

CETECOM ICT Services GmbH

Radio Satellite Communication

Untertürkheimer Straße 6–10, D-66117 Saarbrücken,

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Test report No.: 2-2941-02-04/02

This test report consists of 43 pages

Page 1 of 43

Recognized by the
Federal Communications Commission
FCC–Identification Number
TCB ID: DE001



Accredited by the
German Accreditation Council
DAR–Registration Number
TTI–P–G 166/98-30



Independent ETSI
compliance test house



Test report No.: **2-2941-02-04/02**

Applicant : Agtatec A.G.

Type : RAD 270 10.525GHz

FCC-ID :

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CETECOM ICT Services GmbH

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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
04.12.02	Detlev Gillmann	

Technical responsibility for area of testing:

Date	Name	Signature
04.12.02	Klaus Kammerinke	

CETECOM ICT Services GmbH

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1.2 Testing laboratory

CETECOM ICT Services GmbH

Untertürkheimerstraße 6–10

D-66117 Saarbrücken

Germany

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.ict.de>

Accredited testing laboratory

Accredited by : Regulierungsbehörde für Telekommunikation und Post (RegTP)

Listed by : Federal Communications Commission (FCC)

Authority	Identification/Registration No.
RegTP	TTI-P-G 166/98-30
FCC	90462

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

Name : Not applicable

1.3 Details of applicant

Name : Agtatec A.G.

Street : Allmendstr. 24

Town : CH-8320 Fehraltorf

Country : Schweiz

Tel. : +41 1 954 91 91

Fax : +41 1 954 92 00

Contact person

Name : Thomas Eichmann

Tel. : +41 1 954 91 91

Fax : +41 1 954 03 09

e-mail : thomas.eichmann@record.ch

1.4 Application details

Date of application : 20.11.2002

Date of receipt of EUT : 29.11.2002

Date of test : 29.11. – 04.12.2002

Model
RAD 270 Tx 10.514 GHz

1.7 **Test standard : Code of Federal Regulations (CFR 47)**
Federal Communications Commission (FCC)

FCC Part 15 **Radio Frequency Devices (07/2002)**
Section 15.245
Operation within the band 10500 to 10550 MHz.

Section 15.209
Radiation emission limits, general requirements

Section 15.205
Restricted bands of operation.

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.

☐

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**

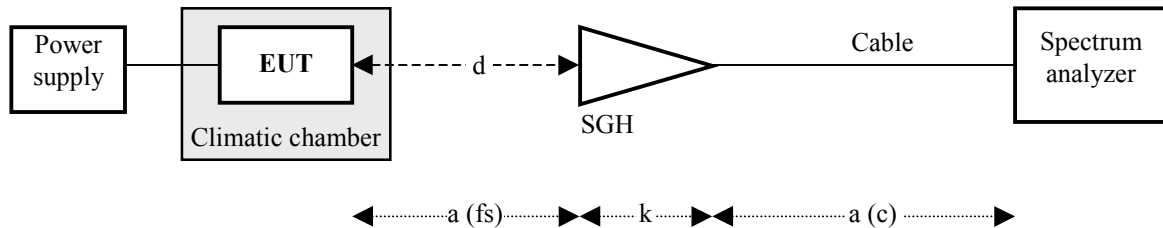
The environmental conditions are documented especially for each test.

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 and spurious radiation in the frequency range 4 GHz to 33 GHz



Frequency f [GHz]	Distance d [m]	SGH	Antenna factor k [dB 1/m]	Cable loss a [dB]
10.5	3.0	narda 640	33.64	0.7
21.0	3.0	narda 638	40.36	2.3
31.5	3.0	narda V637	43.98	7.0

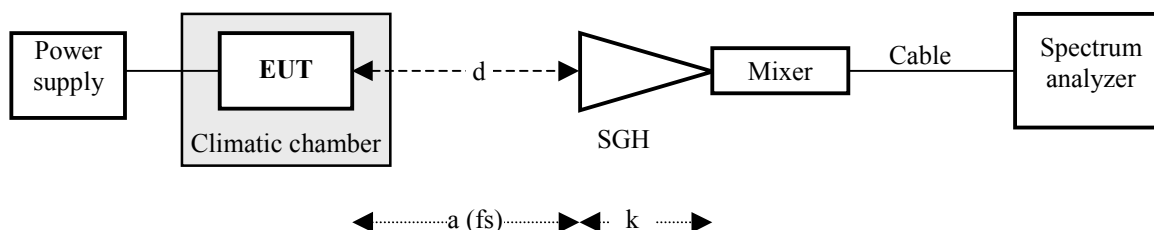
Calculation : Field strength = Analyser reading + Cable loss + Antenna factor

Test equipment	Manufacturer	Type	Cetecom reference
Spectrum Analyser	HP	HP 8565E	300001665
SGH 8.2 ... 12.4 GHz	narda	640	300002213
SGH 18 ... 27 GHz	narda	638	300002442
SGH 27 ... 40 GHz	narda	V637	300000510
RF-cable	HP	5061-5359	300002035

Measurement uncertainty

Test parameter	Measurement uncertainty
Power supply	±0.1 VDC
Temperature	±0.2 °C
Frequency	±0.01 ppm
eirp	±1.4 dB

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



Frequency f [GHz]	Distance d [m]	Distance correction dc (3 m/Xm) [dB]	Antenna factor k [dB 1/m]
42.0	1.0	-9.54	38.98
52.5	1.0	-9.54	39.66
63.0	0.5	-15.56	45.5
73.5	0.5	-15.56	41.5
84.0	0.5	-15.56	40.0

Calculation : Field strength = Analyser reading + Cable loss + Antenna factor + Distance correction

$e = u + a + k + dc$

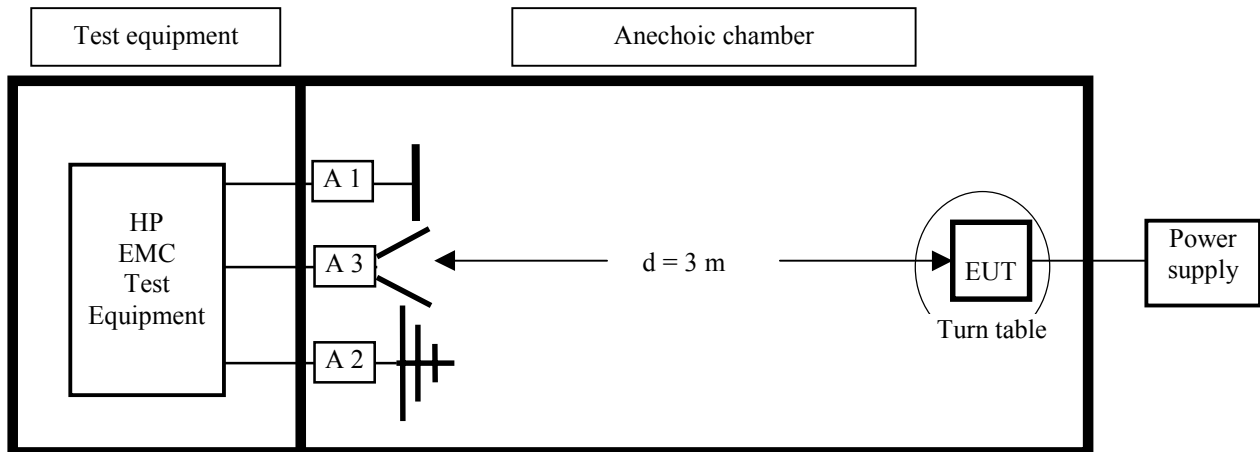
Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300001665
Power supply	HP	6032A	300002115
SGH 33 ... 50 GHz	Thomson	COR 33_50	300000812
Mixer 33 ... 50 GHz	HP	11970Q	300000781i
SGH 50 ... 75 GHz	Thomson	COR 50_75	300000789k
Mixer 50 ... 75 GHz	HP	11970V	300000871o
SGH 75 ... 110 GHz	Thomson	COR 75_110	300000789m
Mixer 50 ... 110 GHz	HP	11970W	300000871v

Measurement uncertainty

Test parameter	Measurement uncertainty
Power supply	±0.1 VDC
Temperature	±0.2 °C
Frequency	±0.01 ppm
eirp	±1.0 dB

2.4.3 Field strength and spurious radiation in the frequency range 9 kHz to 4 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
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
Power supply	HP	HP 6038A	2848A07027
RF-cable	HP	5061-5359	P36303

Measurement uncertainties

Performance	Measurement uncertainty
Input power (DC)	± 0.1 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
- ☐ Equipment Class
- ☐ Power Class
- ☐ Duty cycle Class

2.5.2 Summary of test results

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 60 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 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 setups 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 over various frequency ranges are set according to requirement ANSI C63-4-1992 clause 4.2.

2.5.3 Test results in details

Equipment under test (EUT) : **RAD 270**

Ambient temperature : 23 °C

Relative humidity : 55 %

TRANSMITTER PARAMETERS

SECTION 15.245

FUNDAMENTAL FREQUENCY

10500 MHz to 10550 MHz

Microwave module : RAD operating in CW

Antenna assembly: Integral patch antenna

TEST CONDITIONS		TRANSMITTER POWER			
Power supply with integral AC input		Frequency [GHz]	Spectrum Analyzer e [dBmV/m]	Field strength E [mV/m]	See plot on page
T (nom) = 23.0 °C	U (nom) = 24.0 V	10.514 033	40.51	106.04	21
	U (min) = 10.8 V	10.514 033	40.51	106.04	21
	U (max) = 26.4 V	10.514 033	40.51	106.04	21

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

LIMITS:

SECTION 15.245

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBmV/m]	Field strength E [mV/m]
10 500 – 10 550	3.0	67.9	2 500
Harmonics	3.0	27.9	25

Verdict : Field strength limit is kept

2.5.3 Test results in details

Equipment under test (EUT) : **RAD 270**

Ambient temperature : 23 °C

Relative humidity : 55 %

TRANSMITTER PARAMETERS

SECTION 15.245

FUNDAMENTAL FREQUENCY

10500 MHz to 10550 MHz

Microwave module : RAD operating in CW

Antenna assembly: Integral patch antenna

TEST CONDITIONS		TRANSMITTER POWER			
Power supply with integral DC input		Frequency [GHz]	Spectrum Analyzer e [dBmV/m]	Field strength E [mV/m]	See plot on page
T (nom) = 23.0 °C	U (nom) = 24.0 V	10.514 033	40.51	106.04	21
	U (min) = 10.8 V	10.514 033	40.51	106.04	21
	U (max) = 31.2 V	10.514 033	40.51	106.04	21

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

LIMITS:

SECTION 15.245

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBmV/m]	Field strength E [mV/m]
10 500 – 10 550	3.0	67.9	2 500
Harmonics	3.0	27.9	25

Verdict : Field strength limit is kept

2.5.3 Test results in details

EUT : **RAD 270**

Ambient temperature : 23 °C

Relative humidity : 55 %

TRANSMITTER PARAMETERS

SECTION 15.245

HARMONIC FREQUENCIES

Microwave module : RAD 270 operating in CW

Antenna assembly: Integral patch antenna

TEST CONDITIONS		TRANSMITTER POWER			
Power supply with integral AC input		Frequency [GHz]	Spectrum Analyzer e [dBmV/m]	Field strength E [mV/m]	See plot on page
T (nom) = 23.0 °C	U (nom) = 24.0 V	21.028 413	4.49	1.67	22
	U (min) = 10.8 V	21.028 413	4.49	1.67	22
	U (max) = 26.4 V	21.028 413	4.49	1.67	22

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

LIMITS:

SECTION 15.245 / 15.205 / 15.209

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	500

Verdict : Field strength limit is kept

EUT : **RAD 270**
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS

SECTION 15.245

HARMONIC FREQUENCIES

Microwave module : RAD 270 operating in CW
Antenna assembly: Integral patch antenna

TEST CONDITIONS		TRANSMITTER POWER			
Power supply with integral DC input		Frequency [GHz]	Spectrum Analyzer e [dBmV/m]	Field strength E [mV/m]	See plot on page
T (nom) = 23.0 °C	U (nom) = 24.0 V	21.028 413	4.49	1.67	22
	U (min) = 10.8 V	21.028 413	4.49	1.67	22
	U (max) = 31.2 V	21.028 413	4.49	1.67	22

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

LIMITS:

SECTION 15.245 / 15.205 / 15.209

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	500

Verdict : Field strength limit is kept

EUT : **RAD 270**
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS

SECTION 15.245

HARMONIC FREQUENCIES

Microwave module : RAD 270 operating in CW
Antenna assembly: Integral patch antenna

TEST CONDITIONS		TRANSMITTER POWER			
Power supply with integral AC input		Frequency [GHz]	Spectrum Analyzer e [dBmV/m]	Field strength E [mV/m]	See plot on page
T (nom) = 23.0 °C	U (nom) = 24.0 V	31.542 335	7.94	2.49	23
	U (min) = 10.8 V	31.542 335	7.94	2.49	23
	U (max) = 26.4 V	31.542 335	7.94	2.49	23

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

LIMITS:

SECTION 15.245 / 15.205 / 15.209

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	500
Harmonics	3	87.9 = 27.9 dBmV/m	25.000

Verdict : Field strength limit is kept

EUT : **RAD 270**
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS

SECTION 15.245

HARMONIC FREQUENCIES

Microwave module : RAD 270 operating in CW
Antenna assembly: Integral patch antenna

TEST CONDITIONS		TRANSMITTER POWER			
Power supply with integral DC input		Frequency [GHz]	Spectrum Analyzer e [dBmV/m]	Field strength E [mV/m]	See plot on page
T (nom) = 23.0 °C	U (nom) = 24.0 V	31.542 335	7.94	2.49	23
	U (min) = 10.8 V	31.542 335	7.94	2.49	23
	U (max) = 26.4 V	31.542 335	7.94	2.49	23

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

LIMITS:

SECTION 15.245 / 15.205 / 15.209

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	500

Verdict : Field strength limit is kept

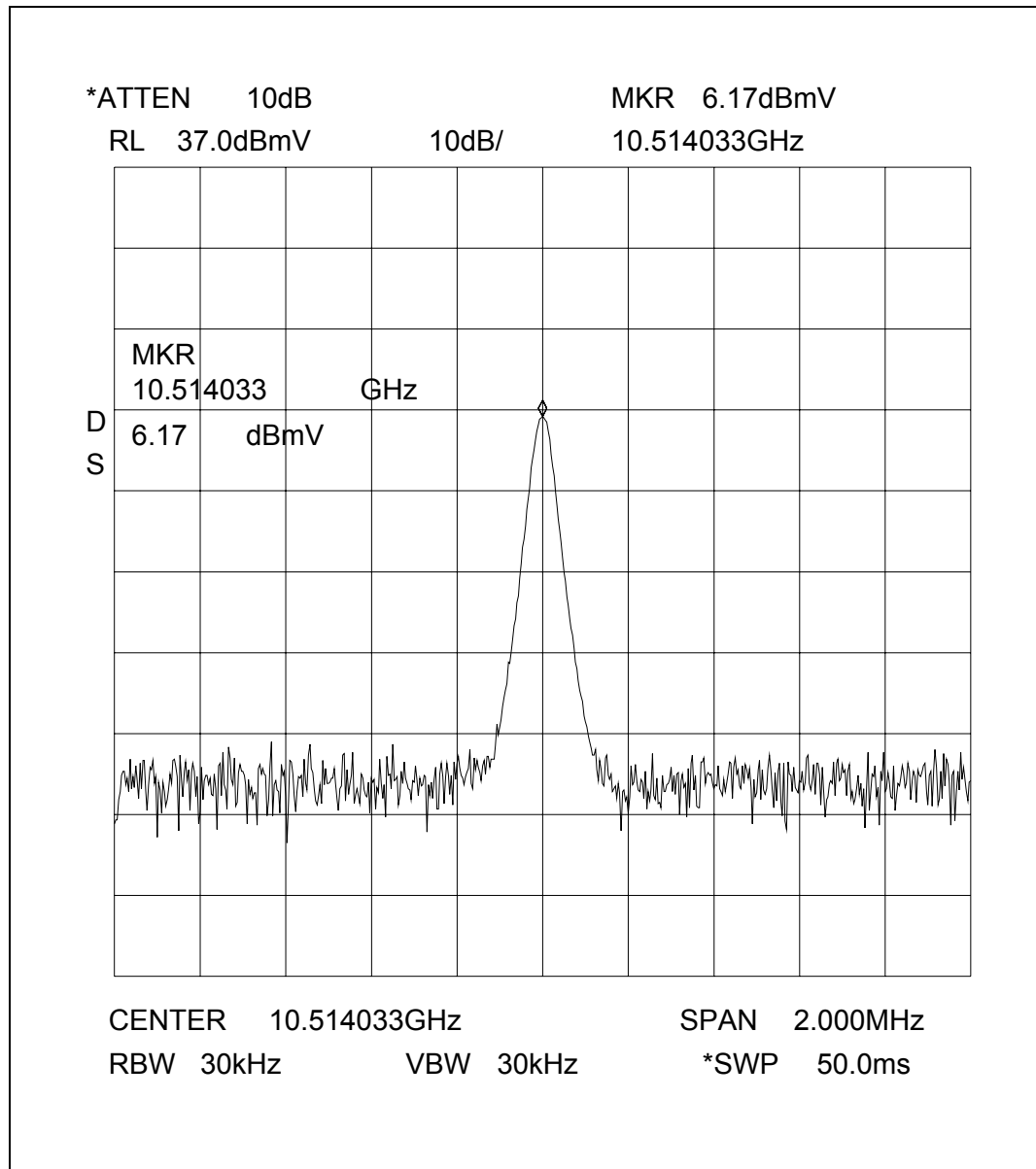
Microwave module : RAD 270 operating in CW
Antenna assembly: Integral patch antenna

Verdict :	Spurious limits are kept
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Verdict :	Spurious limits are kept
-----------	--------------------------

3. Plots of EUT

Plot No.: 01



Measurement distance d = 3.0 m

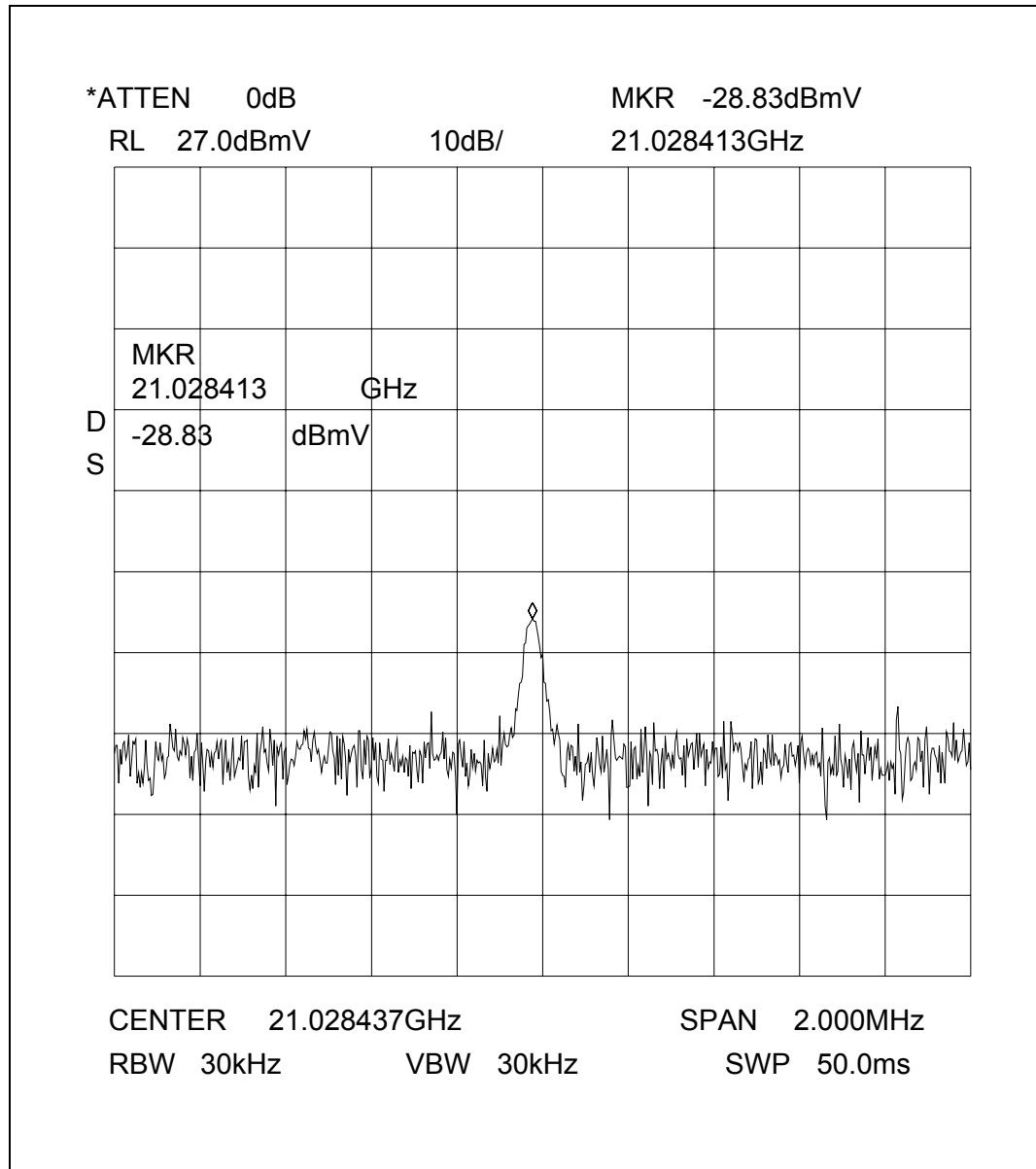
Calculation : Field strength = Analyser reading + Cable loss + Antenna factor

e = 6.17 dB(mV) + 0.7 dB + 33.64 dB(1/m)

e = 40.51 dB(mV/m)

E = 106.04 mV/m

Plot No.: 02

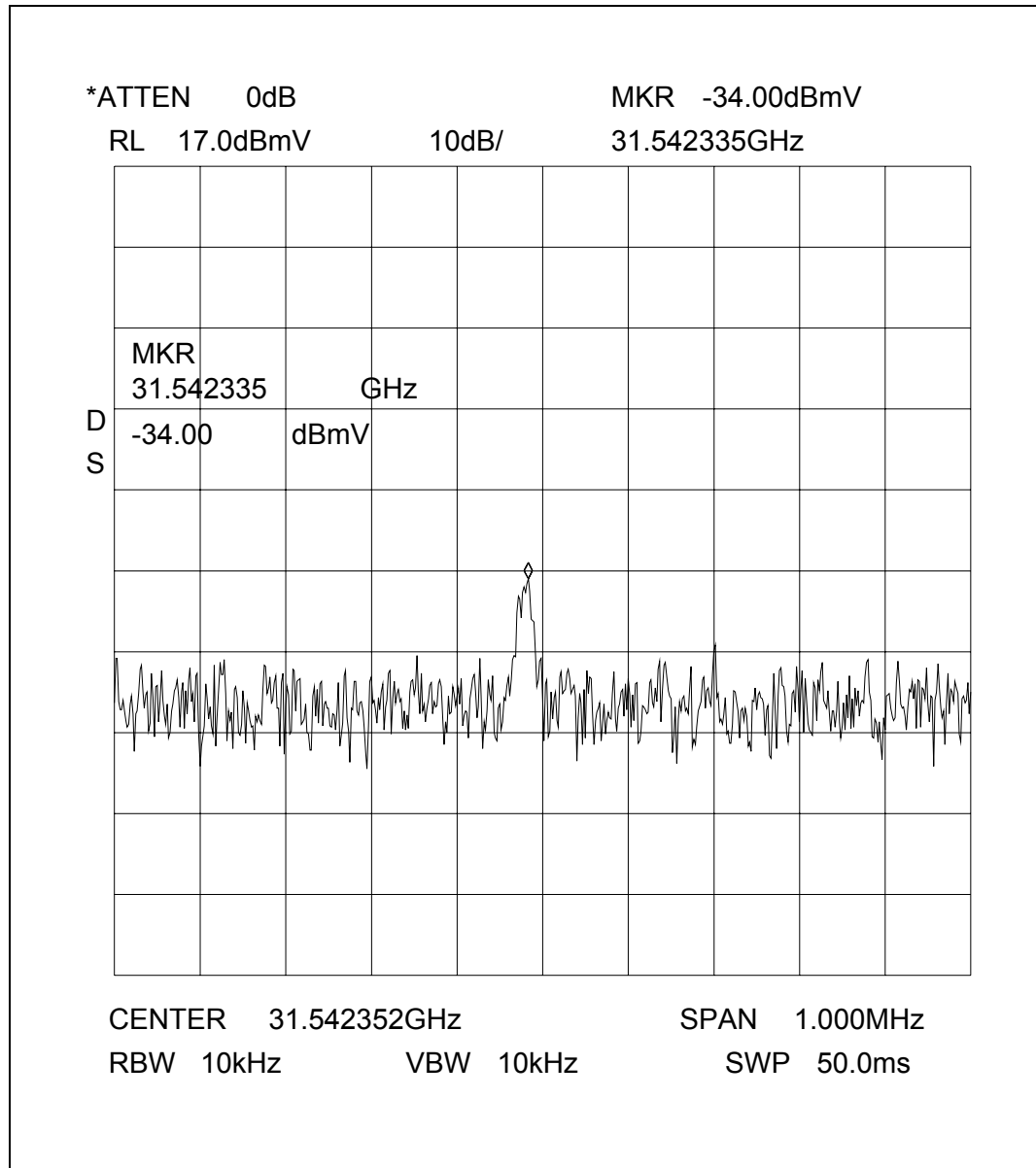


Measurement distance $d = 1.0 \text{ m}$

Calculation :

$$\begin{aligned}
 \text{Field strength} &= \text{Analyser reading} + \text{Dist. corr.} + \text{Cable loss} + \text{Antenna factor} \\
 e &= -28.83 \text{ dB(mV)} + (-9.54) \text{ dB} + 2.5 \text{ dB} + 40.36 \text{ dB (1/m)} \\
 e &= 4.49 \text{ dB(mV/m)} \\
 E &= 1.67 \text{ mV/m}
 \end{aligned}$$

Plot No.: 03

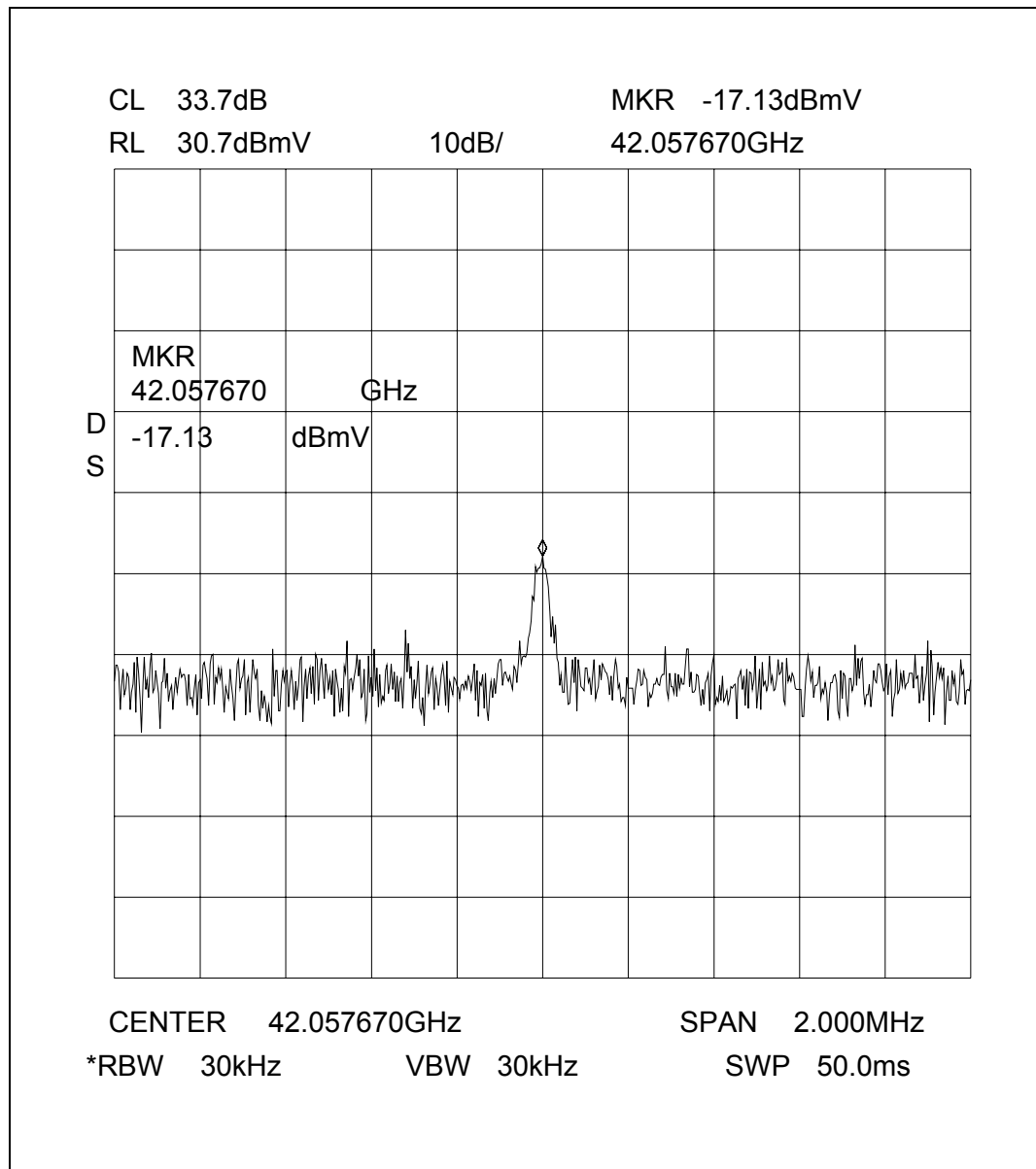


Measurement distance d = 1.0 m

Calculation :

$$\begin{aligned}
 \text{Field strength} &= \text{Analyser reading} + \text{Dist. corr.} + \text{Cable loss} + \text{Antenna factor} \\
 e &= -34.00 \text{ dB(mV)} + (-9.54) \text{ dB} + 7.5 \text{ dB} + 43.98 \text{ dB (1/m)} \\
 e &= \mathbf{7.94 \text{ dB(mV/m)}} \\
 E &= \mathbf{2.49 \text{ mV/m}}
 \end{aligned}$$

Plot No.: 04



Measurement distance d = 0.5 m

Calculation : Field strength = Analyser reading + Dist. corr. + Antenna factor
 e = - 17.13 dB(mV) + (-15.56) dB + 38.98 dB (1/m)
 e = 6.29 dB(mV/m)
 E = 2.06 mV/m

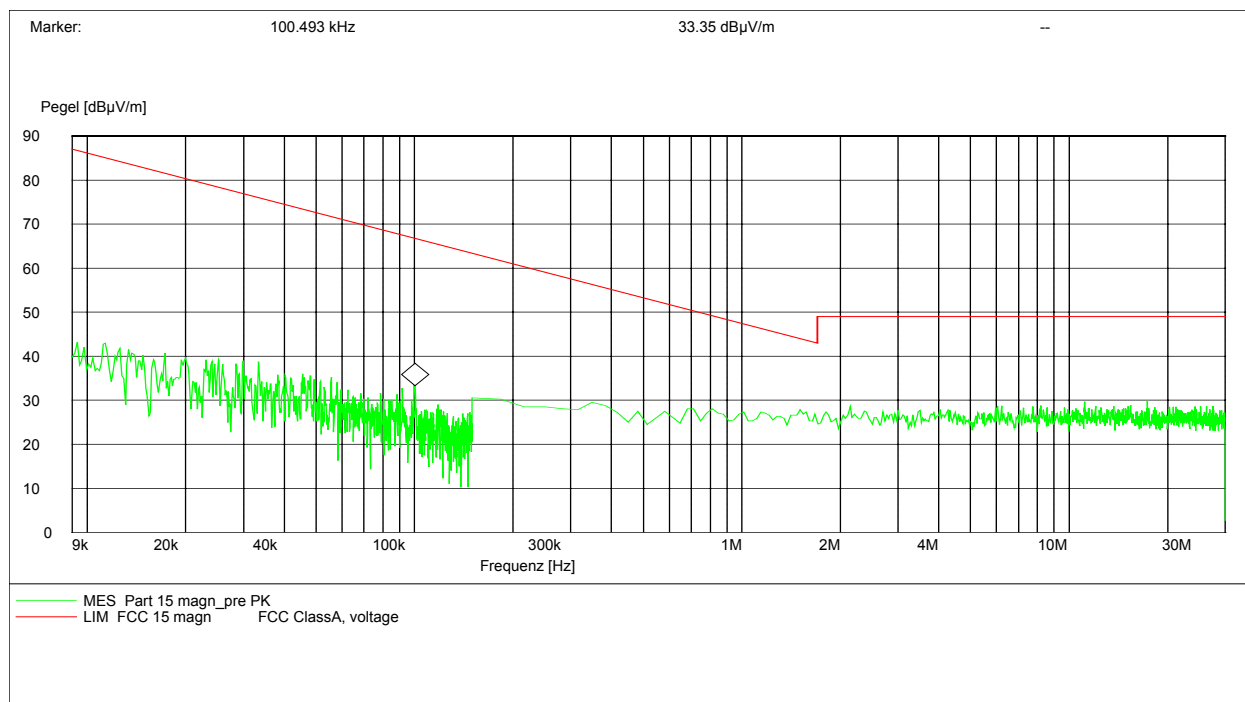
Plot 4

FCC Section 15.209

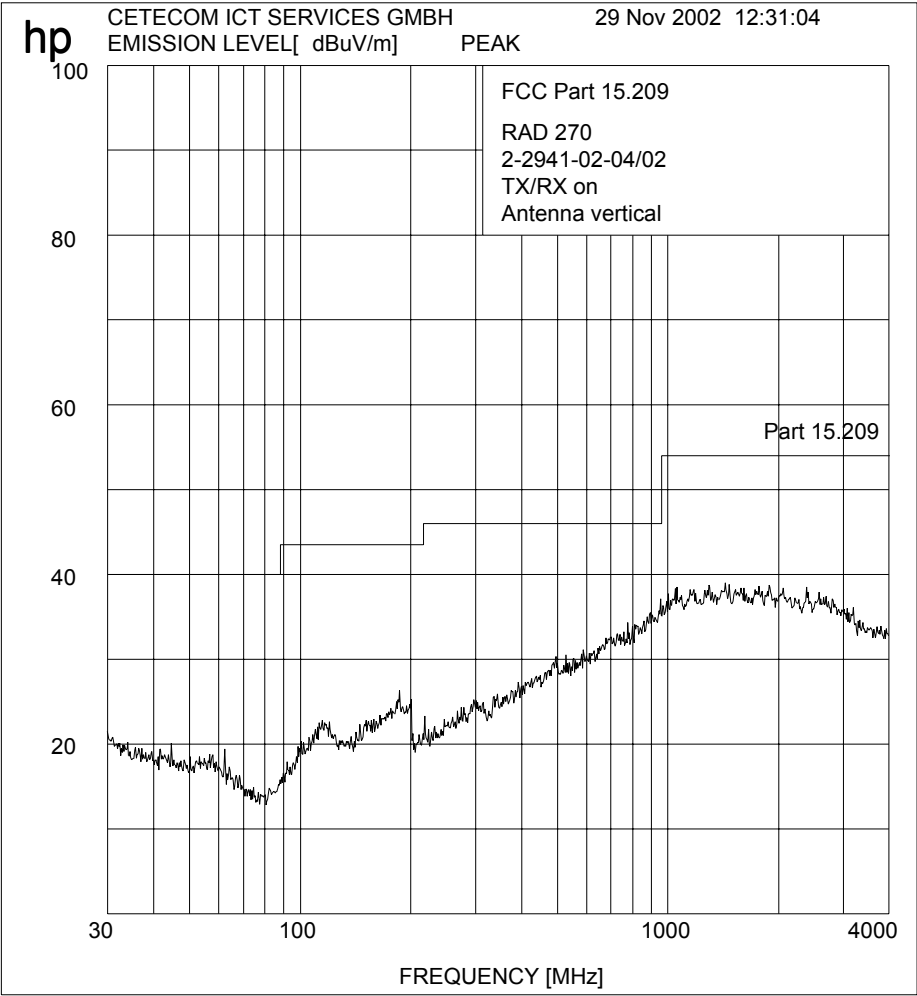
EUT: RAD 270 (10.514 GHz) in CW mode
Applicant: Agtatec A.G.
Operating condition: TX = 10.514 GHz Mod.: N0N ; RX = 10.514 GHz
Test Site: CETECOM ICT Services GmbH Saarbrücken, Room 006

Power Supply: 24 V DC
Start of Test: 27.11.02 / 11:09:38

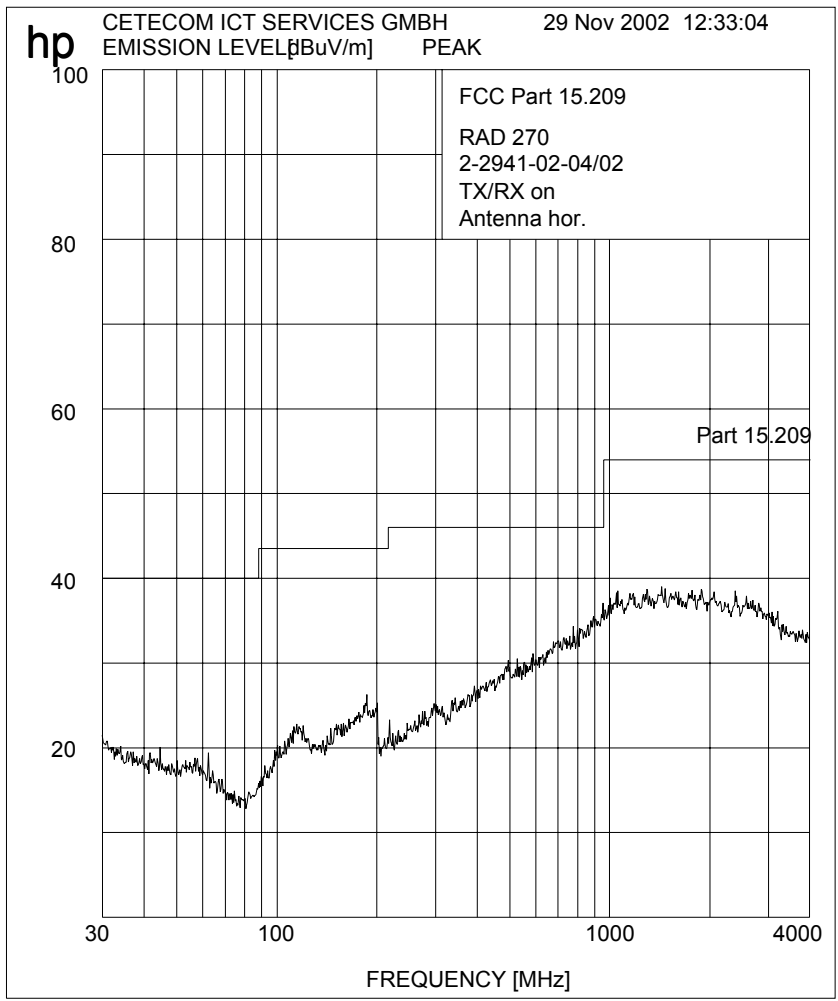
Detector: Quasi peak mode



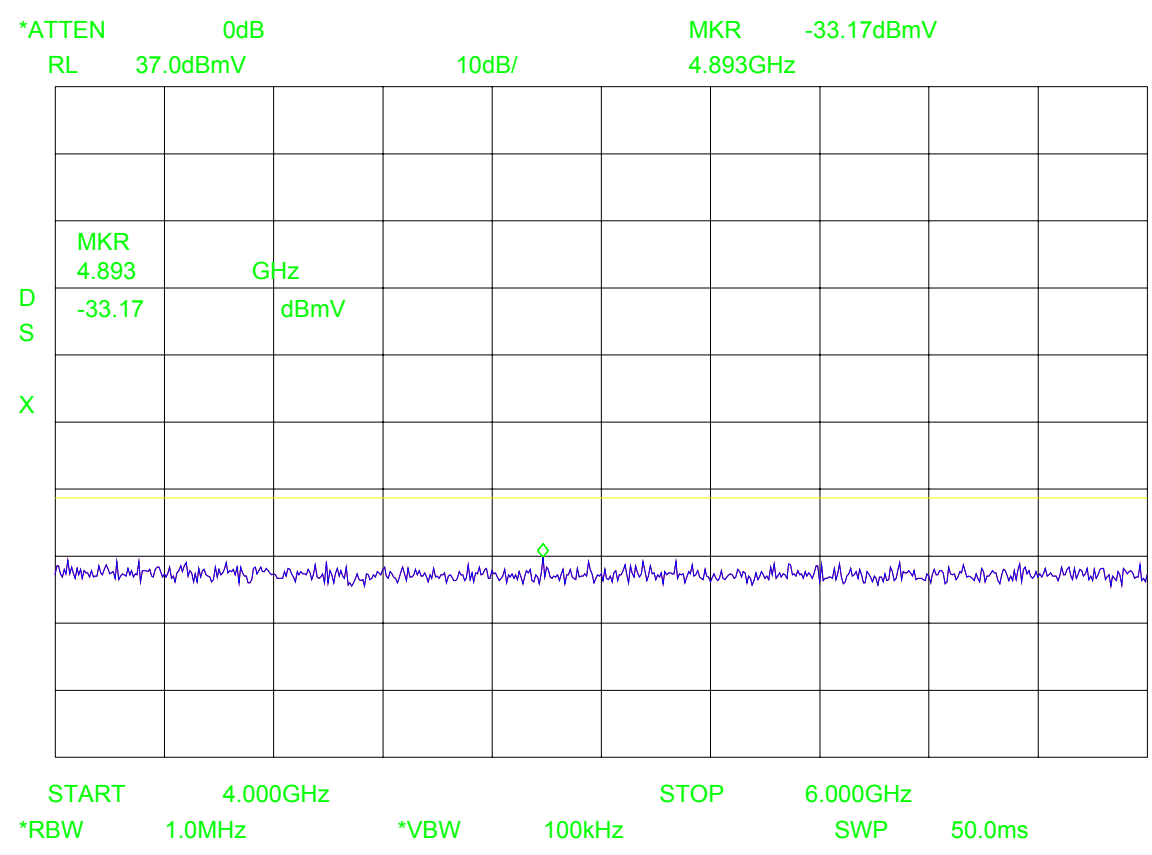
Plot No.: 05



Plot No.: 06



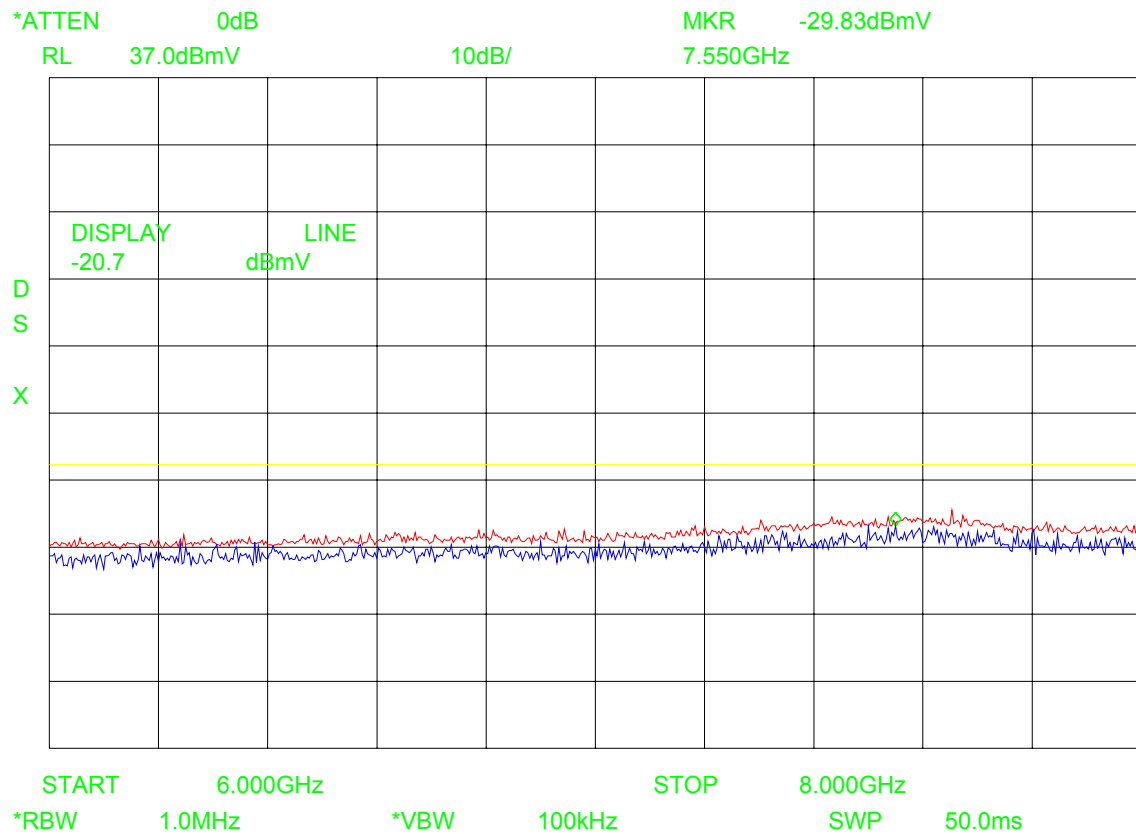
Plot No.: 7



Measurement distance d = 1.0 m

Calculation : Field strength = Analyser reading + Cable loss + Antenna factor + Dist. corr.
e = -33.17 dB(mV) + 1.8 dB + 27.22 dB(1/m) + (-9.54 dB)
Noise e = -13.69 dB(mV/m) = 46.31 dB(µV/m)
Display line = 54 dB(µV/m)

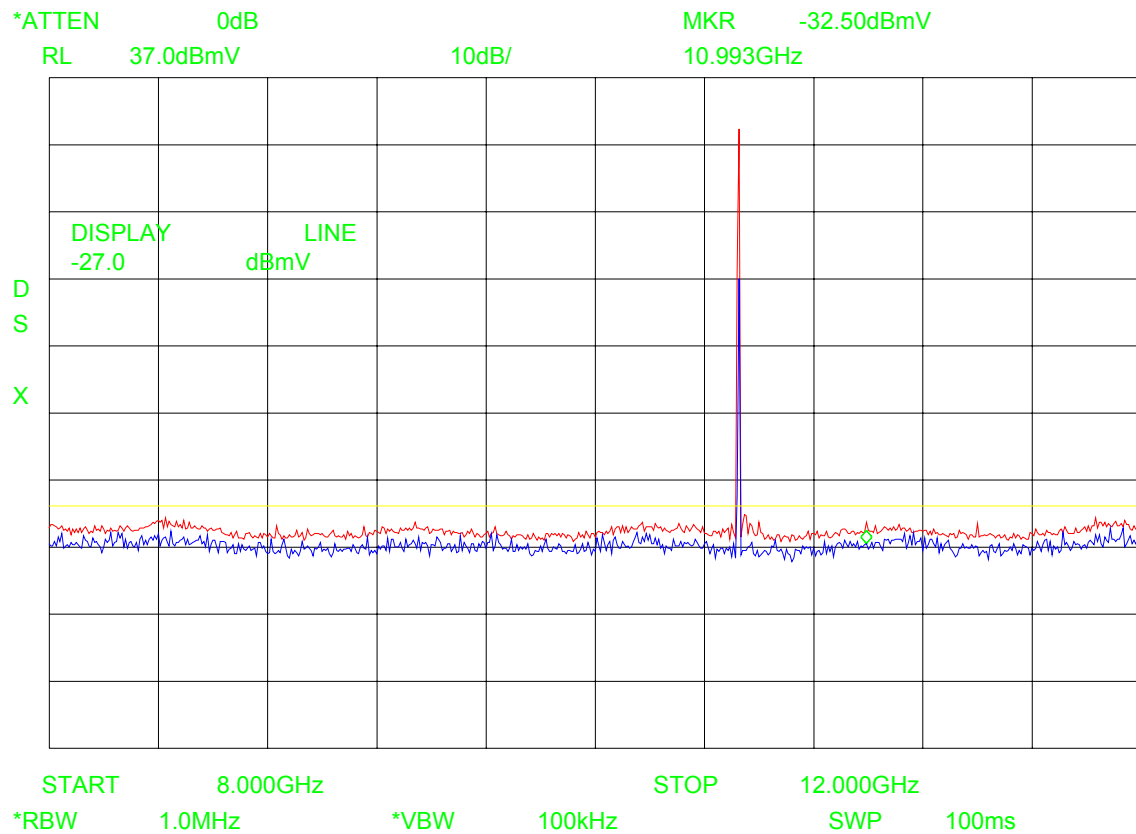
Plot No.: 8



Measurement distance d = 0.5 m

Calculation : Field strength = Analyser reading + Cable loss + Antenna factor + Dist. corr.
 e = -29.83 dB(mV) + 2.0 dB + 29.94 dB(1/m) + (-15.56 dB)
 Noise e = -13.45 dB(mV/m) = 46.55 dB(μV/m)
Display line = 54 dB(μV/m)

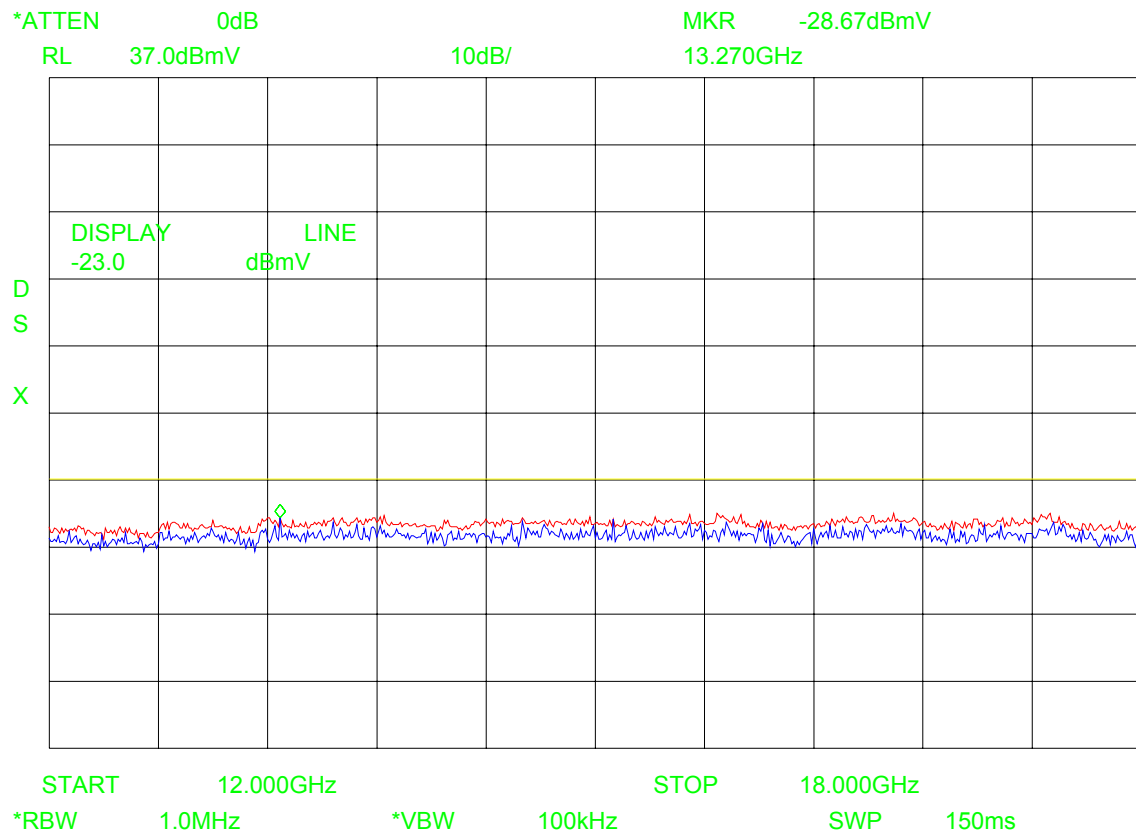
Plot No.: 9



Measurement distance d = 0.5 m

Calculation : Field strength = Analyser reading + Cable loss + Antenna factor + Dist. corr.
 e = -32.50 dB(mV) + 2.5 dB + 33.64 dB(1/m) + (-15.56 dB)
 Noise e = -11.92 dB(mV/m) = 48.08 dB(μ V/m)
Display line = 54 dB(μ V/m)

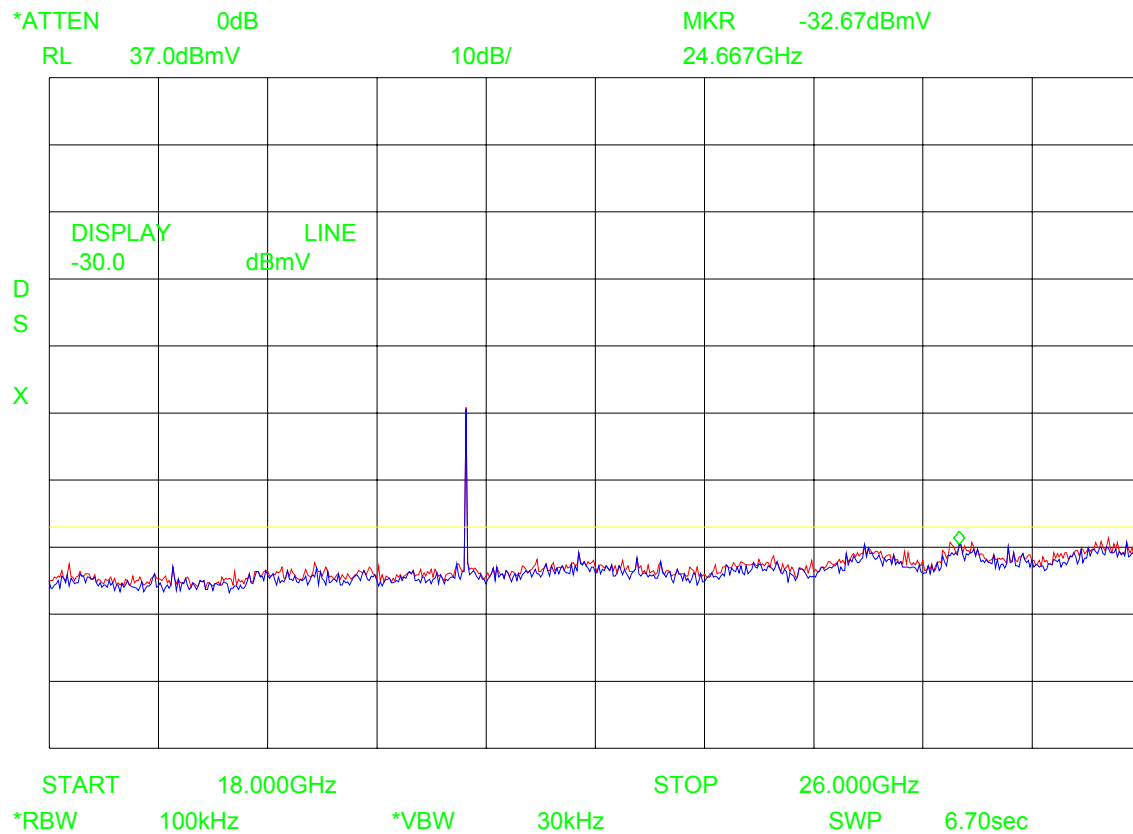
Plot No.: 10



Measurement distance d = 0.25 m

Calculation : Field strength = Analyser reading + Cable loss + Antenna factor + Dist. corr.
e = -28.67 dB(mV) + 2.9 dB + 36.88 dB(1/m) + (-21.58 dB)
Noise e = -10.47 dB(mV/m) = 49.53 dB(μV/m)
Display line = 54 dB(μV/m)

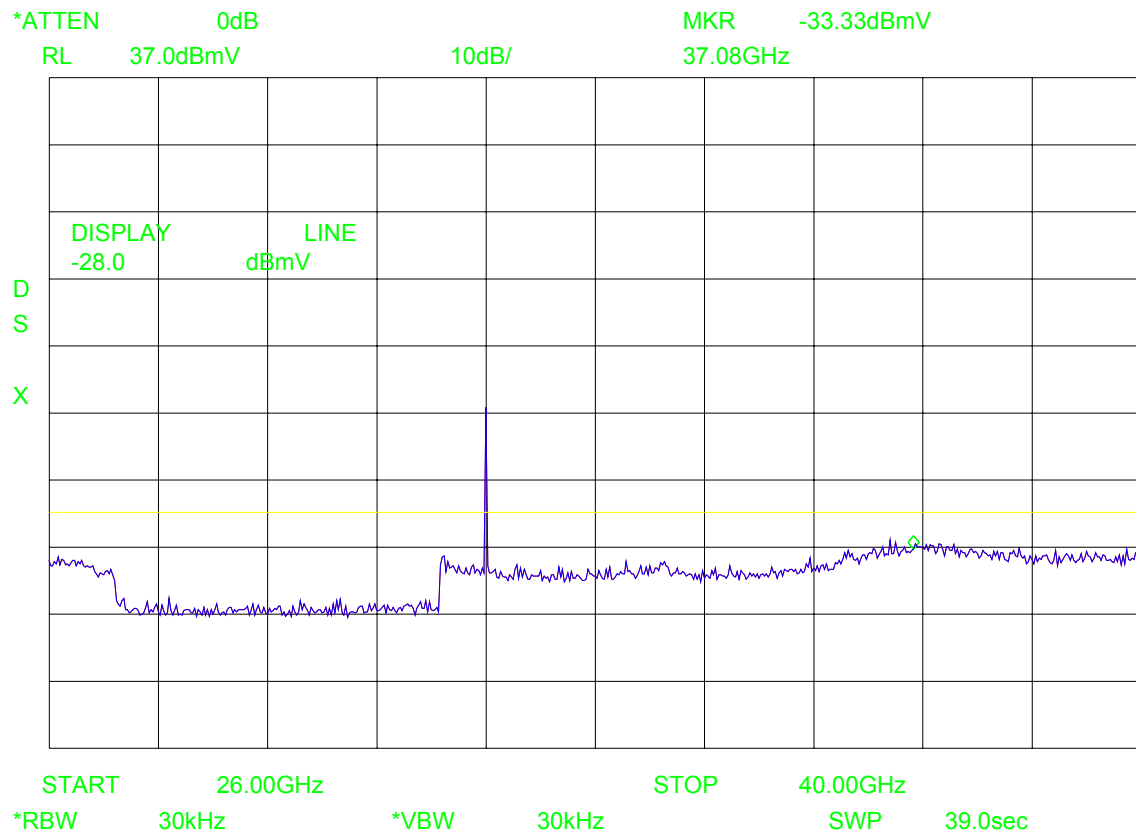
Plot No.: 11



Measurement distance d = 0.25 m

Calculation : Field strength = Analyser reading + Cable loss + Antenna factor + Dist. corr.
 e = -32.67 dB(mV) + 4.5 dB + 40.36 dB(1/m) + (-21.58 dB)
 Noise e = -9.39 dB(mV/m) = 50.61 dB(μ V/m)
Display line = 54 dB(μ V/m)

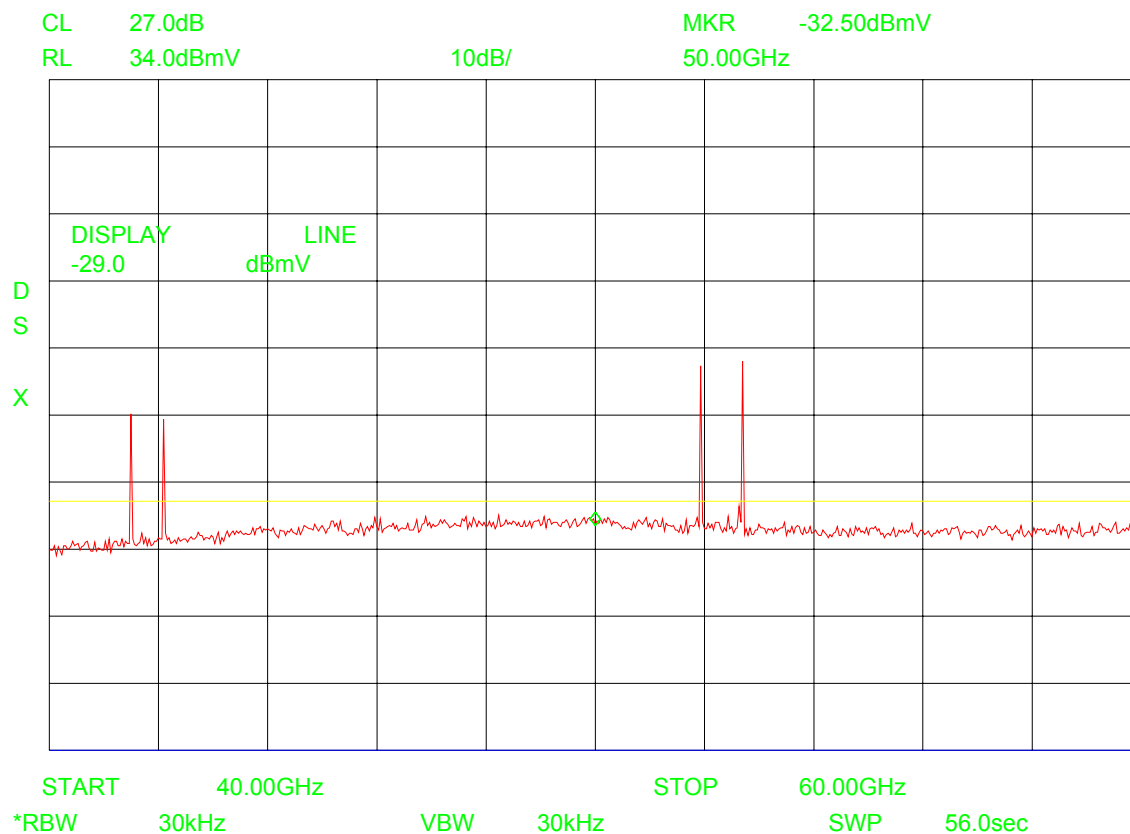
Plot No.: 12



Measurement distance d = 0.25 m

Calculation : Field strength = Analyser reading + Cable loss + Antenna factor + Dist. corr.
 e = -33.33 dB(mV) + 4.8 dB + 43.94 dB(1/m) + (-21.58 dB)
 Noise e = -6.17 dB(mV/m) = 53.81 dB(μ V/m)
Display line = 54 dB(μ V/m)

Plot No.: 12



Measurement distance d = 0.25 m

Calculation : Field strength = Analyser reading + Antenna factor + Dist. corr.

e = -29.00 dB(mV) + 38.98 dB(1/m) + (-21.58 dB)

Noise e = -11.60 dB(mV/m) = 48.40 dB(μV/m)

Display line = 54 dB(μV/m)

**Remark: The displayed emissions 52and 54 GHz are not real.
 They are produced by external mixer.**

Photographs of EUT

Photo No.: 01



Photo No.: 02



Photo No.: 03

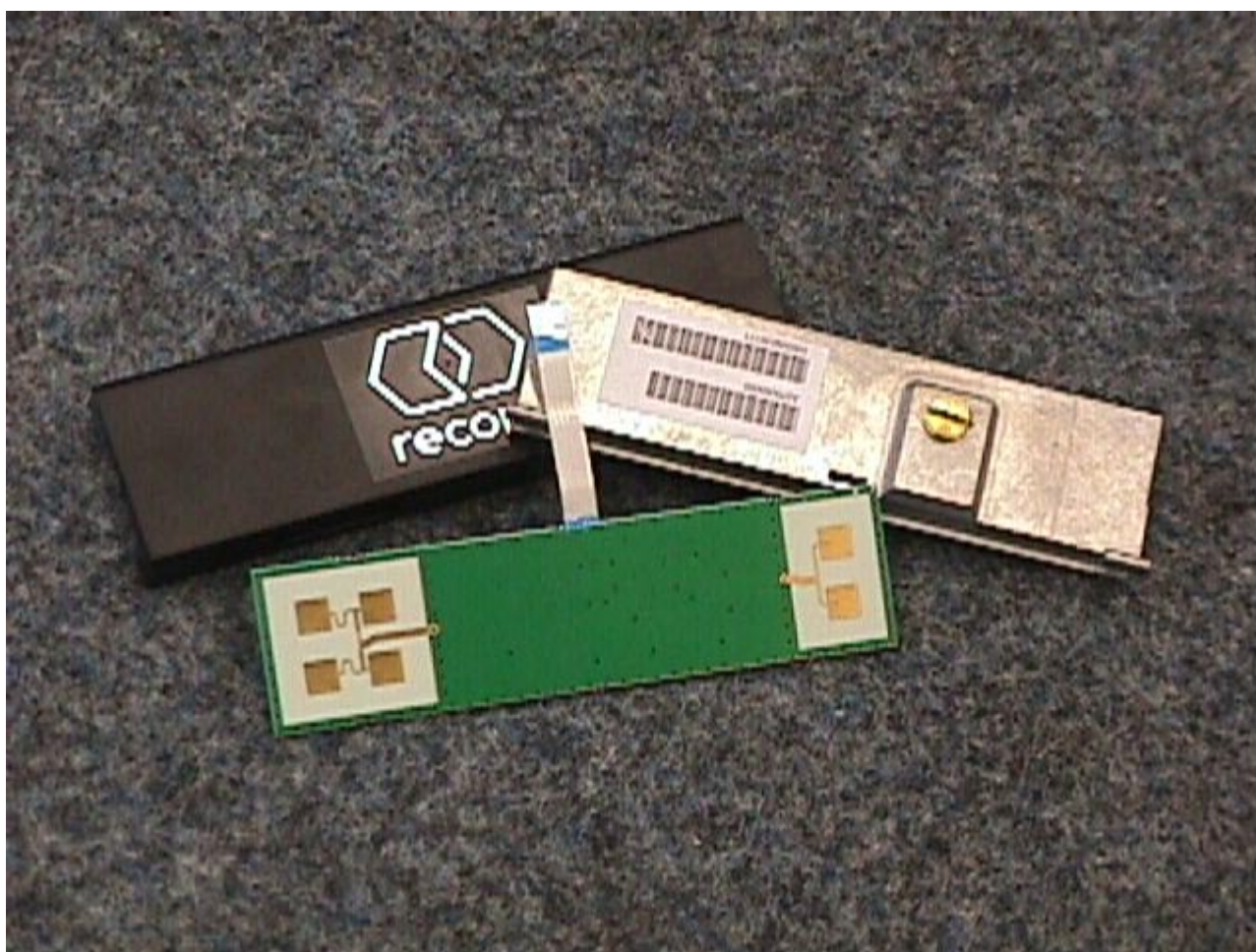


Photo No.: 04

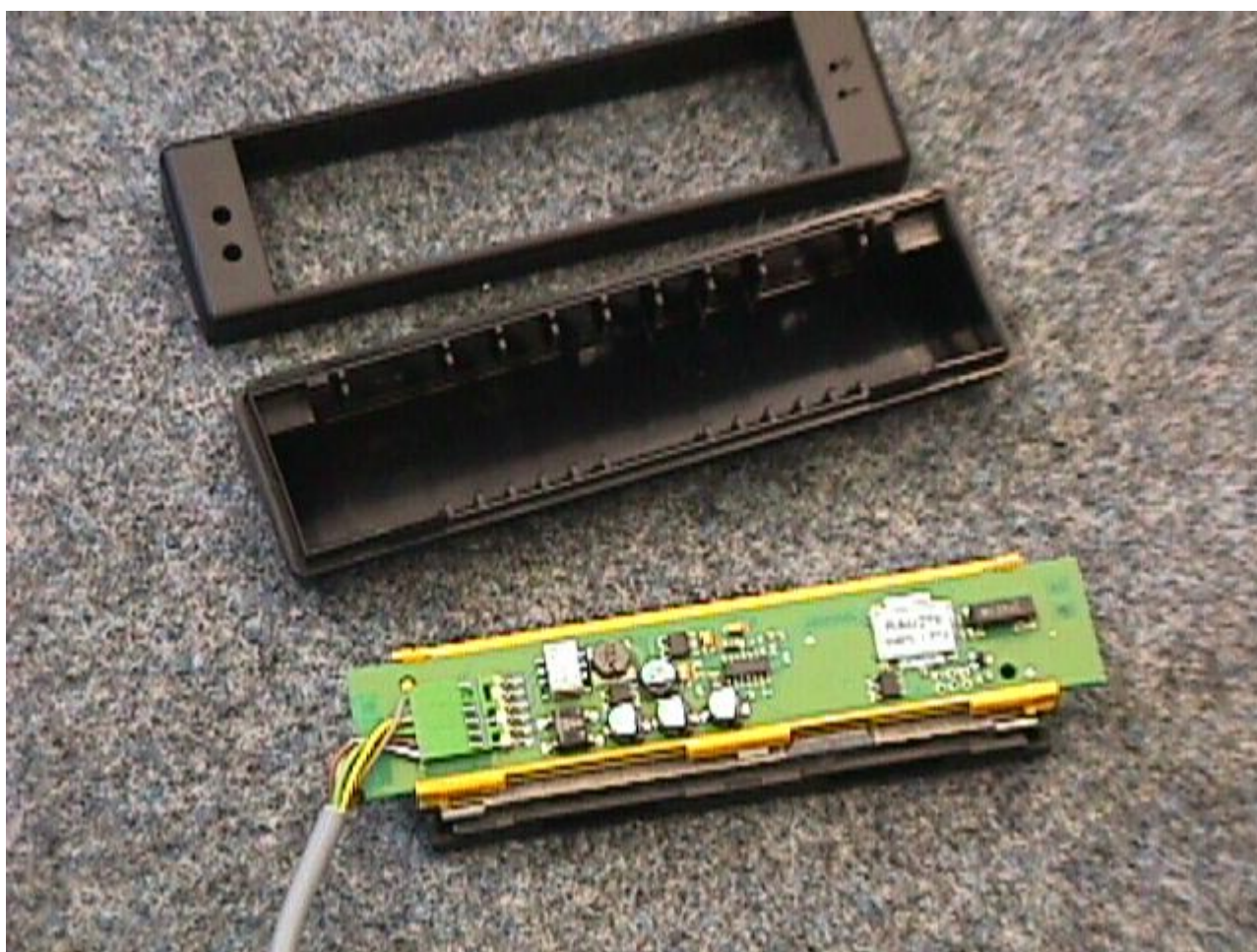


Photo No.: 05

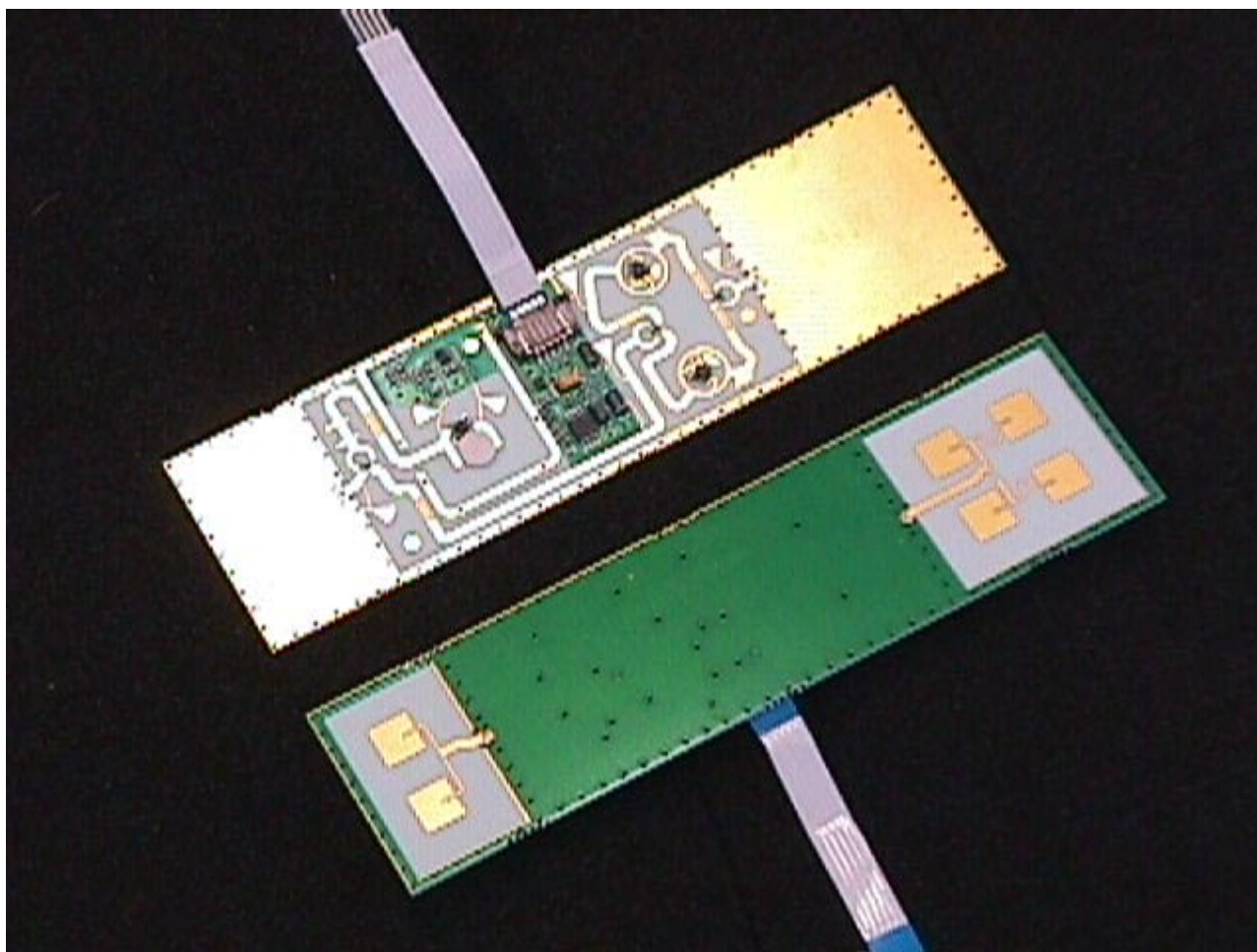


Photo No.: 06

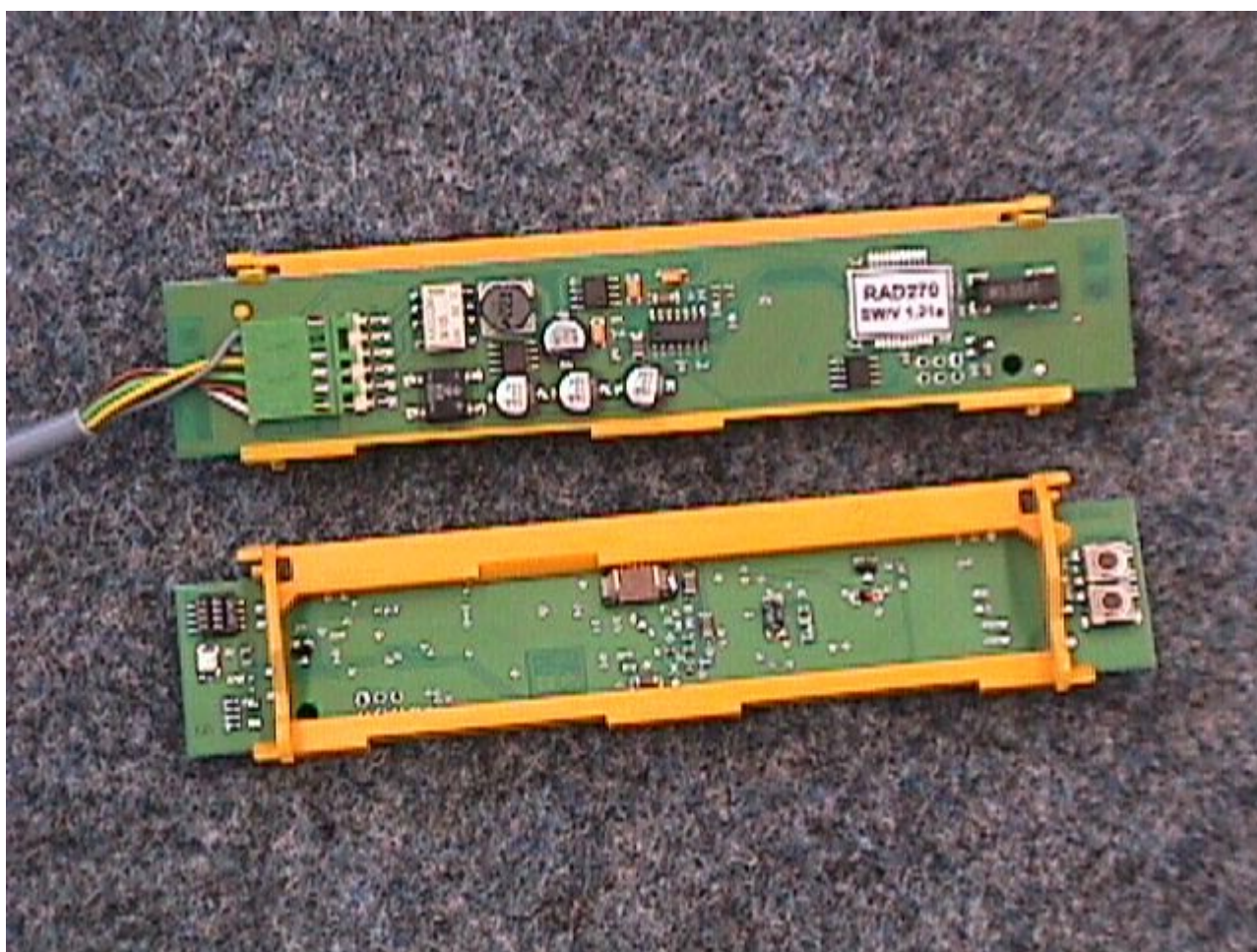


Photo No.: 07



Photo No.: 08



Photo No.: 09

