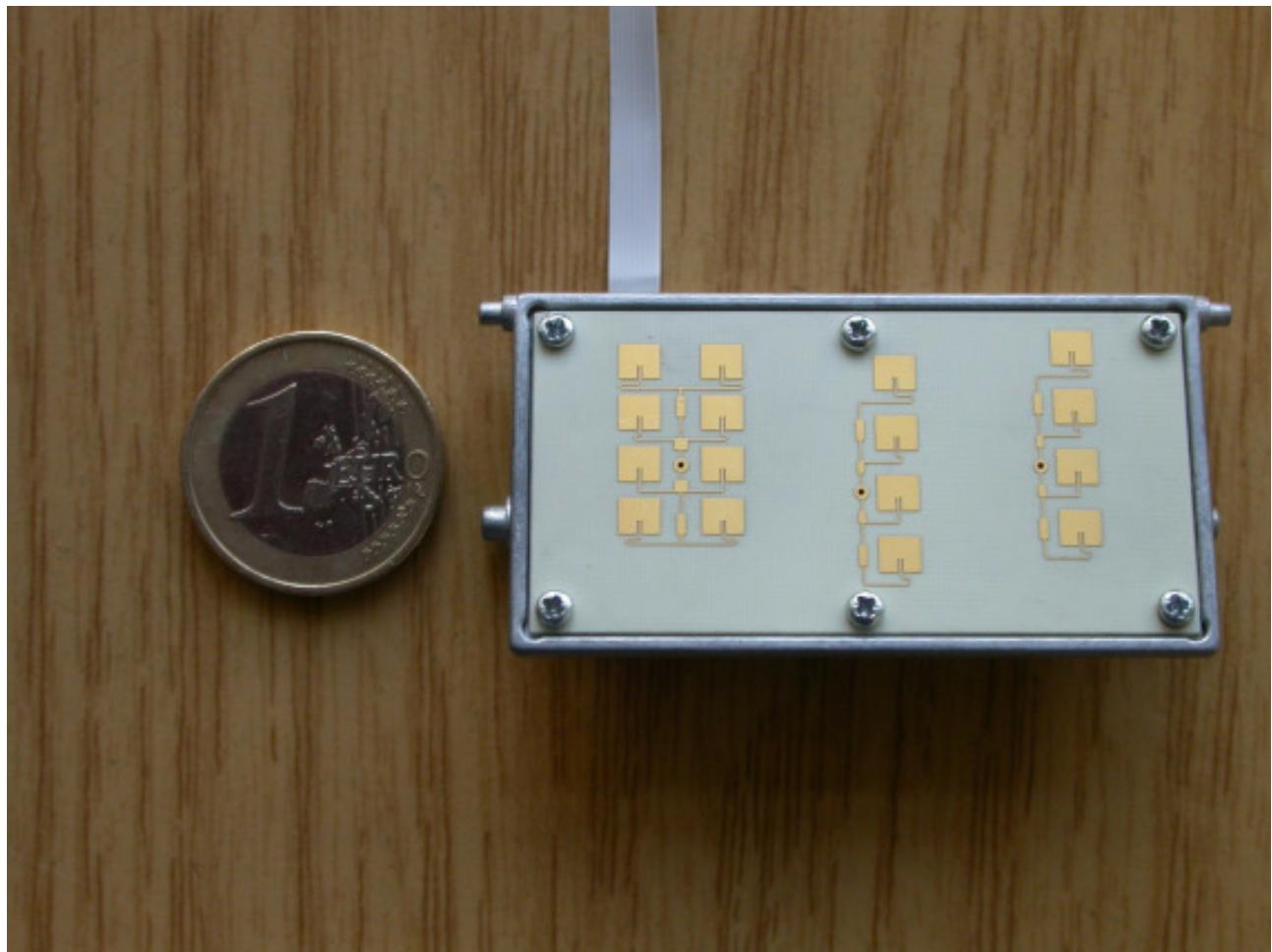


Photo no.: 2



Photo no.: 3

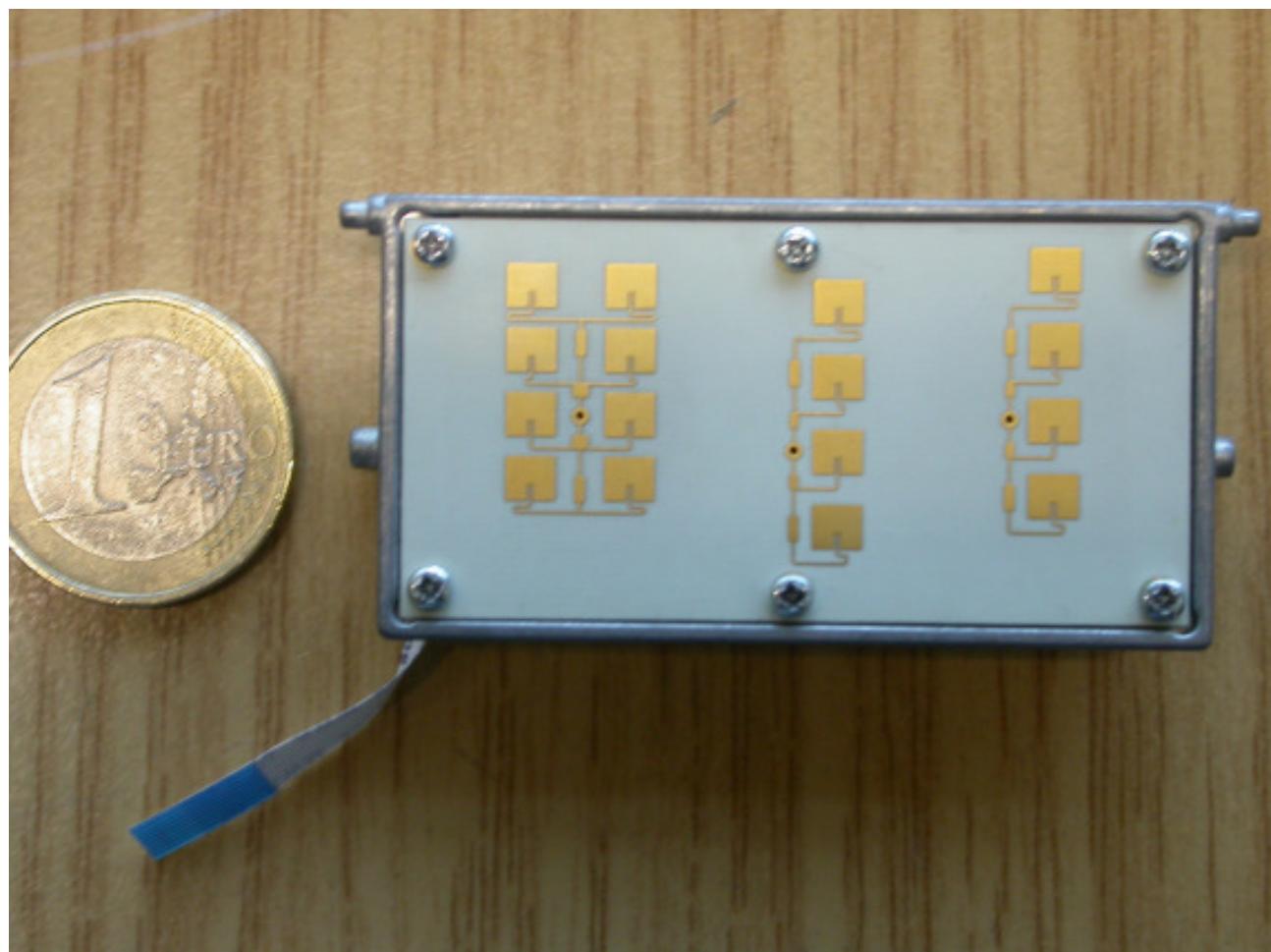


Photo no.: 4

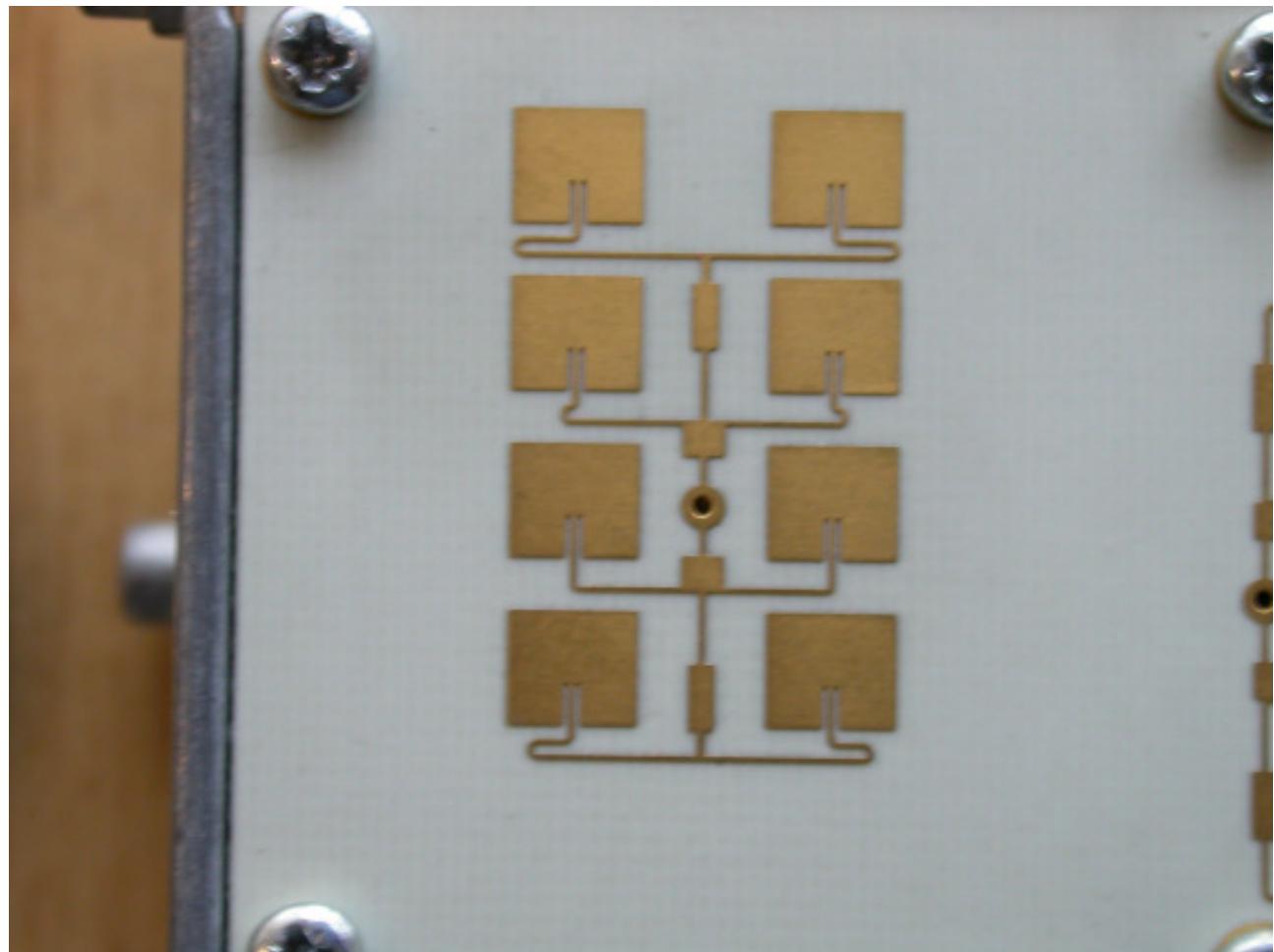


Photo no.: 5

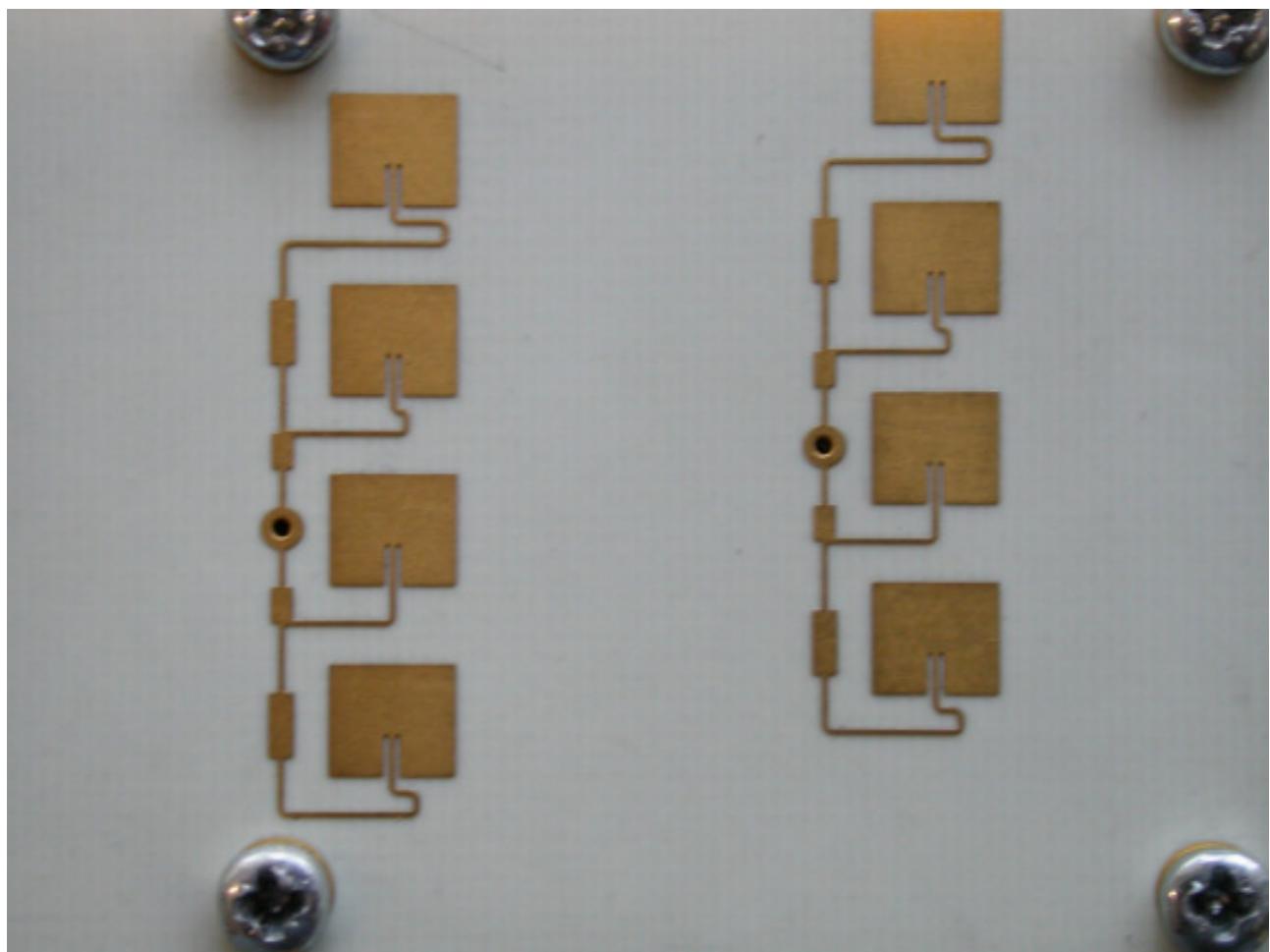


Photo no.: 6

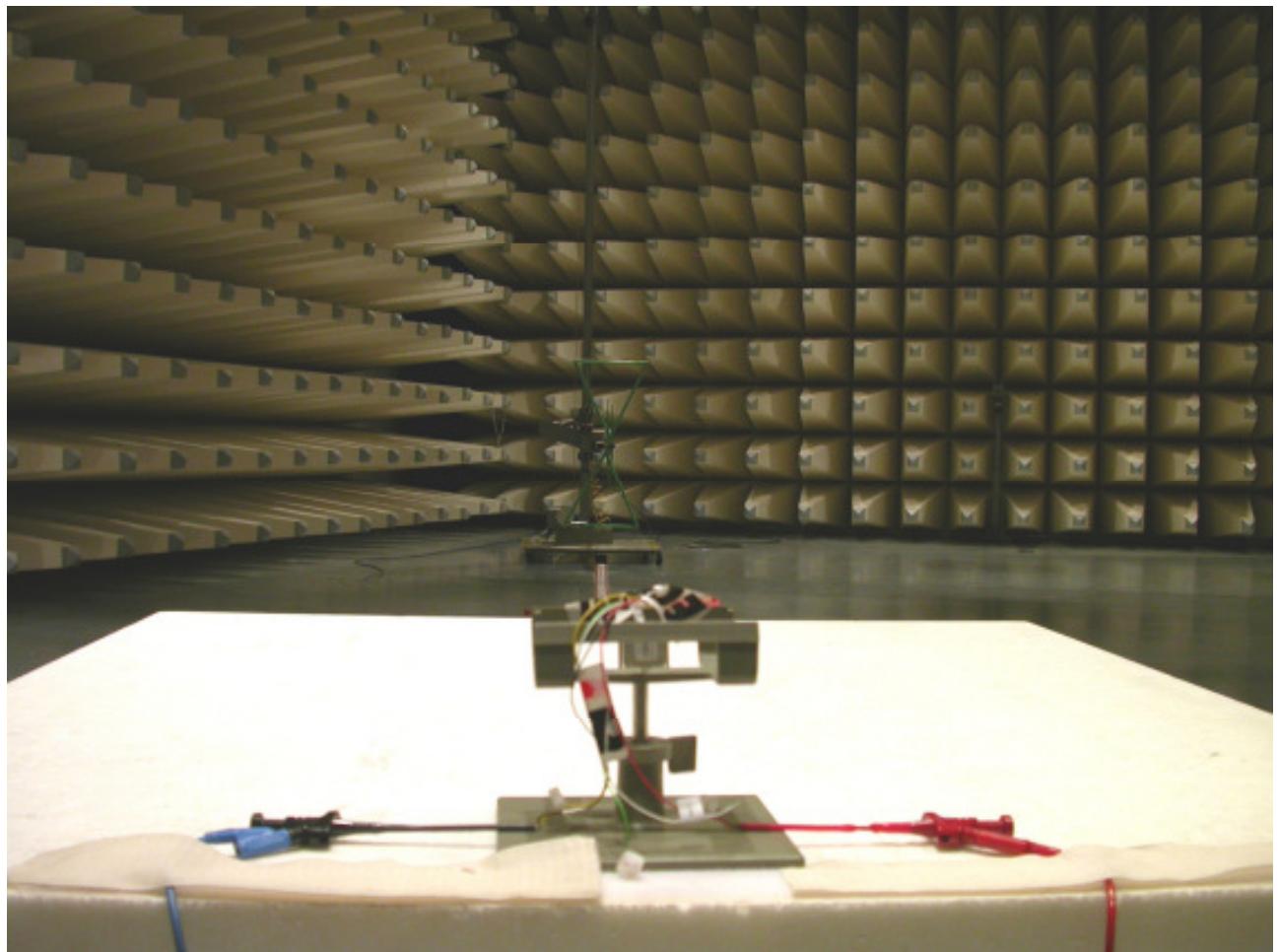


Photo no.: 7

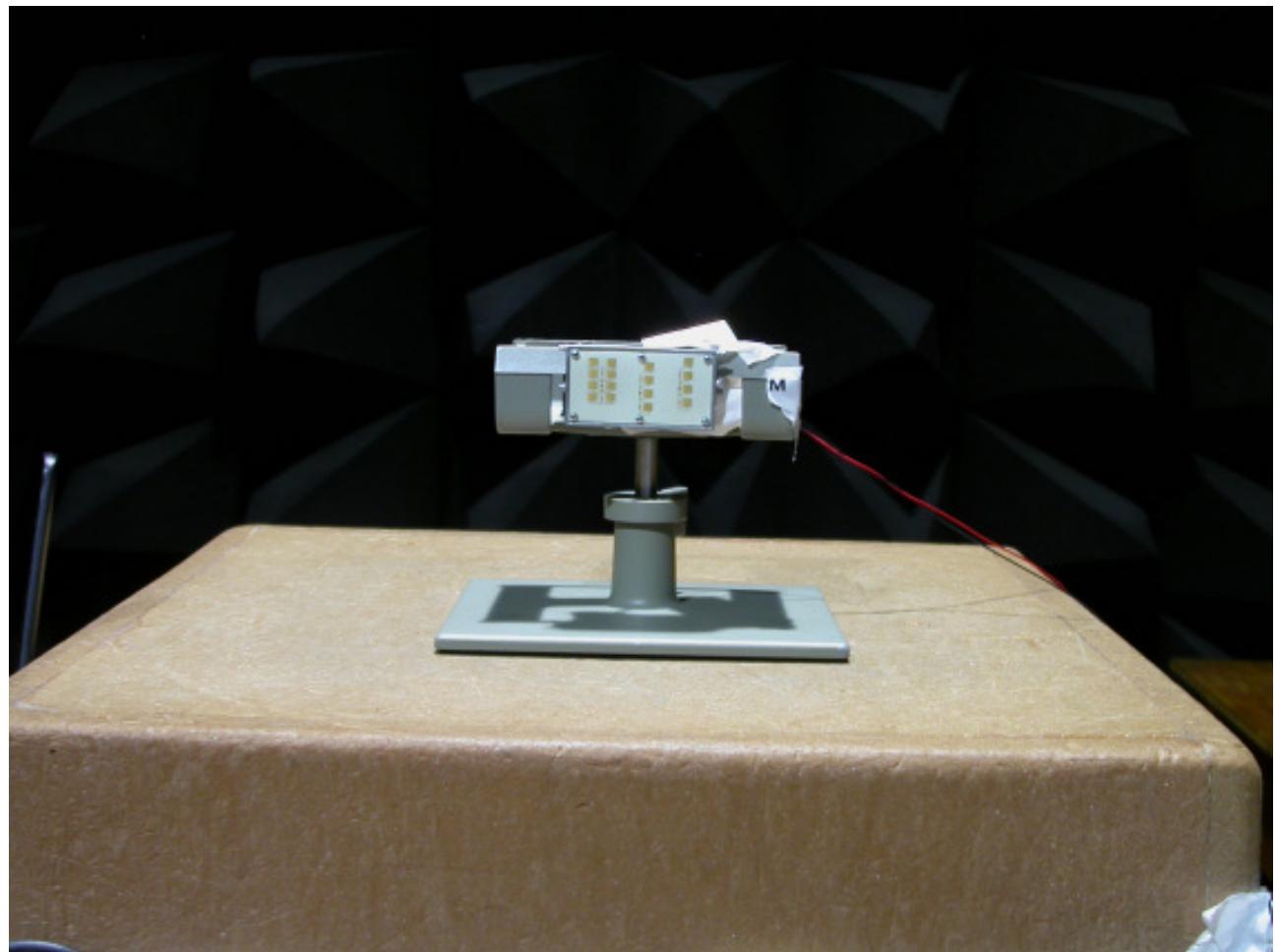


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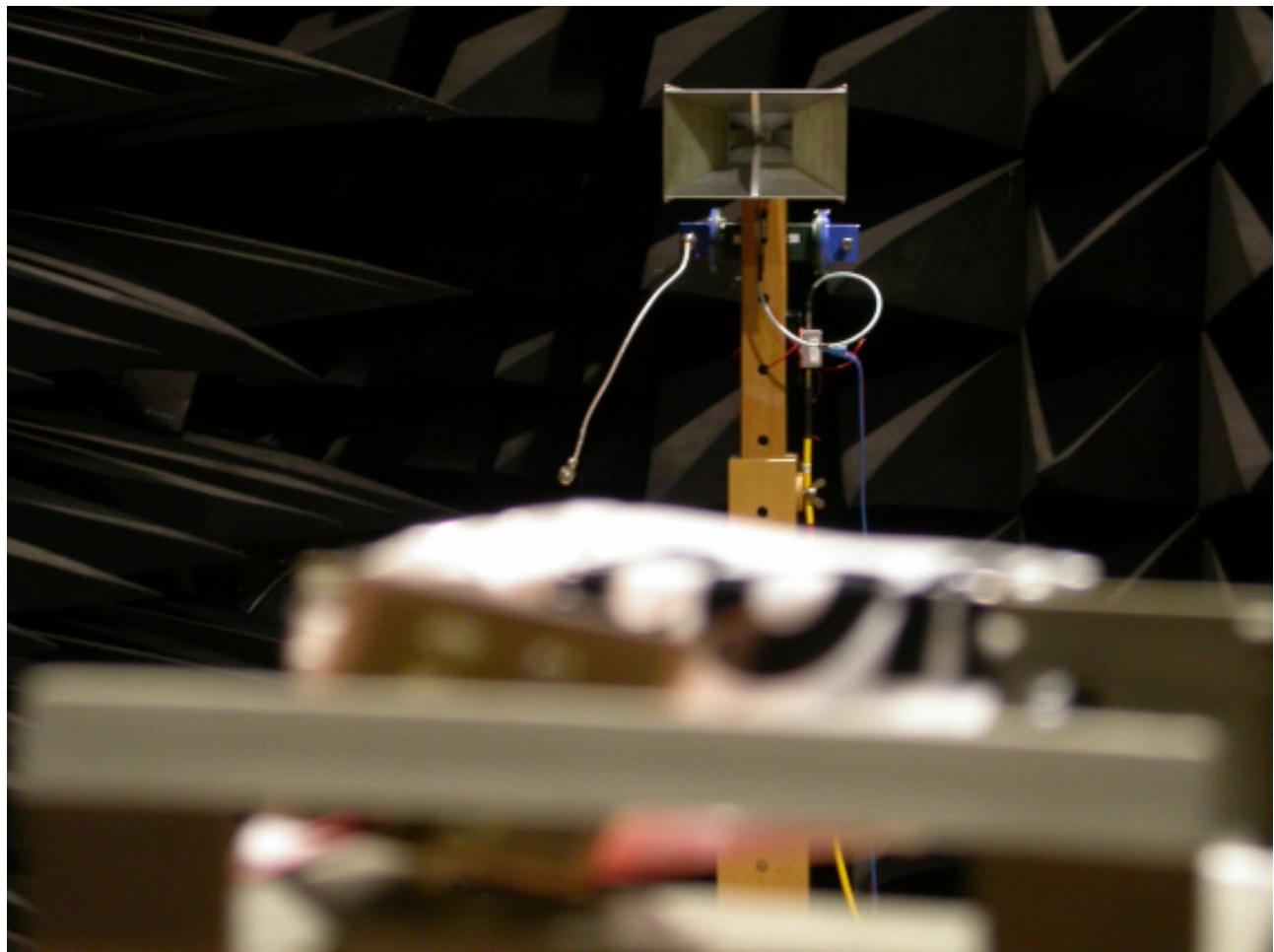


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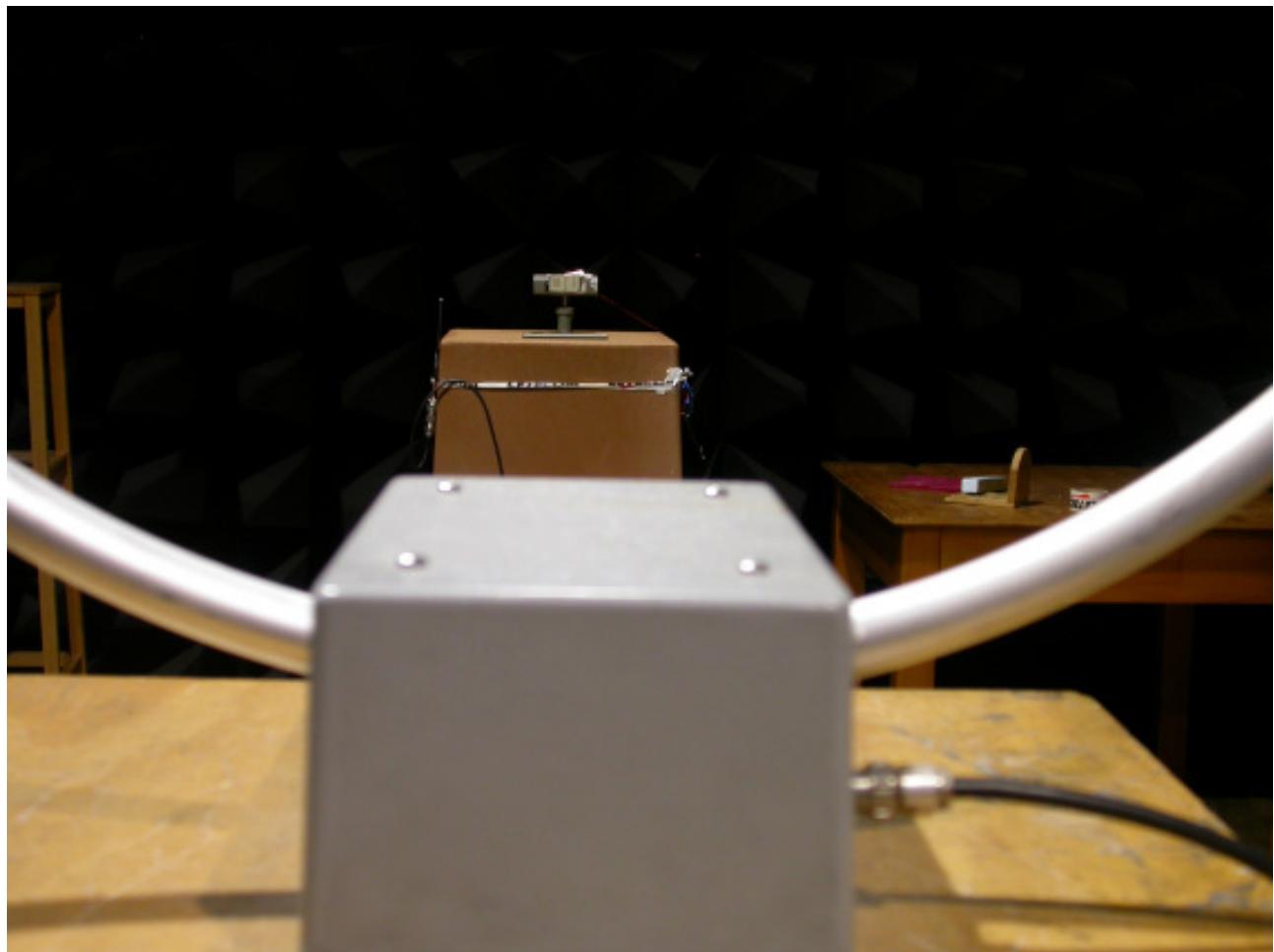


Photo no.: 7



Photo no.: 8

