

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.: 1-1034-01-03/09

Applicant: B.E.A. S.A.

Type: BEA-T1

FCC ID : G9B-210161

IC ID: 4680A-210161

Test standard: FCC Part 15.245 / RSS 210

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1 General information

1.1 Notes

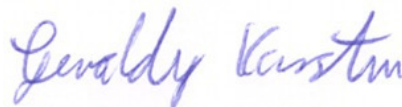
The test results of this test report relate exclusively to the test item specified in 1.5. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by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

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Tester :

Date	Name	Signature
2009-02-27	Nicolas Stamber	

Technical responsibility for area of testing:

Date	Name	Signature
2009-02-27	Karsten Gerald	



1.2 Testing laboratory

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

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P.O. Box 10 04 45
D-66004 Saarbrücken
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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 : B.E.A. S.A.
Street : 5 Allée des Noisetiers
Parc Scientifique du Sart-Tilman
Town : 4030 Angleur
Country : Belgium
Phone : +32-4-361-6565
Fax : +32-4-361-2868

Contact person

Name : Jean-Pierre LERUTH
Phone : +32-4-361-6868
E-Mail : Jean-Pierre.LERUTH@bea.be

1.4 Application details

Date of receipt of application : 2009-01-05
Date of receipt of test item : 2009-01-30
Date of test : 2009-01-30

1.5 Test item (EUT)

Description	:	Field disturbance Sensor
Type designation	:	BEA-T1
Manufacturer	:	B.E.A. S.A.
Street	:	5 Allée des Noisetiers Parc Scientifique du Sart-Tilman
Town	:	4030 Angleur
Country	:	Belgium

1.6 Technical data

Frequency range	:	24.075 GHz ... 24.175 GHz
Operational frequency	:	24.154 GHz / 24.167 GHz
Field strength PEP	:	105.9 dB μ V/m / 107.0 dB μ V/m @ 3m distance
Type of modulation	:	no modulation / pulse
Microwave modules	:	TX / RX – Module with integrated patch antenna
Normal power supply (U nom)	:	5 V DC (CW-Sample) / 15 V DC (Pulse-Sample)
Extreme DC power supply	:	-/-

1.6.1 Operation conditions

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

Purpose of operation : Motion Sensor

1.6.2 Equipment under test

BEA-T1

The EUT has two operational modes:

- CW-Mode
- Pulse-Mode

Normal operation mode is the CW-mode. The pulse mode is used to limit the supply current. This is done by pulsing the power supply, the radar module is the same. The deviation from the main frequency is caused by the time needed for the oscillator to be stable and correctly established when the device is used with pulsed power supply

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

RSS 210 Issue 7, Annex 7 - Field Disturbance Sensors Operating in the Bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10.5-10.55 GHz and 24.075-24.175 GHz

RSS-GEN Issue 2 June 2007
SECTION 4.6.1
Occupied Bandwidth

1.8 Test Report Cover Sheet

Type of equipment	:	Field disturbance sensor
Model name	:	BEA-T1
Manufacturer	:	B.E.A. S.A.
Address	:	5 Allée des Noisetiers Parc Scientifique du Sart-Tilman
City	:	4030 Angleur
Country	:	Belgium
Tested to Radio Standards Specification(RSS) No.	:	210 Issue 7
Open Area Test Site Industry Canada Number	:	IC 3463A-1
Frequency Range (or fixed frequency)	:	24.154 GHz
R F: Power in Watts	:	-/-
Field Strength (at what distance)	:	107.0 dB μ V/m @ 3m distance
Occupied Bandwidth (99% BW)	:	257 kHz (cw sample)
Type of Modulation	:	N0N (cw sample), A1D (pulse sample)
Emission Designator	:	257KN0N, (cw sample)
Antenna Information	:	Integrated antenna
Transmitter Spurious (worst case)	:	64.5 dB μ V/m in 3m (2 nd harmonic)
Receiver Spurious (worst case)	:	64.5 dB μ V/m in 3m (TX and RX operate simultaneously)
FCC ID	:	G9B-210161
IC ID	:	4680A-210161

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.

Laboratory Manager :

2009-02-27	RSC	Nicolas Stamber	
Date	Section	Name	Signature

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

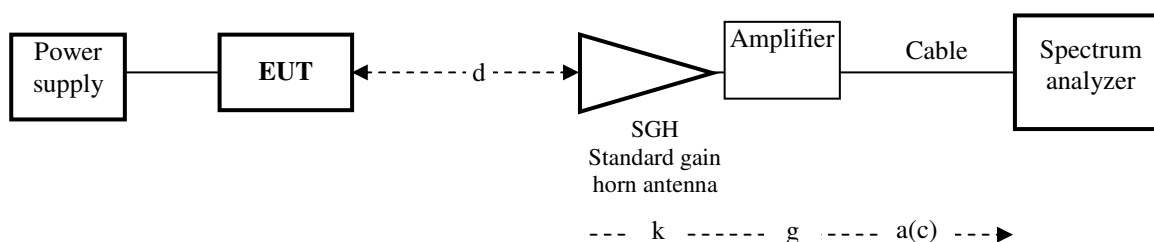
The environmental conditions are documented especially for each test.

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 radiation in the frequency range 12 GHz to 50 GHz



Frequency f [GHz]	Distance d [m]	Distance Correction dc (3 m/Xm) [dB]	Antenna factor k [dB(1/m)]	Amp.gain g [dB]	Cable loss a(c) [dB]
12.0 to 18.0	0.375	-18.0	33.97	33.4 ... 35.9	2.7 ... 2.8
18.0 to 26.0	0.375	-18.0	40.22	30.8 ... 33.4	2.8 ... 4.3
26.0 to 40.0	0.1875	-24.0	44.00	17.4 ... 23.1	4.3 ... 4.8
40.0 to 50.0	0.09375	-30.0	42.32	3.4 ... 17.4	4.8 ... 6.7

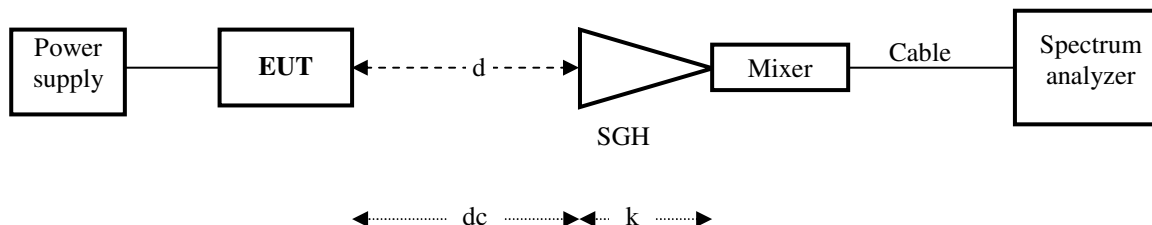
Calculation : Field strength = analyser reading + cable loss - amplifier gain + antenna factor
 $e \text{ [dB}(\mu\text{V/m)}] = u \text{ [dB}(\mu\text{V)}] + a \text{ [dB]} - g \text{ [dB]} + k \text{ [dB(1/m)]}$

Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300000916
SGH 12.0 to 18.0 GHz	narda	639	300000787
SGH 18.0 to 26.0 GHz	narda	638	300002442
SGH 26.0 to 40.0 GHz	narda	V637	300001751
SGH 40.0 to 50.0 GHz	Flann	2324-20	-/-
Amplifier 0.1 to 26.0 GHz	HP	HP 83017A	300002267
Amplifier 26.0 to 50.0 GHz	Farran Technology	-/-	-/-
DC Power supply	HP	HP 6038A	300001174
RF-cable	Huber & Suhner	div.	-/-

Measurement uncertainties

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

2.4.3 Field strength and spurious radiation in the frequency range 50 GHz to 110 GHz



Frequency range [GHz]	Distance d [m]	Distance correction dc (3 m/Xm) [dB]	Antenna factor k [dB 1/m]
50.0 ... 75.0	0.125	-27.60	40.7
75.0 ... 110.0	0.125	-27.60	45.1

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

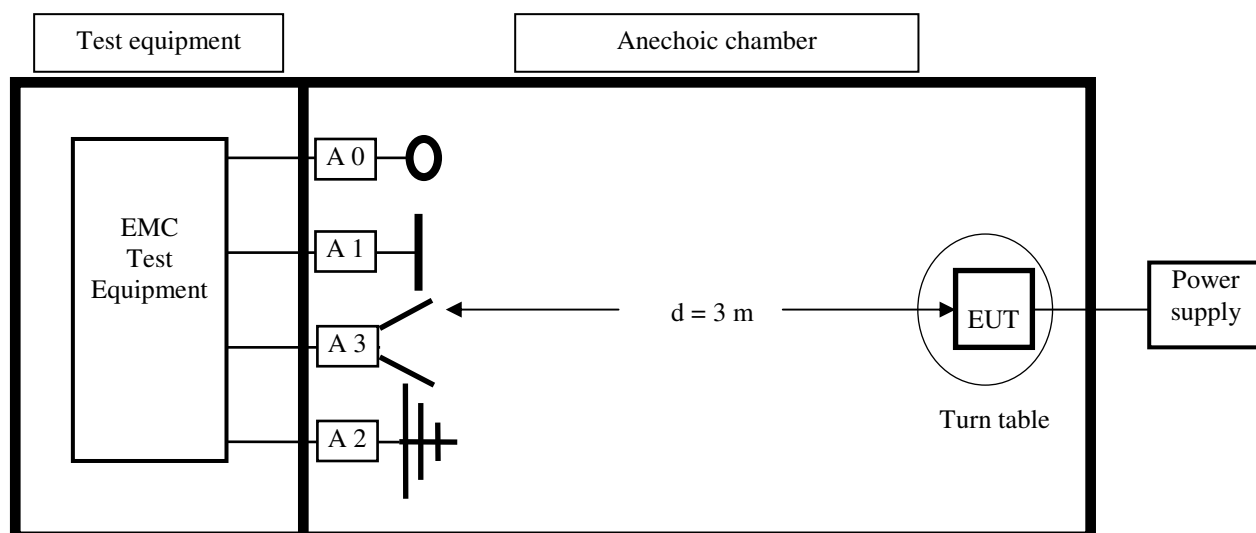
Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300000916
Power supply	HP	HP 6038A	300001174
SGH 50 ... 75 GHz	Thomson	COR 50_75	300000813
Mixer 50 ... 75 GHz	HP	11970V	300000781n
SGH 75 ... 110 GHz	Thomson	COR 75_110	300000798b
Mixer 75 ... 110 GHz	HP	11970W	300000781c

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

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

Set-up for radiated measurements



No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
Radiated emission in chamber A					
A-1	Spectrum Analyzer	Rohde & Schwarz	ESU26	100037	300003555
A-2	Signal Generator	Rohde & Schwarz	SMR20B11	1104.0002.20	300003593
A-3	RF System Panel	Rohde & Schwarz	TS RSP	---	300003556
A-4	Relais Matrix	Rohde & Schwarz	PSN	860673/009	300001385
A-5	Horn Antenna	EMCO	3115	9709-5290	300000212
A-6	Bilog.-Log. Antenna	Schwarzbeck	VULB 9163	02/00	300003696
A-7	Notch Filter GSM 900	Wainwright	WRCD 901.9/903.1EE	9	---
A-8	Notch Filter GSM 1800	Wainwright	WRCD 1747/1748-5EE	1	---
A-9	Notch Filter GSM 1900	Wainwright	WRCB 1879.5/1880.5EE	9	---
A-10	Notch Filter GSM 850	Wainwright	WRCT 837-0.2/50-8EE	1	---
A-11	Notch Filter UMTS	Wainwright	WRCD 1800/2000-0.2/40-5EEK	2	---
A-12	Notch Filter ISM 2400	Wainwright	WRCG 2400/ 2483-2375/ 2505-50/10SS	26	---
A-13	High Pass Filter 1.1 GHz	Wainwright	WHK 1.1/15G-10SS	---	---
A-14	High Pass Filter 2.6 GHz	Wainwright	WHKX 2.6/18G-12SS	---	---
A-15	High Pass Filter 7 GHz	Wainwright	WHKX 7.0/18G-8SS	---	---
A-14	Amplifier	Miteq	AFS4-00201800-15-10P-6	US42-0050 2650-28-5A	300003204
A-16	Controller	Inn co	CO 2000	2020507	---
A-17	DC Power Supply	Hewlet Packard	HP6632A	---	300000924
A-18	Computer	F+W	---	---	300003303

Measurement uncertainties

Performance	Measurement uncertainty
Input power (DC)	± 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 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 C63.2-1987 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 analyzers 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 12 GHz are carried out in a shielded anechoic test chamber. The measurement distance is 3.0 m.

In the frequency range 12 GHz to 110 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 : 23 °C
 Relative humidity : 55 %

TRANSMITTER PARAMETERS

SECTION 15.245
 SECTION RSS 210 ANNEX 7

Fundamental frequency

Microwave module :

Test condition t = 23.0 ° C	TRANSMITTER FIELD STRENGTH			
EUT operating: TX on and RX on DC power supply	Frequency f [GHz]	Field strength e [dBμV/m] @ 3 m	Field strength E [V/m] @ 3 m	See plot no.:
CW-Mode U DC = 5 V	24.180	105.91	0.20	1
Pulse-Mode U DC = 15 V	24.167	107.03	0.22	2

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

LIMITS:

SECTION 15.245
 SECTION RSS 210 ANNEX 7

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
Spurious emissions	3	54.0 or -50dBc	0.5

Verdict : Field strength limits are kept

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
 SECTION RSS 210 ANNEX 7

Microwave module : BEA-T1 (CW-Mode)

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	3
0.030 to 1.0 (h + v)	noise	n.a.	< Limit	4a
1.0 to 12.0 (h + v)	noise	n.a.	< Limit	5a
12.0 to 18.0 (h + v)	noise	< 32.9	< Limit	6a
18.0 to 26.0 (h + v)	noise + carrier	< 43.5	< Limit	7a
26.0 to 40.0 (h + v)	noise	< 51.2	< Limit	8a
40.0 to 50.0 (h + v)	noise [+ 48.25 (2 nd Harmonic)]	< 50.1 [64.5]	< Limit	9a/10a
50.0 to 75.0 (h + v)	noise	< 50.7	< Limit	11a
75.0 to 110.0 (h + v)	noise	< 52.8	< Limit	12a

LIMITS:

SECTION 15.205 / 15.209 / 15.245
 SECTION RSS 210 ANNEX 7

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) (or -50 dBc)	500
> 960.0	3	74.0 (PK)	5000
Harmonics	3	88.0	25000

Verdict : Field strength limits are kept

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
 SECTION RSS 210 ANNEX 7

Microwave module : BEA-T1 (Pulse-Mode)

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	3
0.030 to 1.0 (h + v)	noise	n.a.	< Limit	4b
1.0 to 12.0 (h + v)	noise	n.a.	< Limit	5b
12.0 to 18.0 (h + v)	noise	< 33.1	< Limit	6b
18.0 to 26.0 (h + v)	noise + carrier	< 43.6	< Limit	7b
26.0 to 40.0 (h + v)	noise	< 50.9	< Limit	8b
40.0 to 50.0 (h + v)	noise [+ 48.25 (2 nd Harmonic)]	< 50.0 [63.8]	< Limit	9b/10b
50.0 to 75.0 (h + v)	noise	< 46.7	< Limit	11b
75.0 to 110.0 (h + v)	noise	< 52.8	< Limit	12b

LIMITS:

SECTION 15.205 / 15.209 / 15.245
 SECTION RSS 210 ANNEX 7

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) (or -50 dBc)	500
> 960.0	3	74.0 (PK)	5000
Harmonics	3	88.0	25000

Verdict : Field strength limits are kept

SECTION RSS-GEN 4.6.1

Microwave module :BEA-T1

Test condition t = 23.0 ° C	Emission Bandwidth		
EUT operating: TX on and RX on DC power supply	Frequency f [GHz]	Emission Bandwidth [MHz]	See plot no.:
CW-Mode U DC = 5 V	24.180	0.880	13a
Pulse-Mode U DC = 15 V	24.167	21.3	13b

LIMITS: SECTION RSS-GEN 4.6.1

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The span between the two recorded frequencies is the occupied bandwidth.

Verdict :	Bandwidth limits are kept
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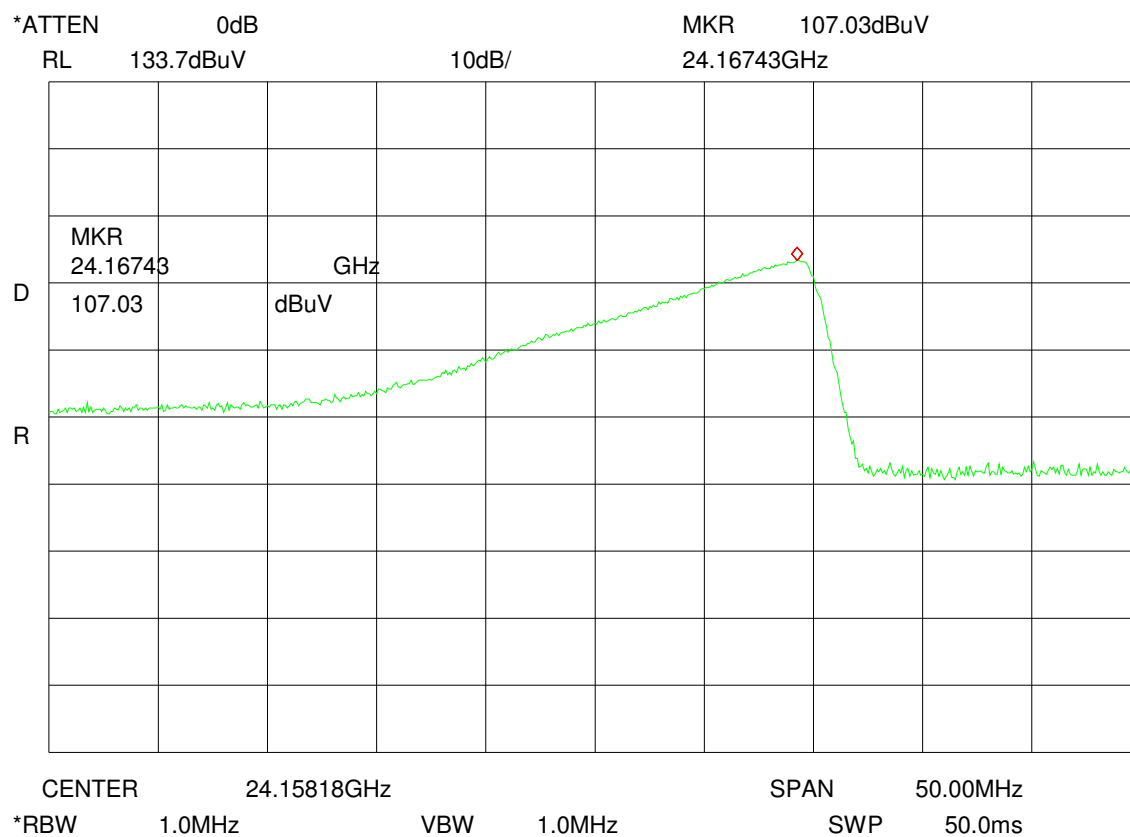
ATTN 10dB
 RL 151.6dBuV
 10dB/
 MKR 105.91dBuV
 24.17955GHz

D
 MKR
 24.17955
 GHz
 105.91
 dBuV

R

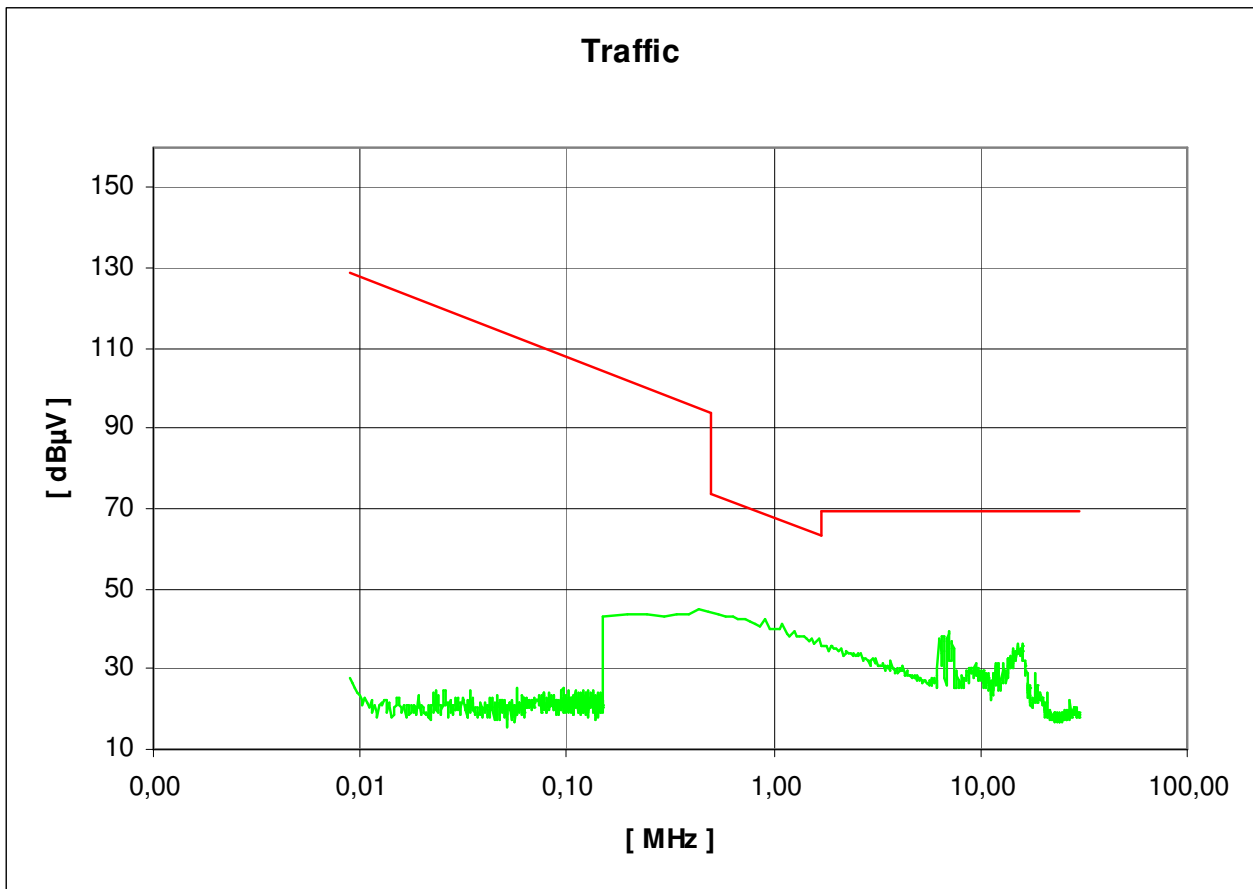
CENTER 24.17907GHz
 SPAN 10.00MHz
 *RBW 100kHz
 VBW 100kHz
 SWP 50.0ms

Plot 2:

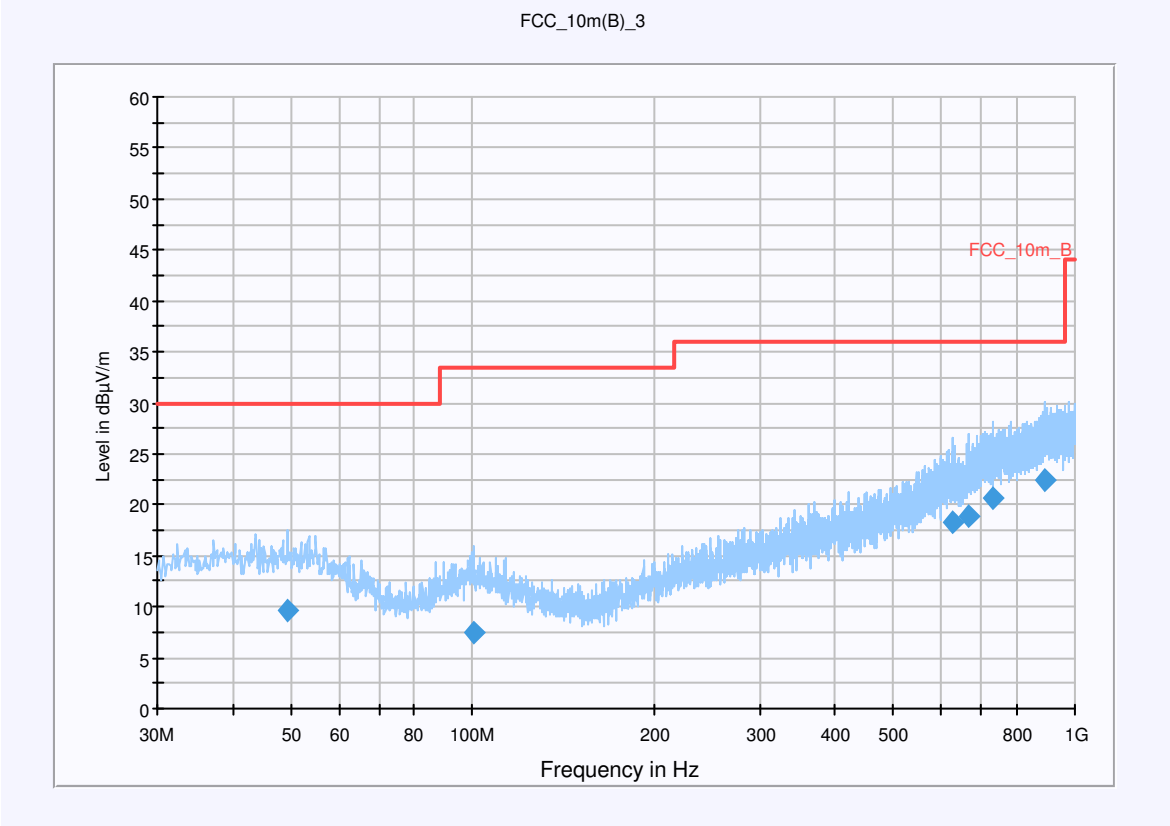


Normal operation mode is the CW-mode. The pulse mode is used to limit the supply current. This is done by pulsing the power supply, the radar module is the same. The deviation from the main frequency is caused by the time needed for the oscillator to be stable and correctly established when the device is used with pulsed power supply

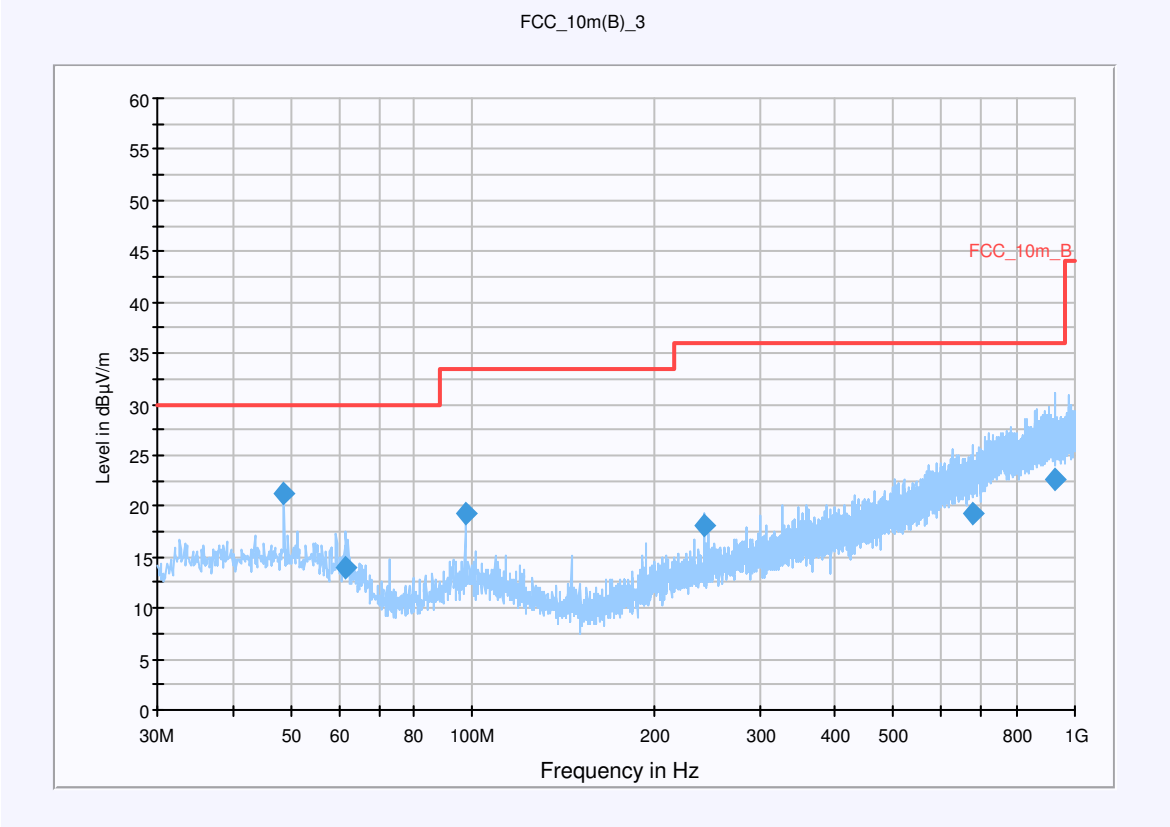
Plot 3:



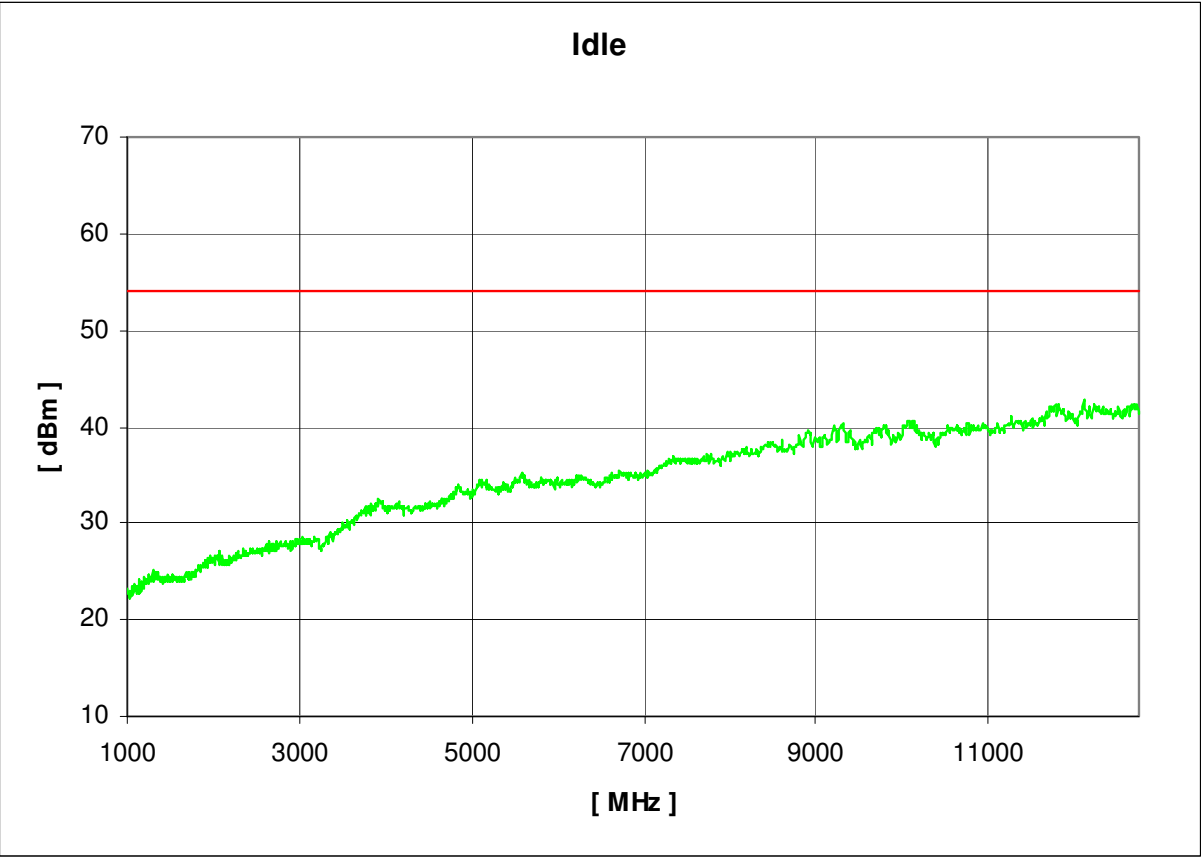
Plot 4a:



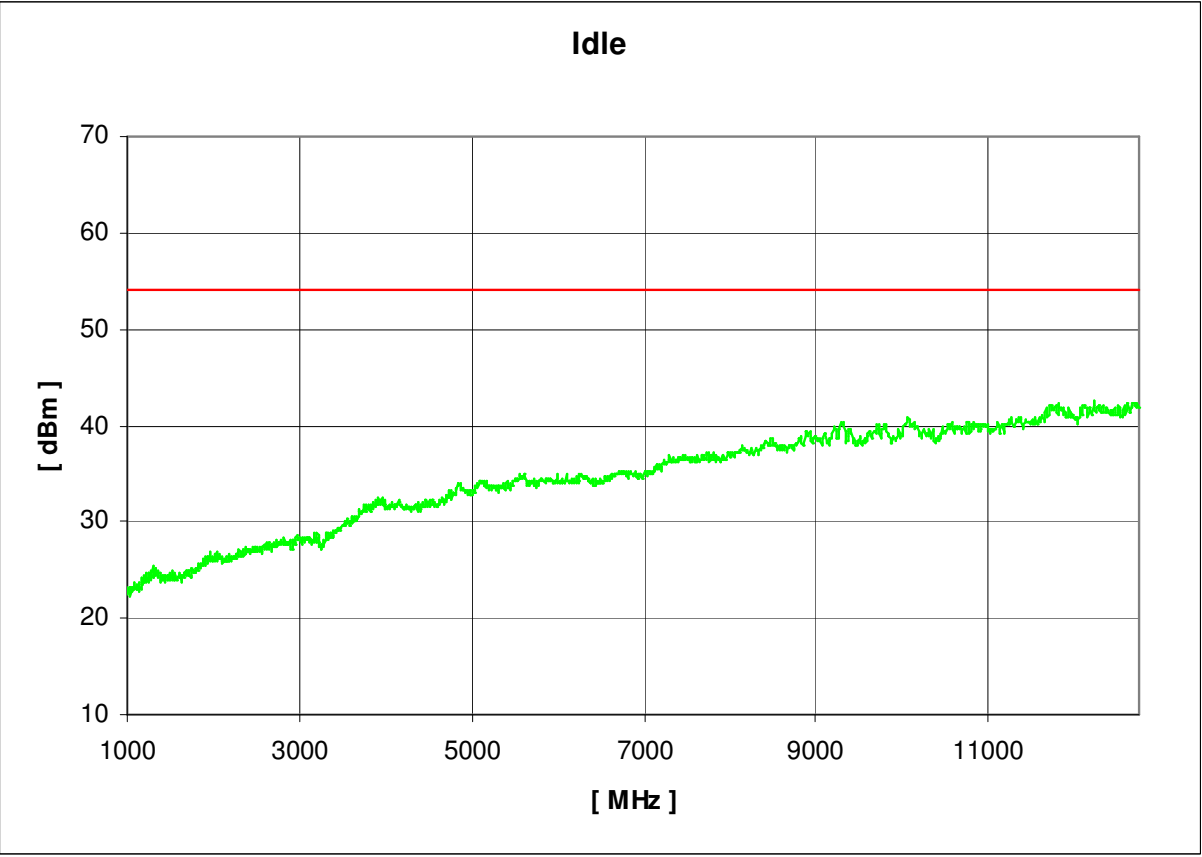
Plot 4b:



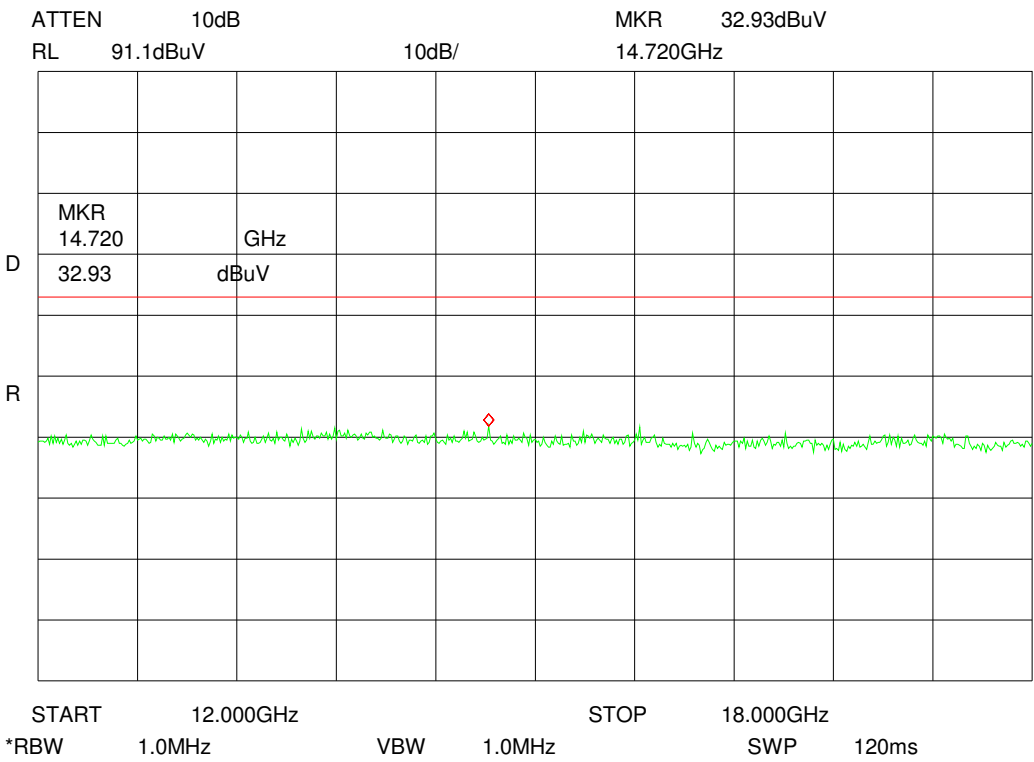
Plot 5a:



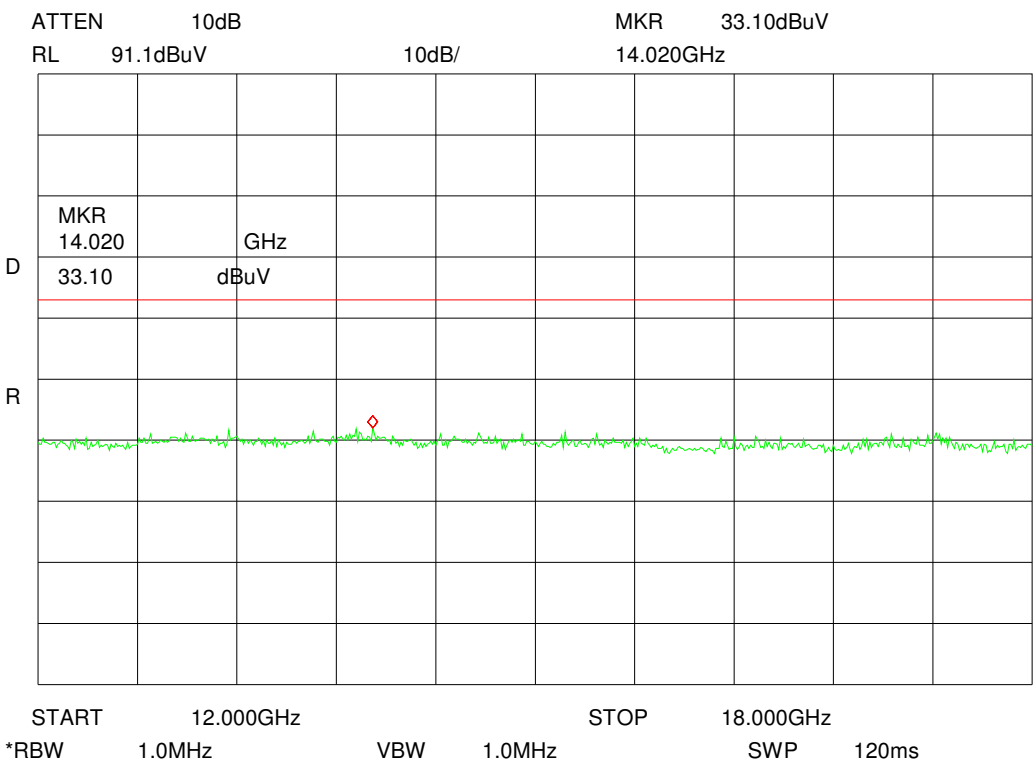
Plot 5b:



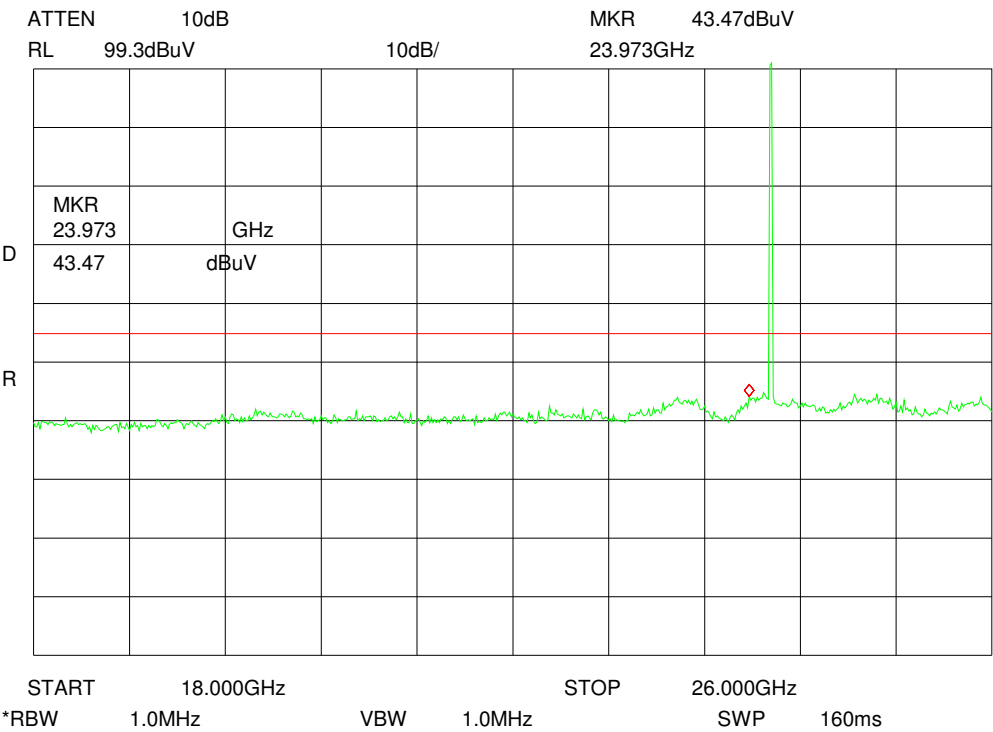
Plot 6a:



Plot 6b:

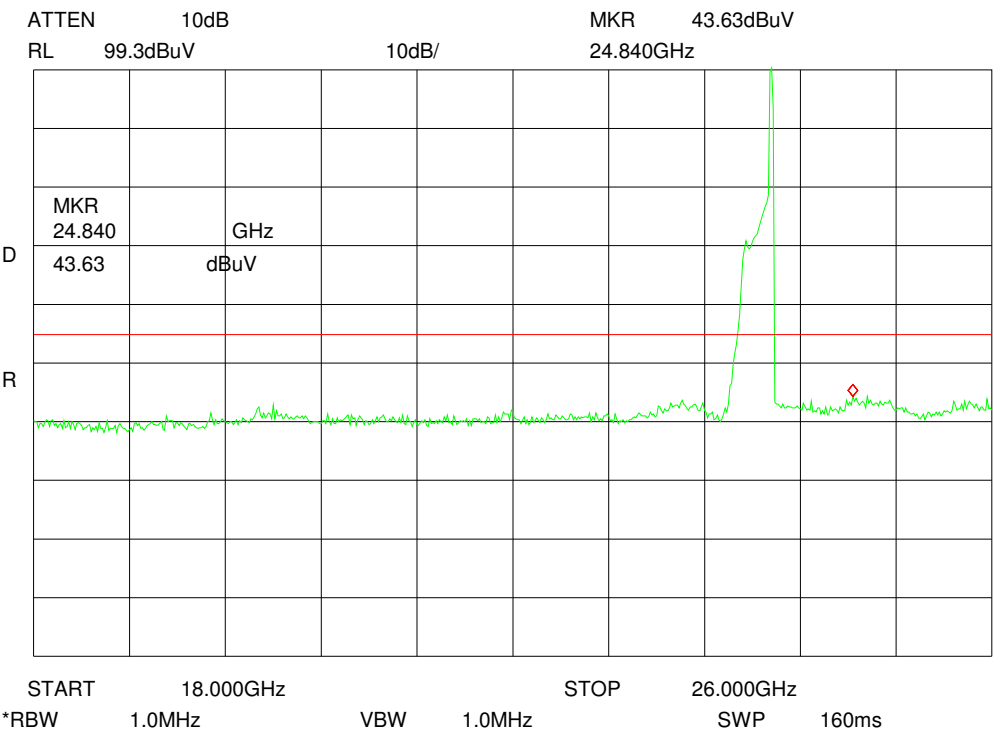


Plot 7a:

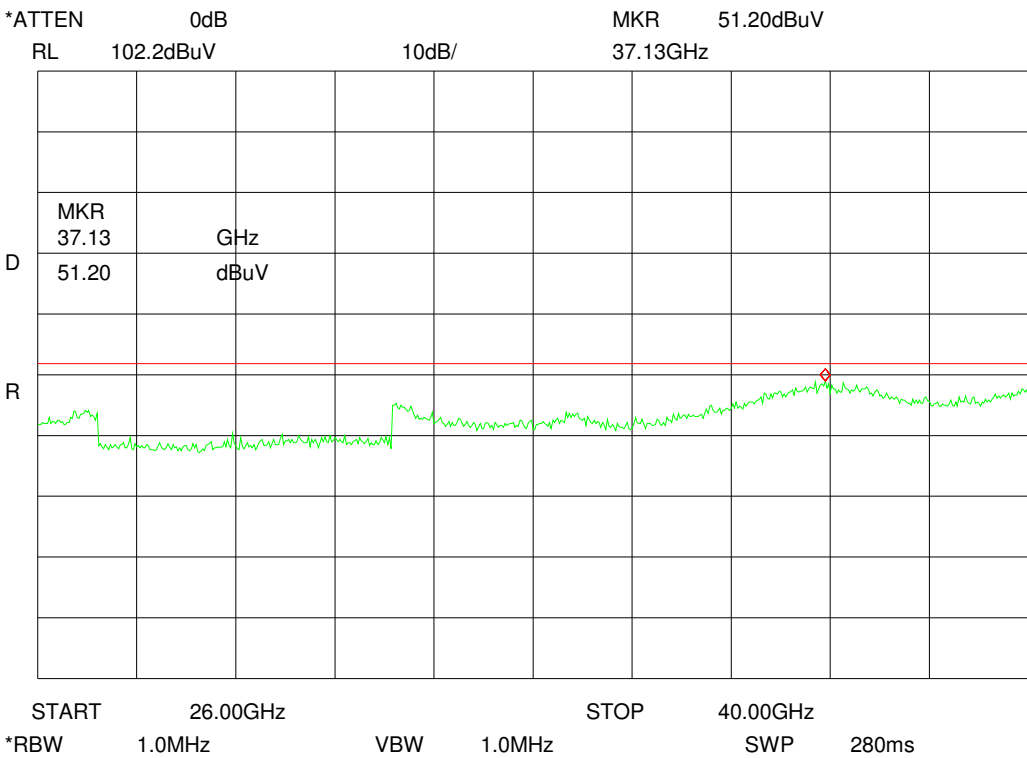


The peak at 24.1 GHz shows the carrier.

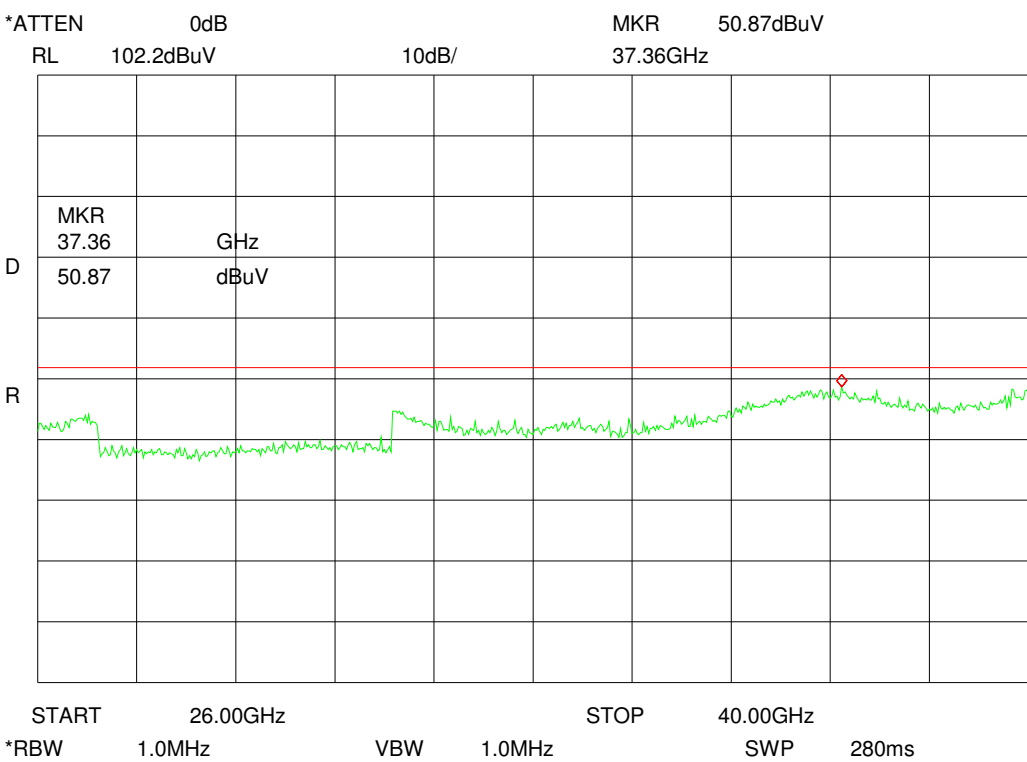
Plot 7b:



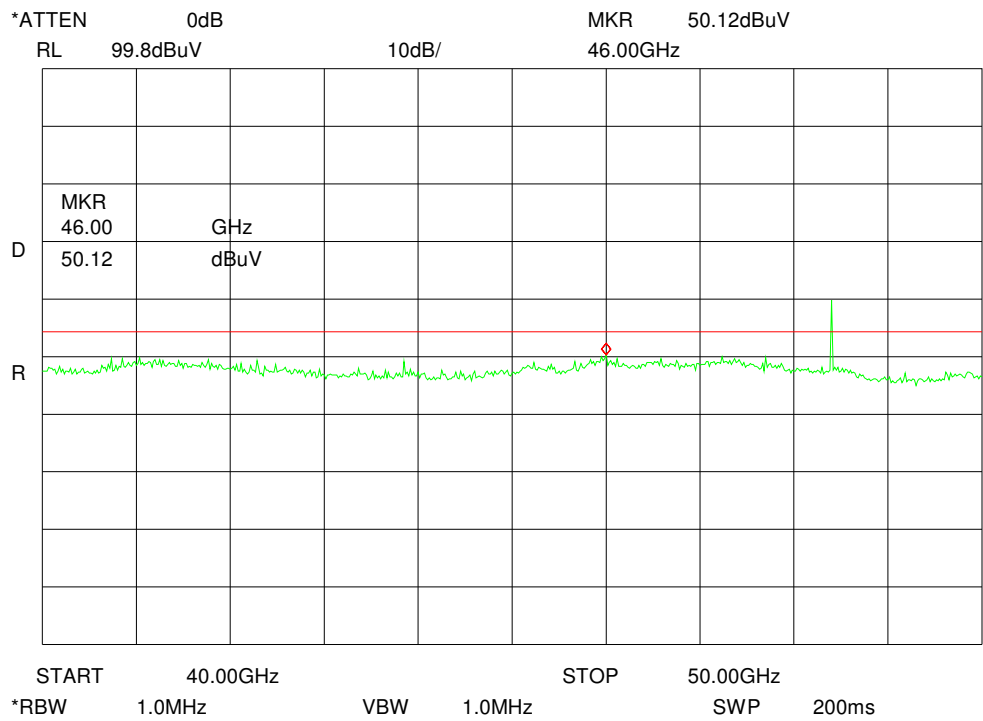
Plot 8a:



Plot 8b:

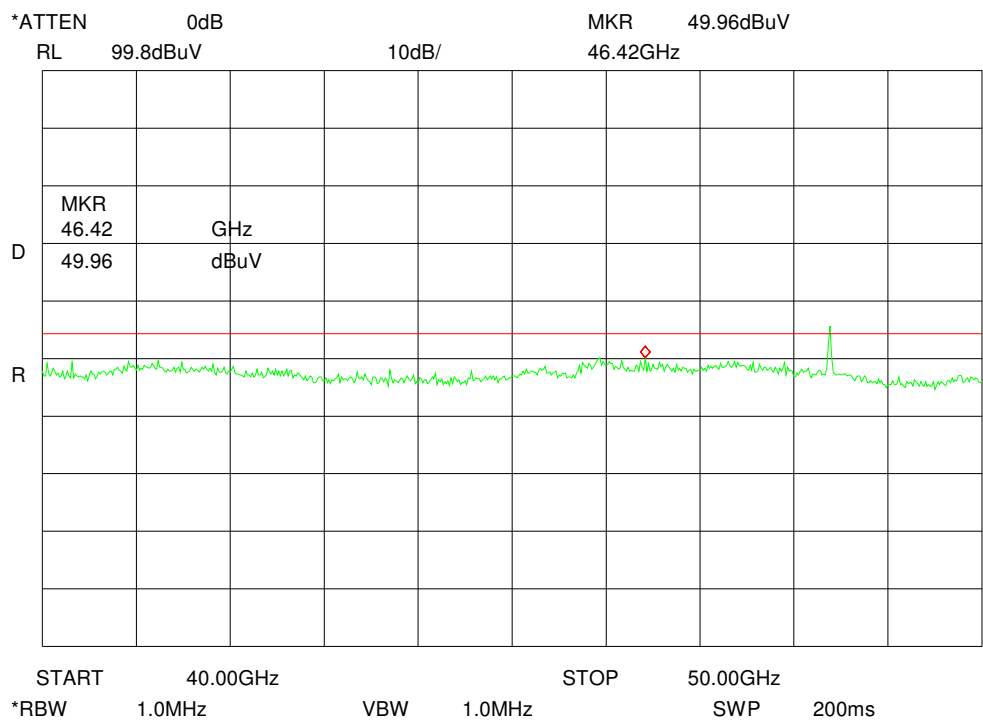


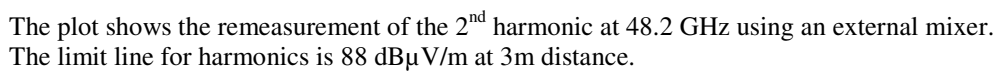
Plot 9a:



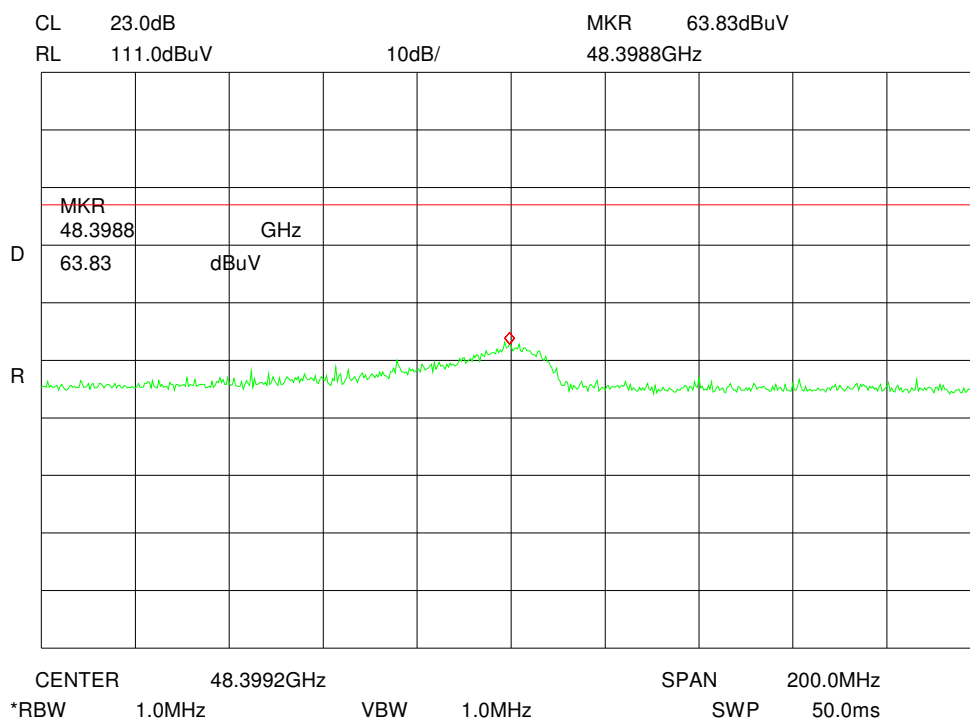
The peak at 48.25 GHz is the 2nd harmonic. The limit for harmonics is 88 dB μ V/m at 3m distance. Measurement is pass (see plots on the next page)

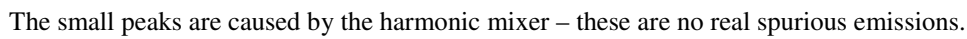
Plot 9b:



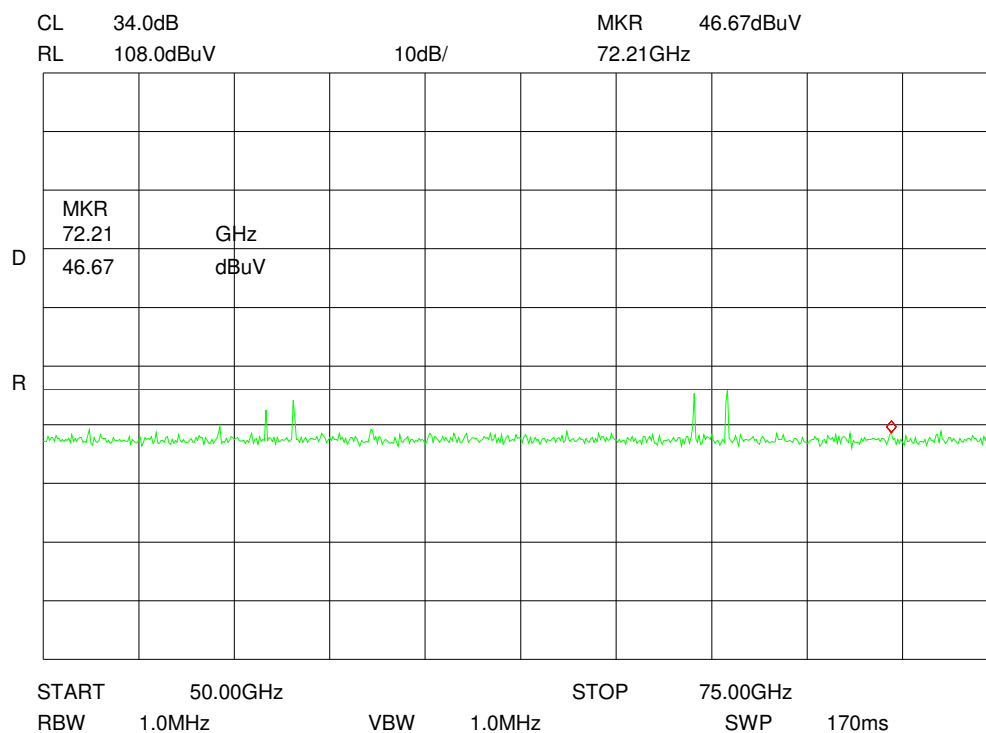


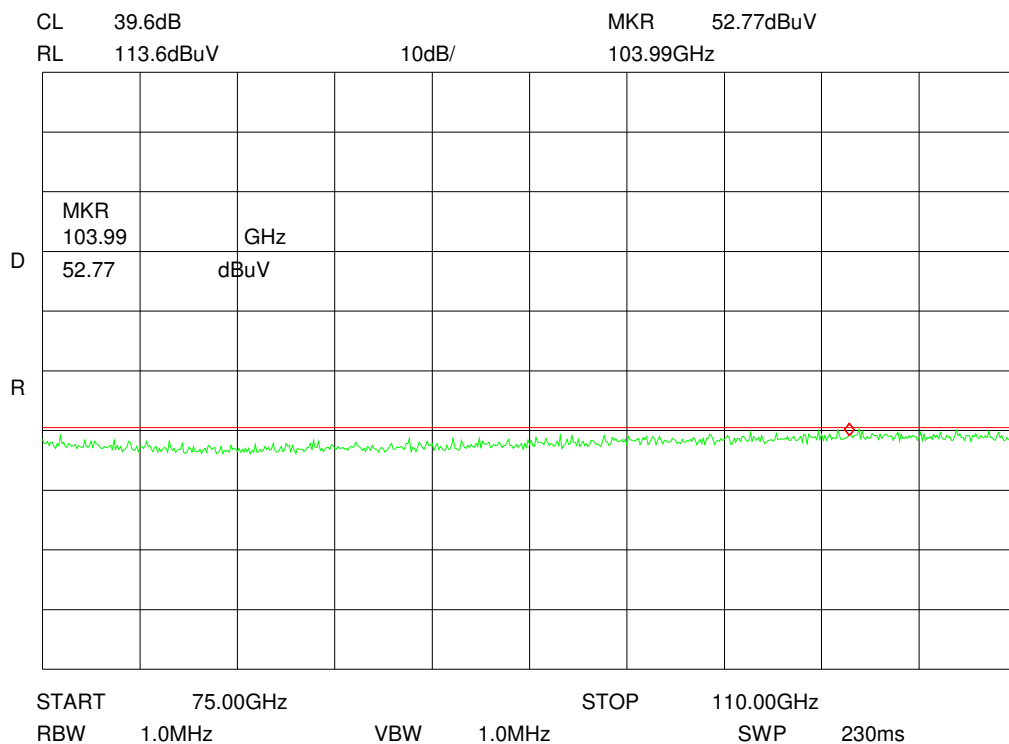
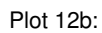
Plot 10b:



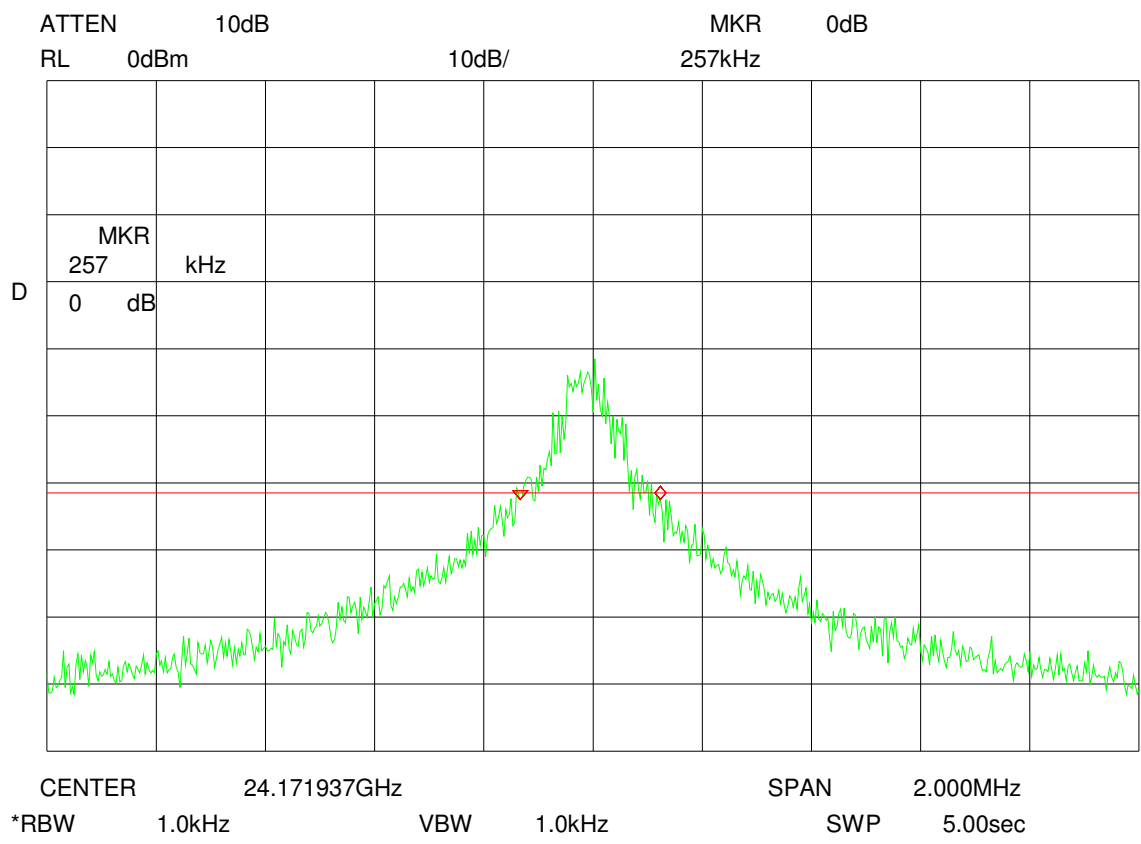


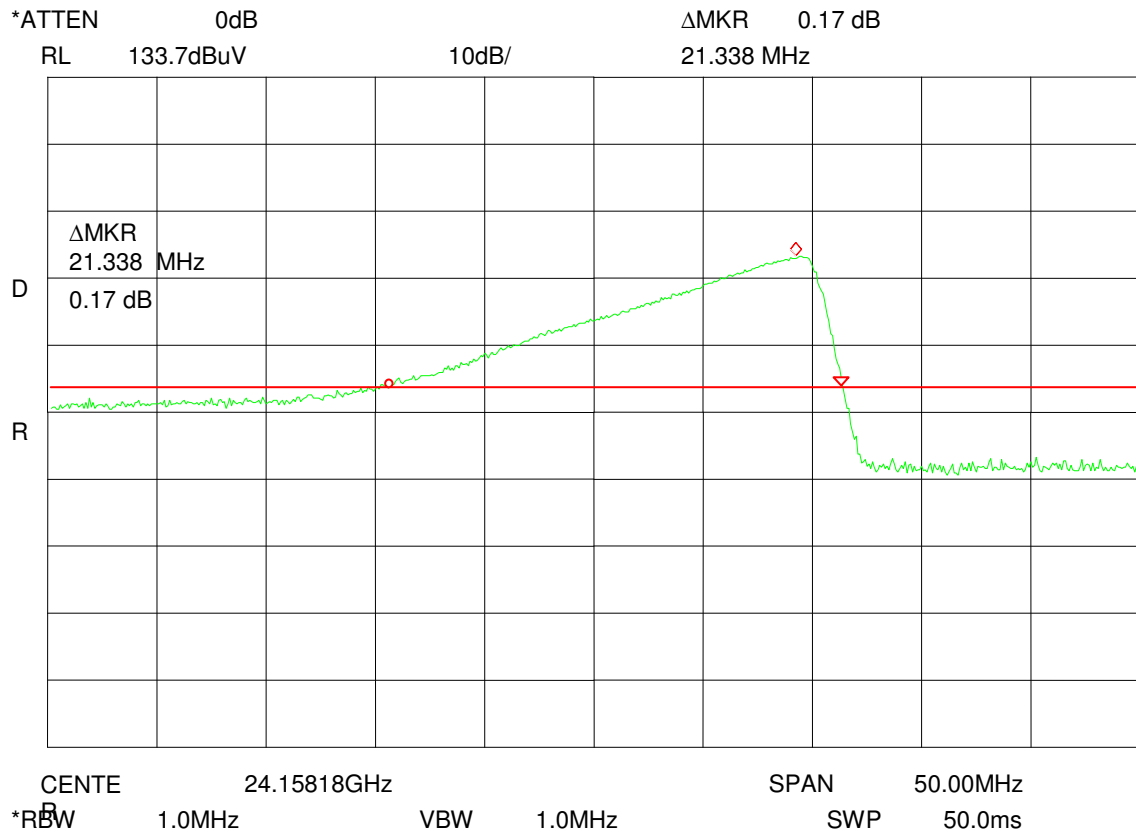
Plot 11b:





Plot 13a:





Photographs

Photo no.: 1

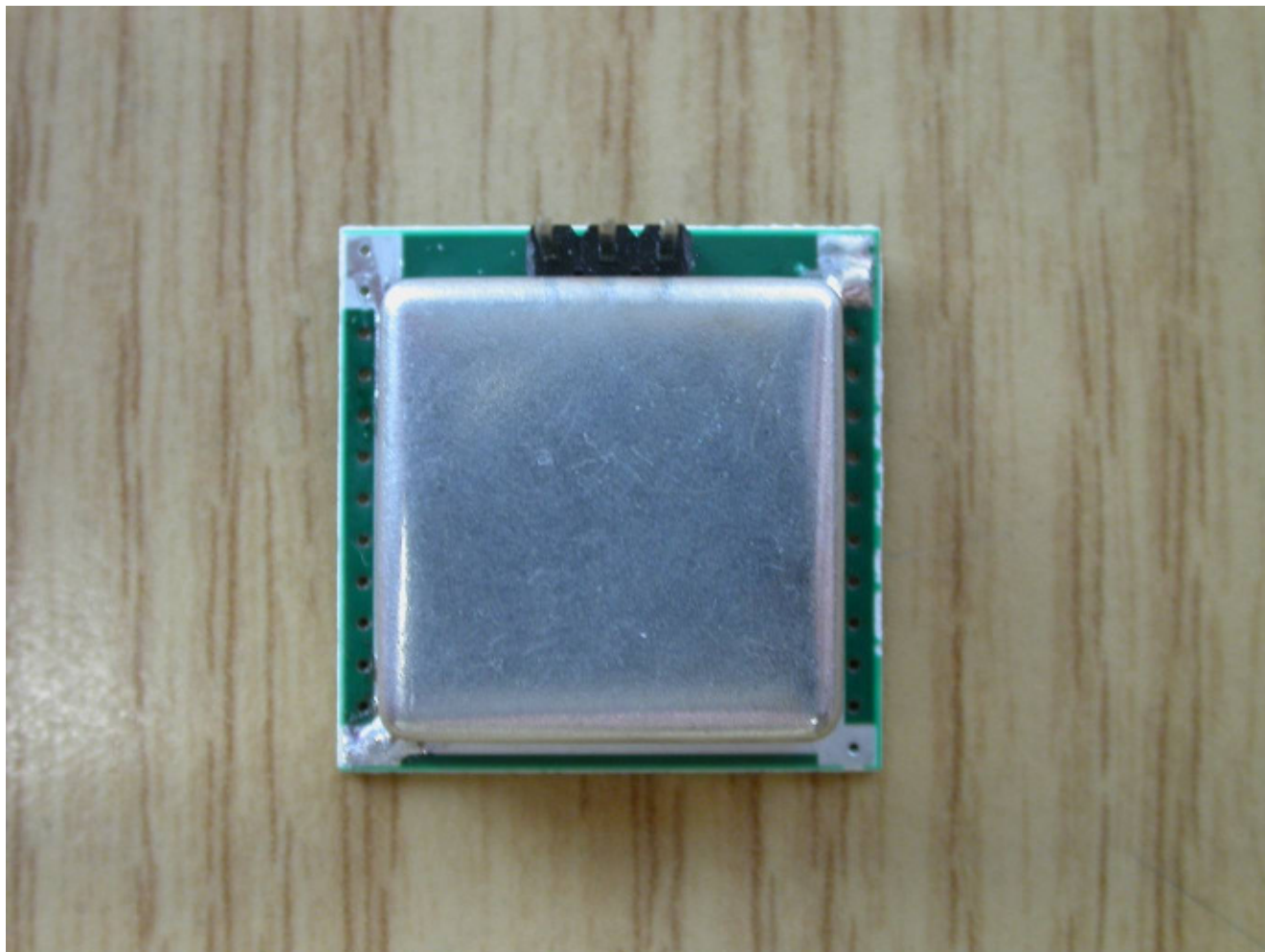


Photo no.: 2

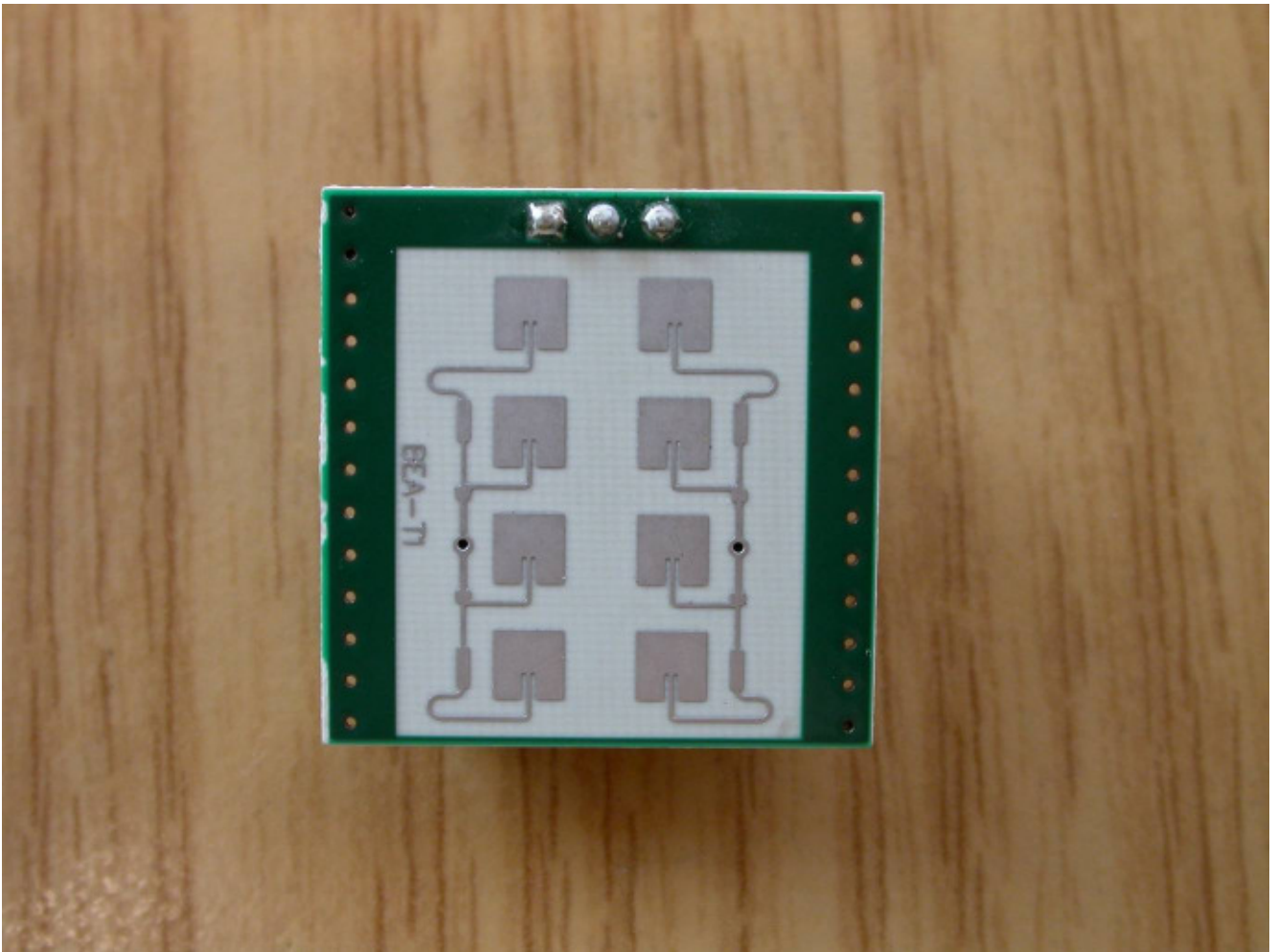


Photo no.: 3

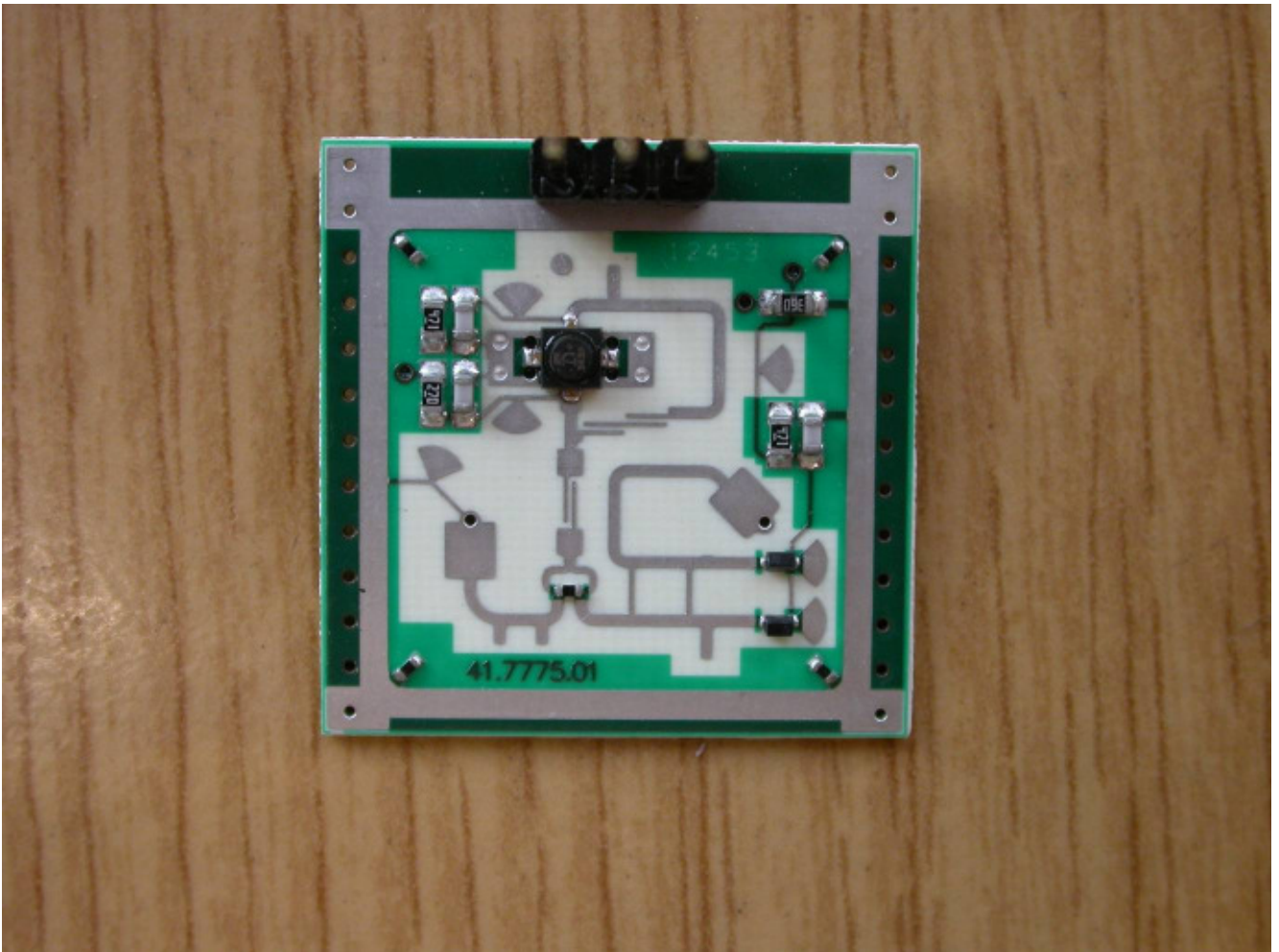
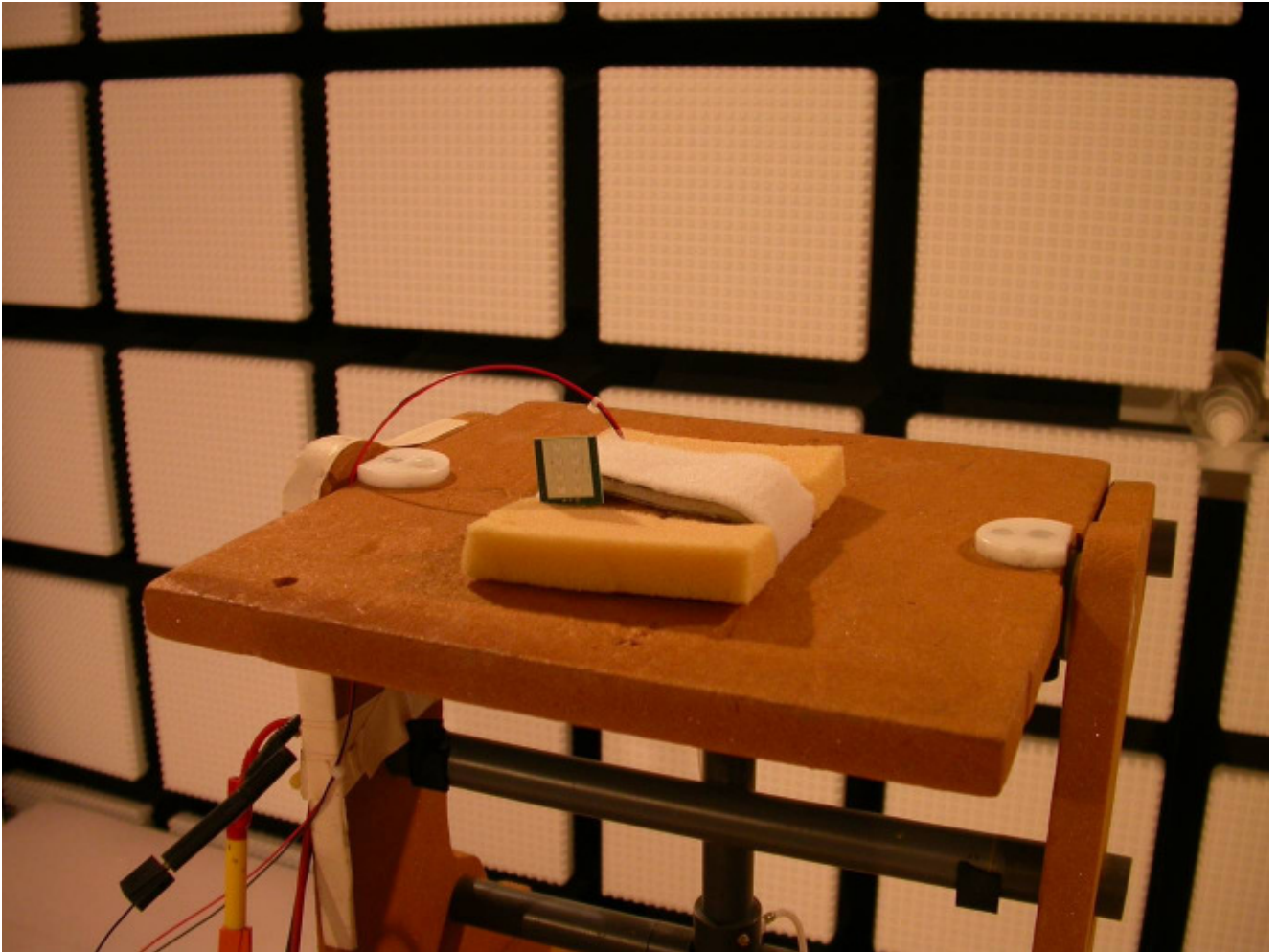
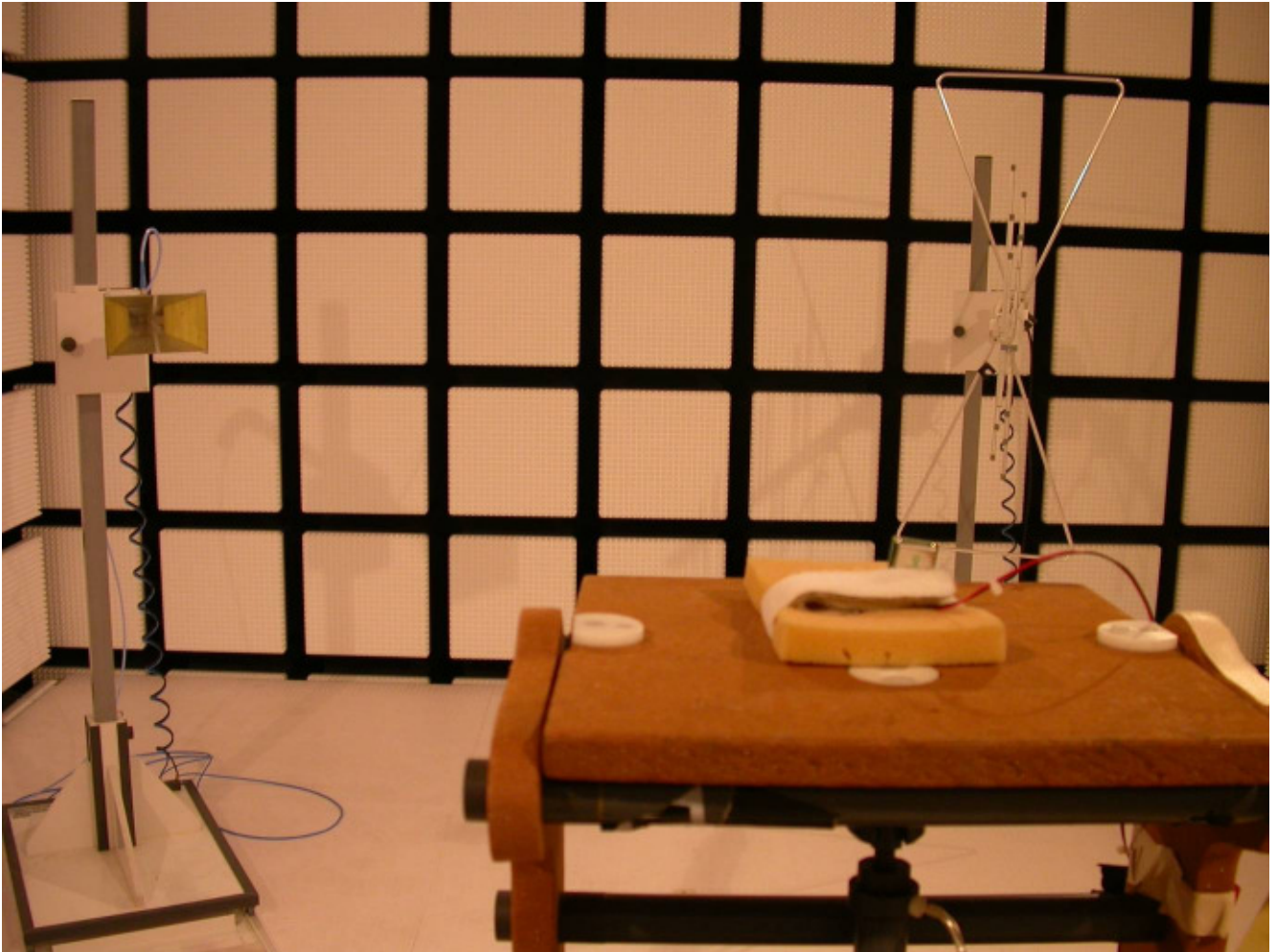


Photo no.: 4



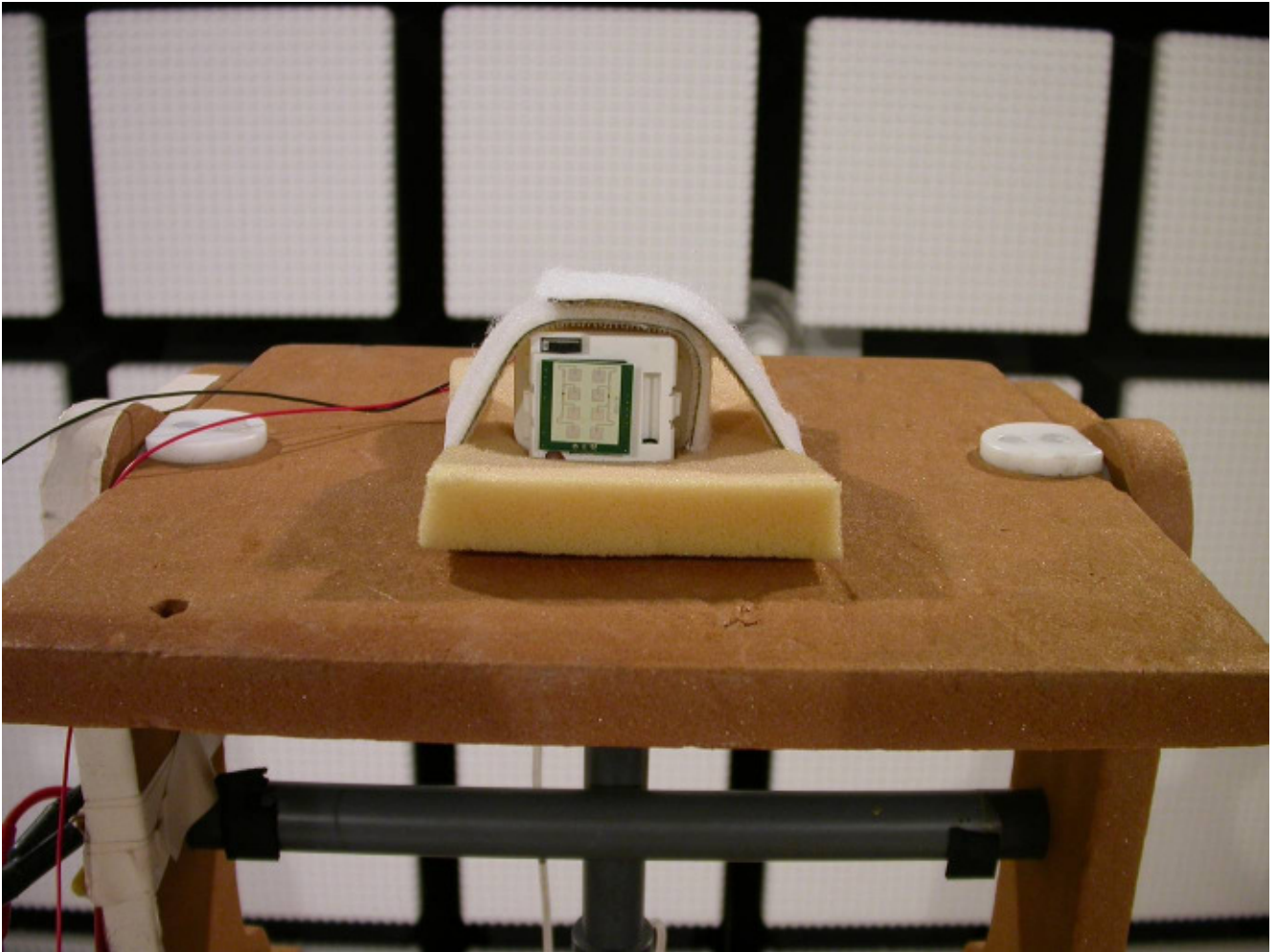
Spurious emission measurement 1 GHz – 12 GHz (CW-Mode)

Photo no.: 5



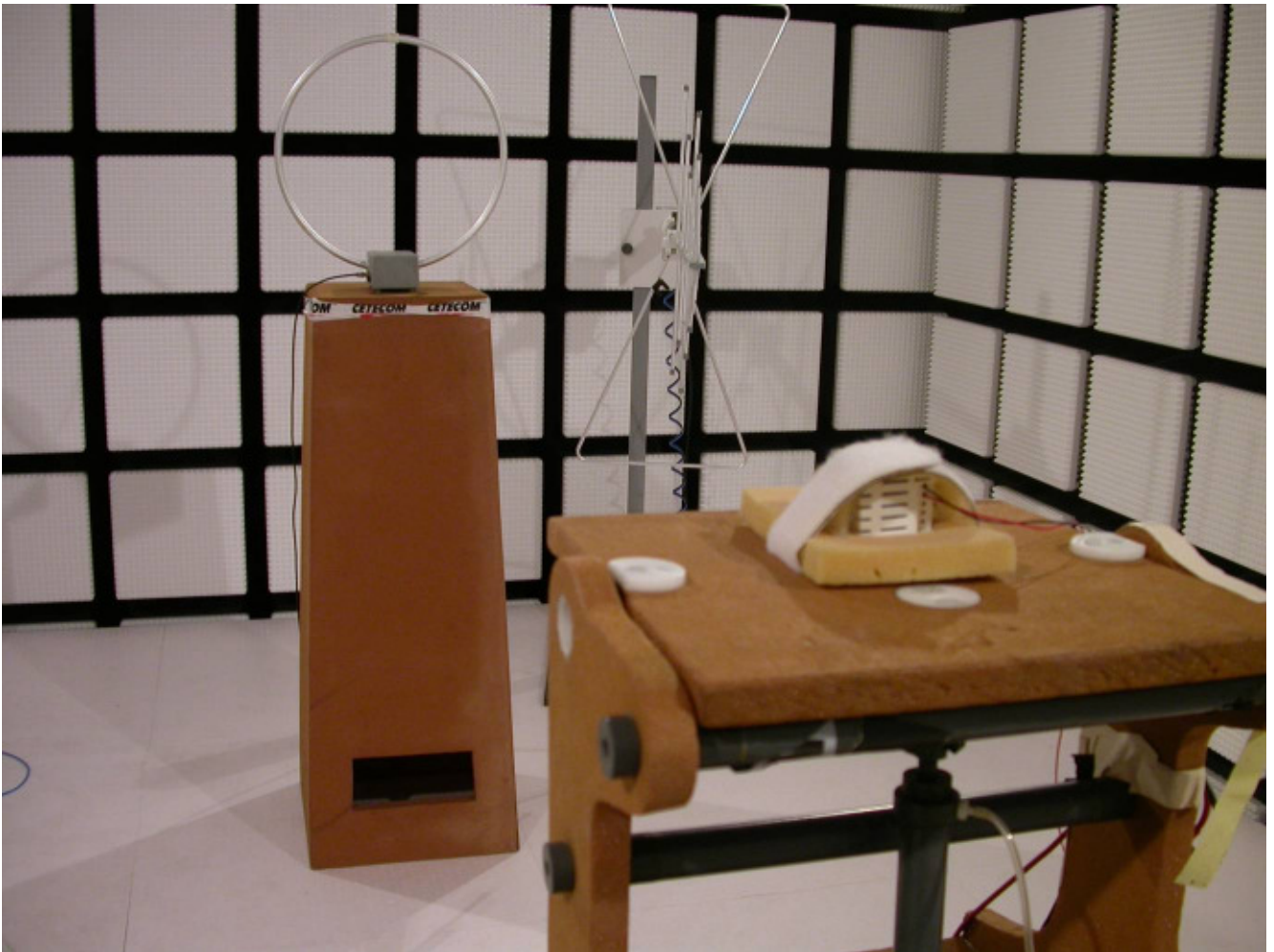
Spurious emission measurement 1 GHz – 12 GHz (CW-Mode)

Photo no.: 6



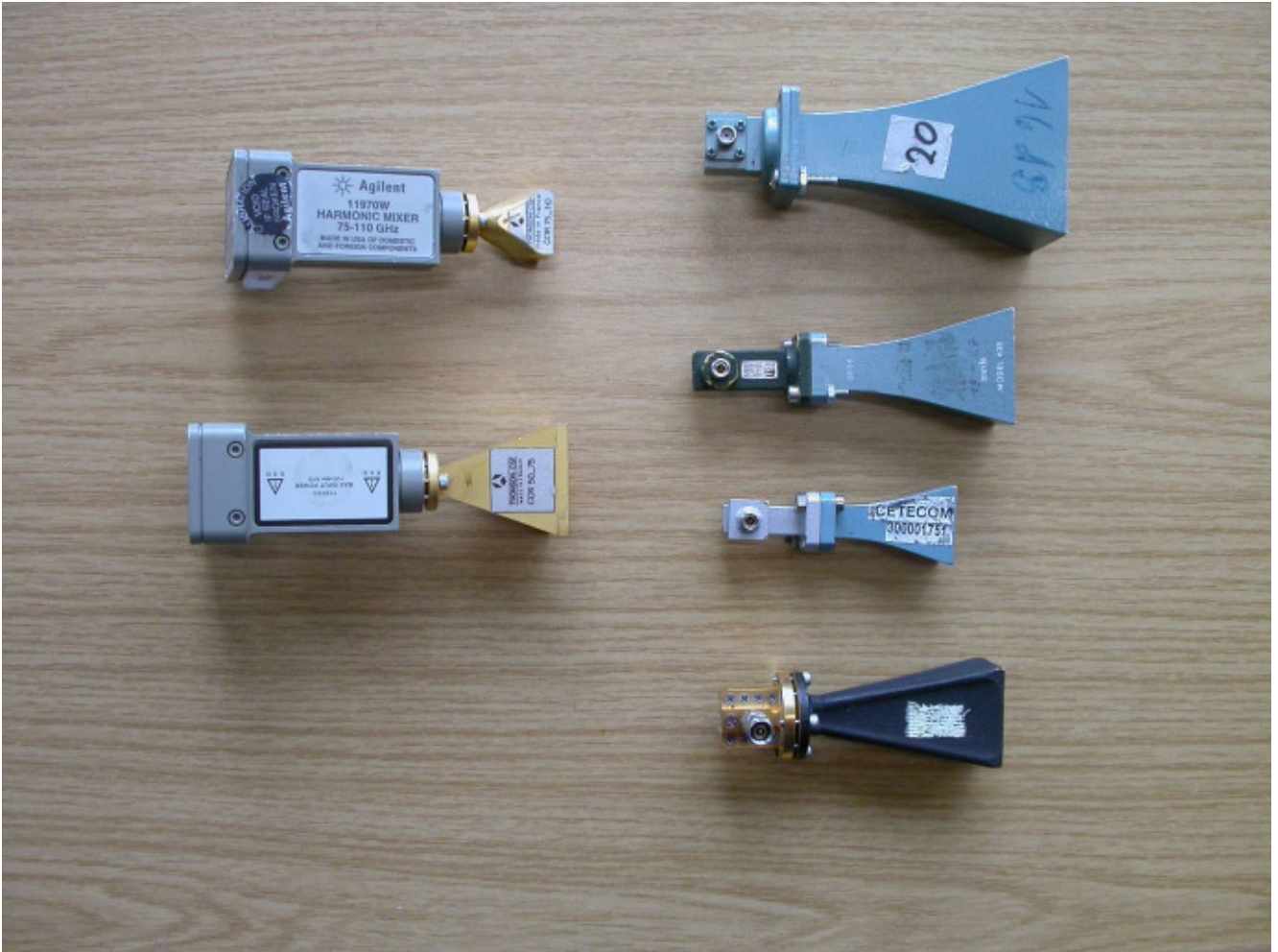
Spurious emission measurement 1 GHz – 12 GHz (Pulse-Mode – using external Box))

Photo no.: 7



Spurious emission measurement 9 kHz – 30 MHz

Photo no.: 8



Spurious emission measurement equipment 12 GHz – 110 GHz