CETECOM ICT Services GmbH

Radio Satellite Communication
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Recognized by the
Federal Communications Commission
FCC–Identification Number
TCB ID: DE0001

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

Independent ETSI
compliance test house

Test report No.	:	2–3190–01–02/03
Applicant	:	OPTEX Co. Ltd.
Type	:	Microwave Door Sensor

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 :

16.06.2003	Manfred Paschwitz	
Date	Name	Signature

Technical responsibility for area of testing :

16.06.2003	Klaus Kammerinke	
Date	Name	Signature

1.2. Testing laboratory

CETECOM ICT Services GmbH
Untertürkheimerstraße 6–10 P.O. Box 65 01 55
66117 Saarbrücken 66140 Saarbrücken
Germany 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)

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 : OPTEX Co. Ltd.
Street : 5-265-1 Ogoto
Town : Otsu 520-0101
Country : Japan
Telephone : +81 77 579 8111
Fax : +81 77 579 8137

Contact person
Name : Osamu Imanishi
Telephone : +81 77 579 8111
Fax : +81 77 579 8137
e mail : o–imanishi@optex.co.jp

1.4. Application details

Date of receipt of application : 28.04.2003
Date of receipt of test item : 28.04.2003
Date of test : 16.05.2003

1.5. Test item (EUT)

Description of EUT	:	Field disturbance sensor
System designation	:	Automatic door opener
Type designation	:	Microwave Door Sensor
Manufacturer	:	OPTEX Co. Ltd.
Street	:	5-265-1 Ogoto
Town	:	Otsu 520-0101
Country	:	Japan

1.6. Technical data

Frequency range	:	24.000 GHz ... 24.250 GHz
Operational frequency	:	24.129 GHz
Field strength EZ	:	74.4 mV/m
Type of modulation	:	100H0N0N (CW)
Microwave modules	:	TX / RX – Module with integral antenna
Antenna module 1 for EZ	:	normal cover
Normal DC power supply	:	+12.0 V
Extreme DC power supply	:	+9.0 V ... +30.0 V
Normal AC power supply	:	12.0 V
Extreme AC power supply	:	9.0 V ... 24.0 V

1.6.1. Operation conditions

Operation:	:	As soon as the equipment is powered up, TX and RX start operating
Purpose of operation	:	Automatic door opener

1.6.2. Equipment under test

Model	Microwave module
EZ	normal cover

1.7. Test standards:

1.8. Code of Federal Regulations (CFR 47)

FCC Part 15	Section 15.209 Radiation emission limits, general requirements
	Section 15.245 Operation within the band 24.075 - 24.175 GHz
	Section 15.249 Operation within the band 24.000 - 24.250 GHz
	Section 15.205 Restricted bands of operation.

1.9. Industry Canada Radio Standards Specification

RSS 210

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 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

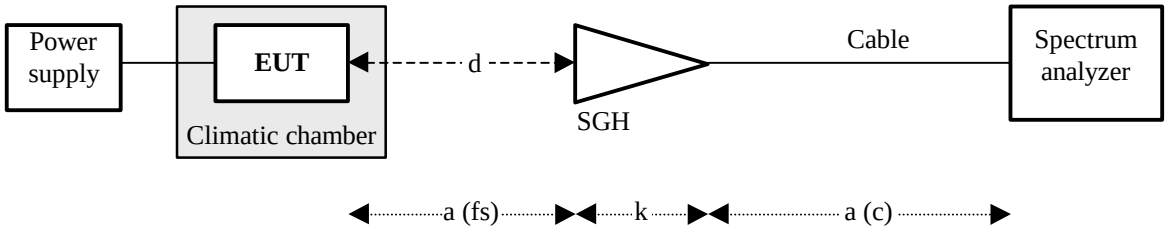
The environmental conditions are documented especially for each test.

2.3. Measurement and test set-up

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

2.4. 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 range [GHz]	Distance d [m]	Standard gain Horn ant. (SGH)	Dist. correction dc (3 m/X m) [dB]	Antenna factor k [dB 1/m]	Cable loss a [dB]
3.8 ... 6.0	1.0	narda 643	-9.54	27.22	1.8
5.3 ... 8.2	0.5	narda 642	-15.56	29.94	2.0
8.2 ... 12.4	0.5	narda 640	-15.56	33.64	2.5
12.4 ... 18.0	0.25	narda 639	-21.58	36.88	2.9
18 ... 26	0.25	narda 638	-21.58	40.36	4.5
26 ... 40	0.25	narda V637	-21.58	43.94	4.8
24.125	3.0	narda 640	n.a.	33.64	4.8

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

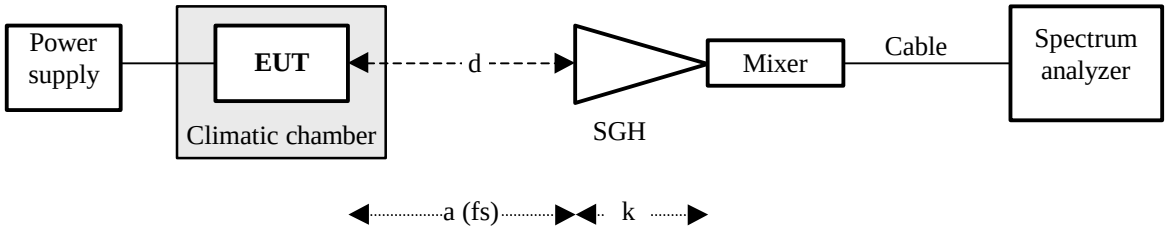
e = u + a + k + dc

Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300001665
SGH 3.8 ... 6.0 GHz	narda	643	300002447
SGH 5.3 ... 8.2 GHz	narda	642	300000767
SGH 8.2 ... 12.4 GHz	narda	640	300002213
SGH 12.4 ... 18.0 GHz	narda	639	300000786
SGH 18 ... 27 GHz	narda	638	300002442
SGH 27 ... 40 GHz	narda	V637	300000510
SGH 27 ... 40 GHz	Thomson	COR 27_40	300000797a
Power supply	HP	6032A	300002115
RF-cable	HP	5061-5359	300002033

Measurement uncertainty

Test parameter	Measurement uncertainty
Power supply	±0.1 VDC
Temperature	±0.2 °C
Frequency	±0.01 ppm
Field strength	±1.4 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/Xm) [dB]	Antenna factor k [dB 1/m]
40.0 ..... 60.0	0.25	-21.58	33.20
50.0 ..... 75.0	0.25	-21.58	34.50
75.0 ... 110.0	0.125	-27.60	35.70

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

e = u + a + k + dc

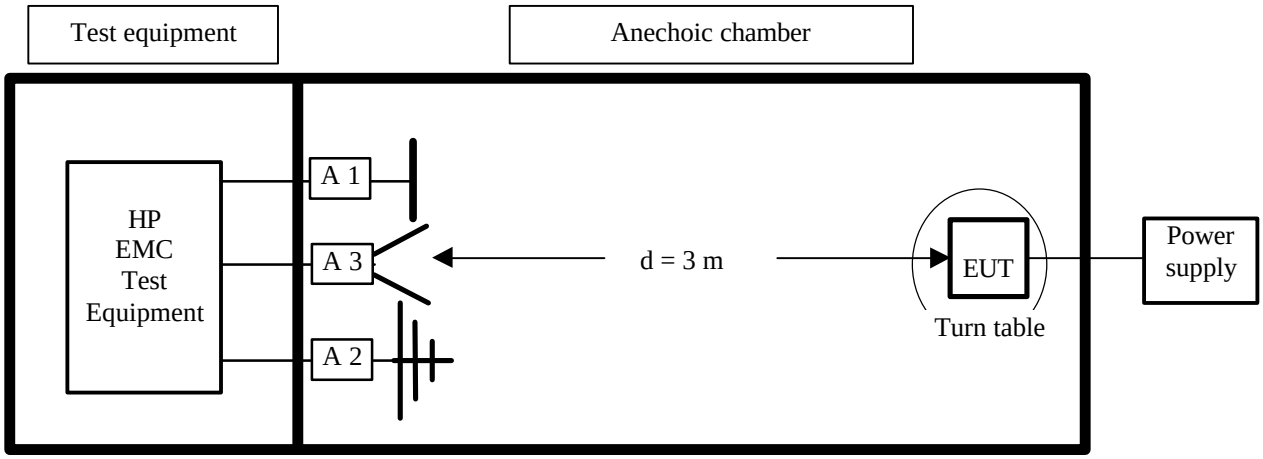
Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300001665
Power supply	HP	6032A	300002115
SGH 40 ... 60 GHz	Thomson	COR 40_60	300000812
Mixer 40 ... 60 GHz	HP	11970Q	300000781i
SGH 50 ... 75 GHz	Thomson	COR 50_75	300000789k
Mixer 50 ... 75 GHz	HP	11970V	300000871o
SGH 75 ... 110 GHz	Thomson	COR 75_110	300000789m
Mixer 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 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
Field strength	±1.4 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 and RSS 210 requirement

2.5.2 Summary of test set up

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 325 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 by 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

EUT : EZ
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS SECTION 15.245 /15.249

Microwave module : EZ with Antenna module 1 (normal cover)
Antenna assembly: Antenna module 1

TEST CONDITIONS		TRANSMITTER FIELD STRENGTH			
EUT operating: TX on and RX on DC power supply		Frequency [GHz]	S.A. u [dBmV]	E [mV/m]	See plot on page
T nom = 23.0°C	V nom = 12.0 V DC	24.129 578	- 1.0	74.473	14
	V min = 9.0 V DC	24.129 570	- 1.0	74.473	-
	V max = 30.0 V DC	24.129 575	- 1.0	74.473	-

TEST CONDITIONS		TRANSMITTER FIELD STRENGTH			
EUT operating: TX on and RX on AC power supply		Frequency [GHz]	S.A. u [dBmV]	E [mV/m]	See plot on page
T nom = 23.0°C	V nom = 12.0 V AC	24.129 570	- 1.0	74.473	-
	V min = 9.0 V AC	24.129 575	- 1.0	74.473	-
	V max = 24.0 V AC	24.129 575	- 1.0	74.473	-

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

LIMITS: SECTION 15.245 / 15.249

Section	Frequency range [GHz]	Measurement distance [m]	Field strength e [dBmV/m] @ 3 m	Field strength E [mV/m]
15.249	24.000 to 24.250	3.0	47.96	250
15.245	24.075 to 24.175	3.0	67.96	2500

Verdict :	Field strength limit 15.249 is kept

EUT : EZ
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS SECTION 15.209
SPURIOUS FREQUENCIES
Microwave module : EZ with Antenna module 1 (normal cover)
Antenna assembly: Antenna module 1

	TRANSMITTER SPURIOUS FIELD STRENGTH			
Frequency range [GHz]	Spurious frequencies [GHz]	S A u [dBmV]	E [µV/m]	See plot on page
0.009 – 30.000 MHz	Noise		<<Limit	15
30.000 – 4.000 (horizontal)	0.040 818	30.6 dBµV/m	33.8	27
4.000 – 6.000 (h + v)	Noise	- 14.8	180.9	16
6.000 – 8.000 (h + v)	Noise	-14.8	180.9	17
8.000 – 12.000 (h + v)	Noise	- 16.6	147.7	18
12.000 – 18.000 (h + v)	Noise	- 10.6	294.1	19
18.000 – 26.500 (h + v)	Noise	- 8.9	359.3	20
26.500 – 40.000 (h + v)	Noise	- 8.2	407.5	21
40.000 – 60.000 (h + v)	Noise	- 23.9	63.9	22
50.000 – 75.000 (h + v)	Noise	- 4.7	237.5	23
75.000 – 110.000 (h + v)	Noise	- 6.4	476.9	24
48.235 - 48.285 (h + v)	48.259 125	3.4	1,485	25
72.175 - 72.375 (h + v)	Noise	-3.8	187.5	26

LIMITS: SECTION 15.249 / 15.205 / 15.209

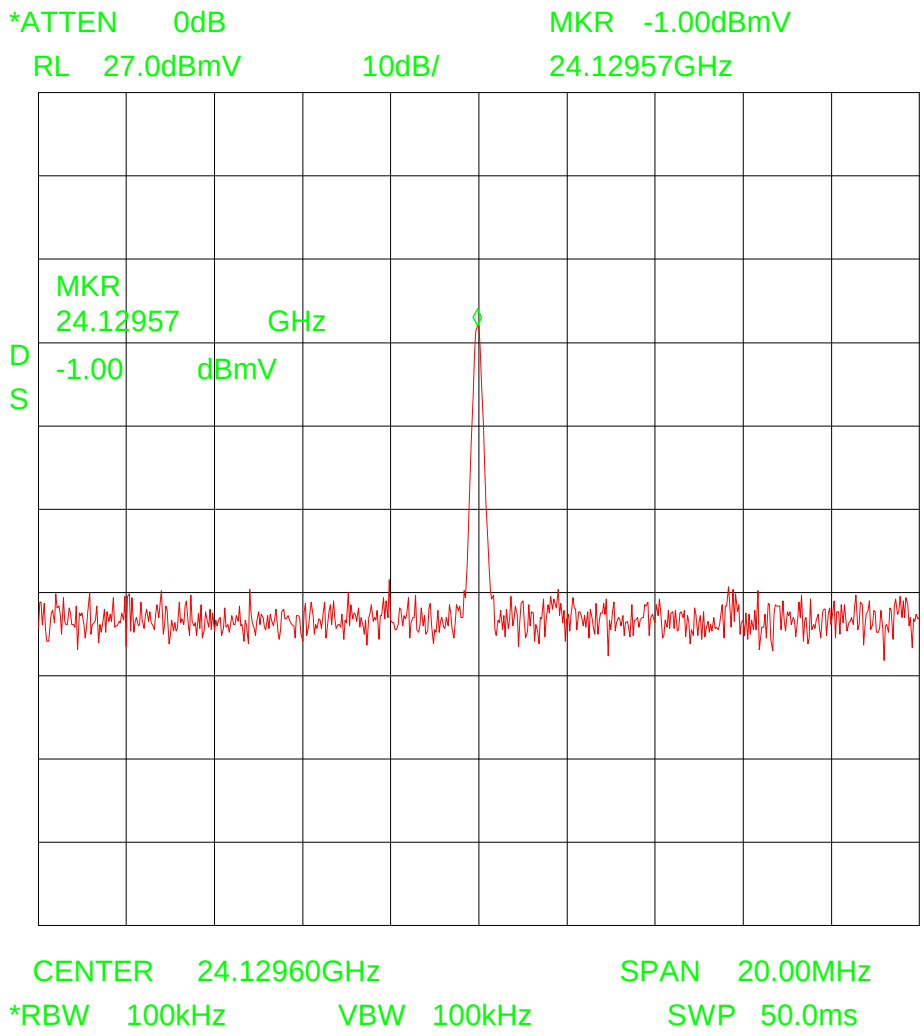
Frequency range (MHz)	Measurement distance [m]	Field strength e [dBµV/m] @ 3 m	Field strength E [µV/m]
0.009 – 0.490	300	88.5 ... 53.8	2400/F(kHz)
0.490 – 1.705	30	53.8 ... 43.0	24000/F(kHz)
1.705 – 30.0	30	49.5	30
30.0 – 88.0	3	40.0	100
88.0 – 216.0	3	43.5	150
216.0 – 960.0	3	46.0	200
> 960.0	3	54.0	500
Harmonics	3	67.9 = 7.9 dBmV/m	2,500

REFERENCE OF TEST EQUIPMENT USED : see test set-up on pages 8, 9 and 10

Verdict :	Spurious limits / harmonics limits are kept

3. Plots, graphs and data sheets

Plot 1



Measurement distance d = 3.0 m

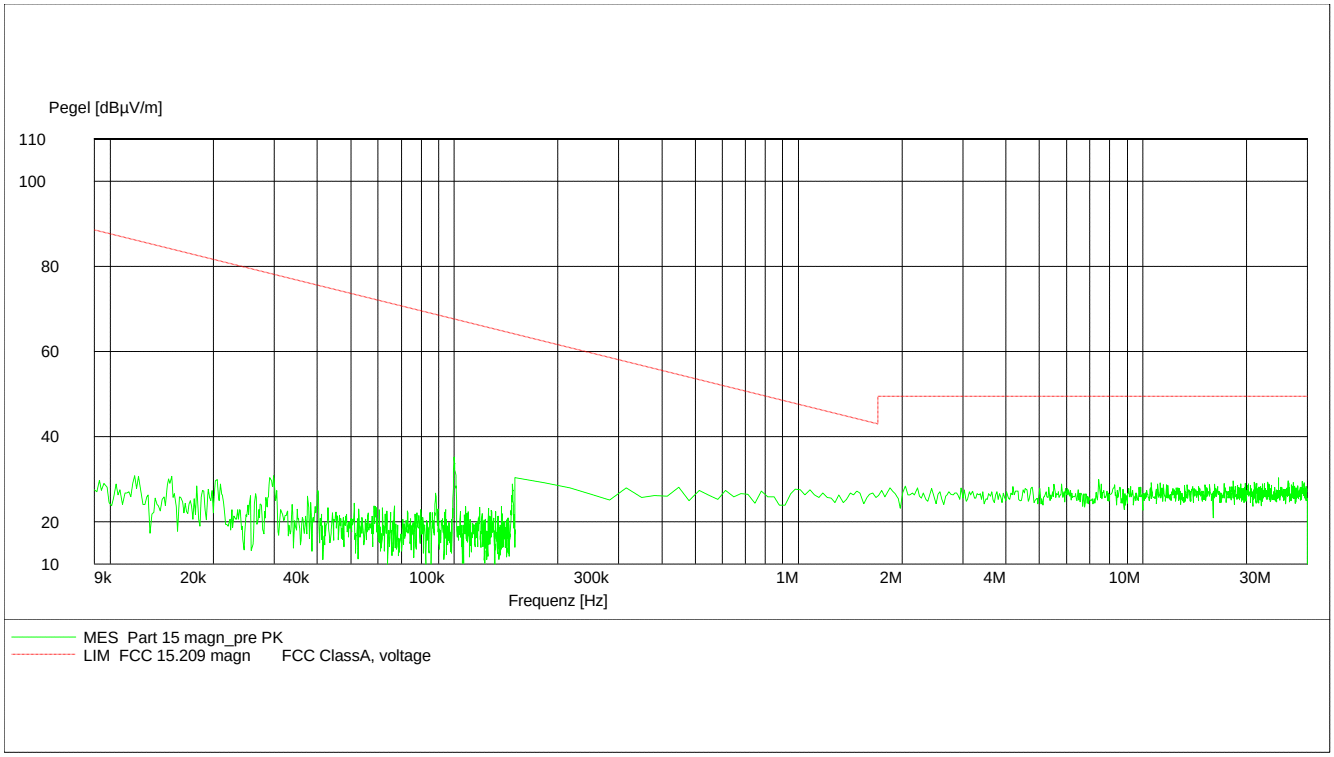
Calculation : Field strength = Analyser reading + Antenna factor + cable loss

e = -1.00 dBmV + 33.64 dB(1/m) + 4.8 dB

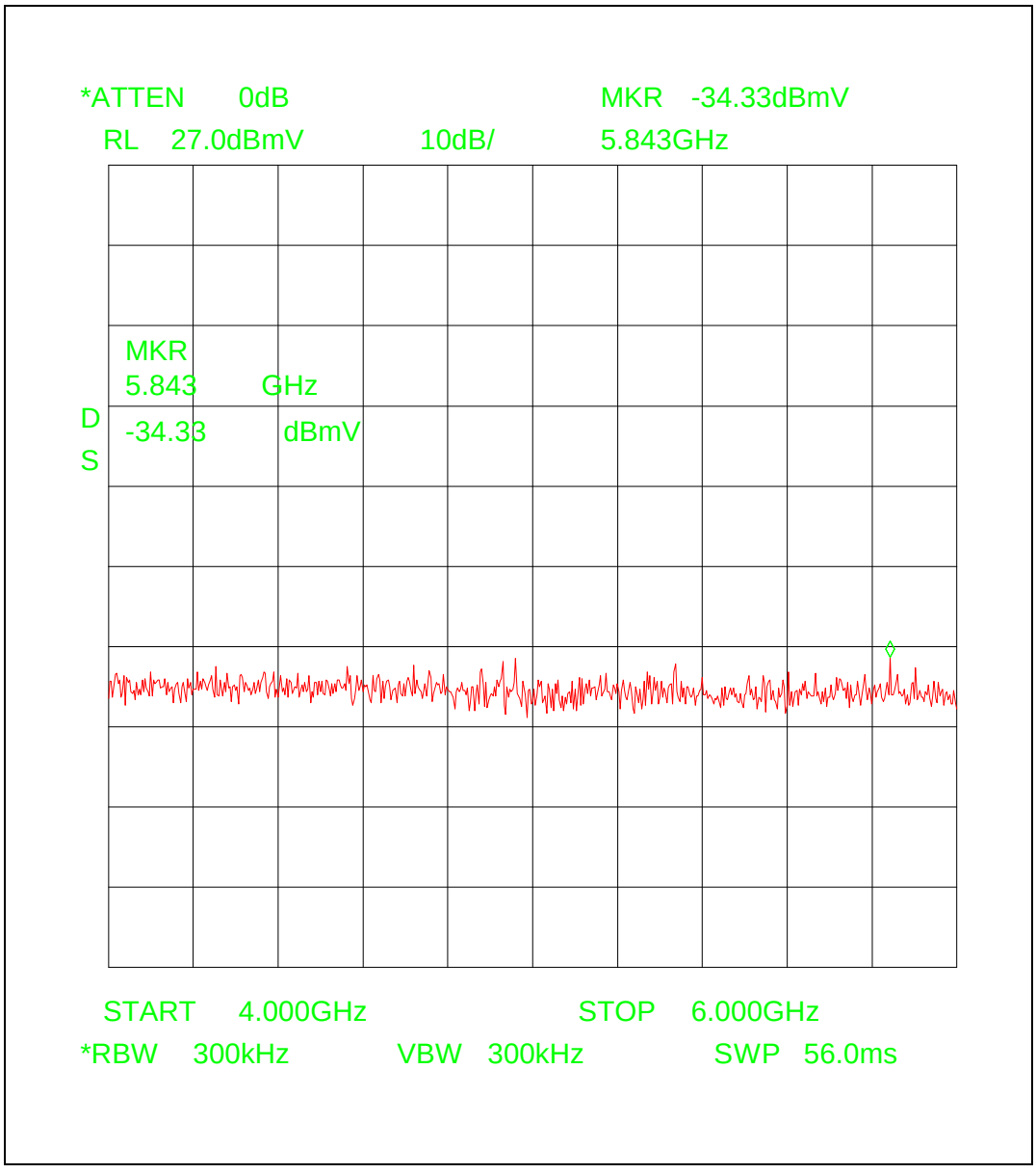
e = 37.44 dB(mV/m)

E = 74.473 mV/m

Plot 2


Pegel [dBµV/m]
110
100
80
60
40
20
10
9k
20k
40k
100k
300k
1M
2M
4M
10M
30M
Frequenz [Hz]
MES Part 15 magn_pre PK
LIM FCC 15.209 magn FCC ClassA, voltage

Plot 3



Measurement distance d = 1.0 m

Calculation : Field strength = Analyser reading + Antenna factor + distance corr. + cable loss

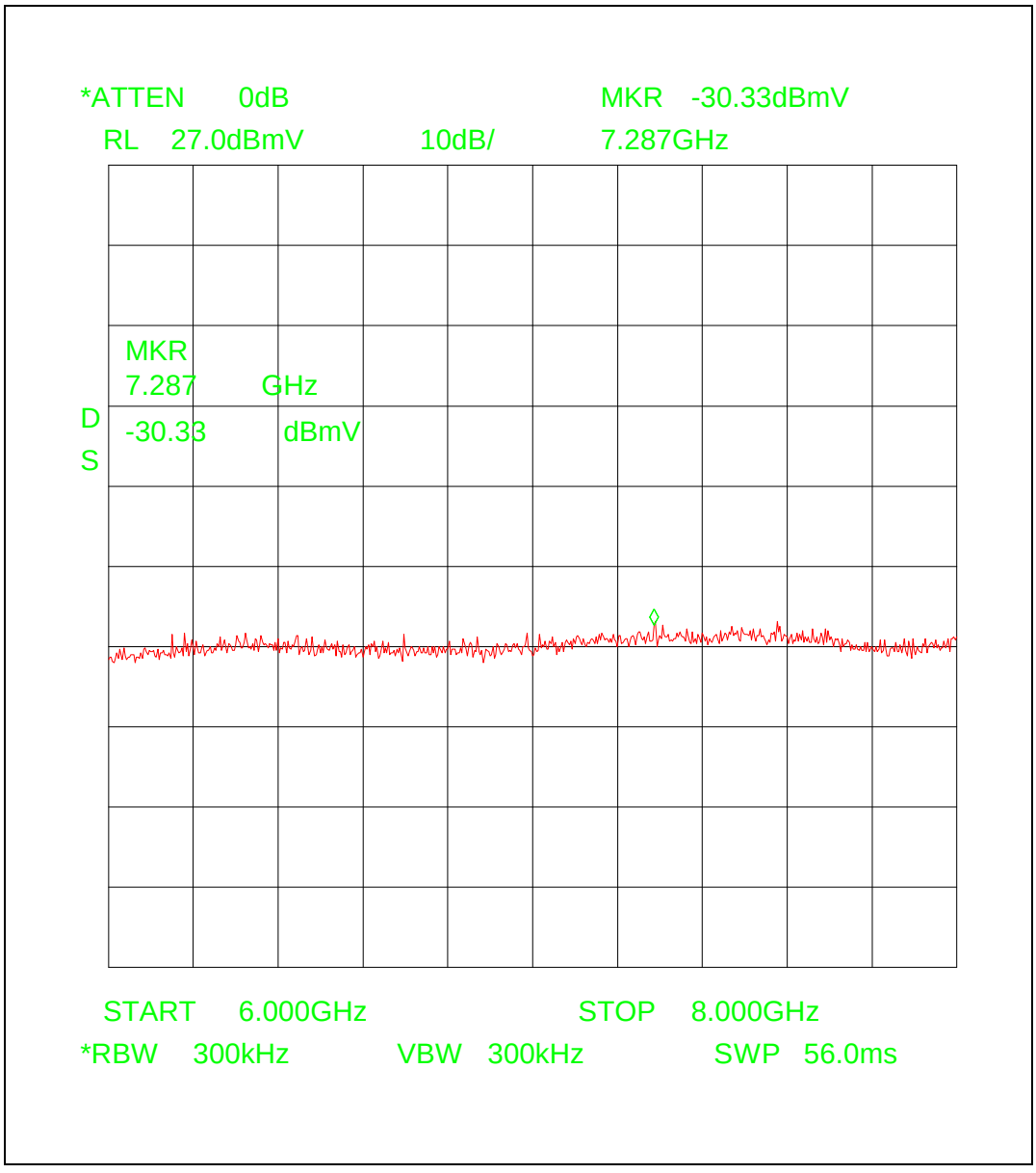
e = -34.33 dBmV + 27.22 dB(1/m) + (- 9.54 dB) + 1.8 dB

e = -14.85 dB(mV/m)

E = 0.1809 mV/m

E = 180.9 µV/m

Plot 4



Measurement distance d = 0.5 m

Calculation : Field strength = Analyser reading + Antenna factor + distance corr. + cable loss

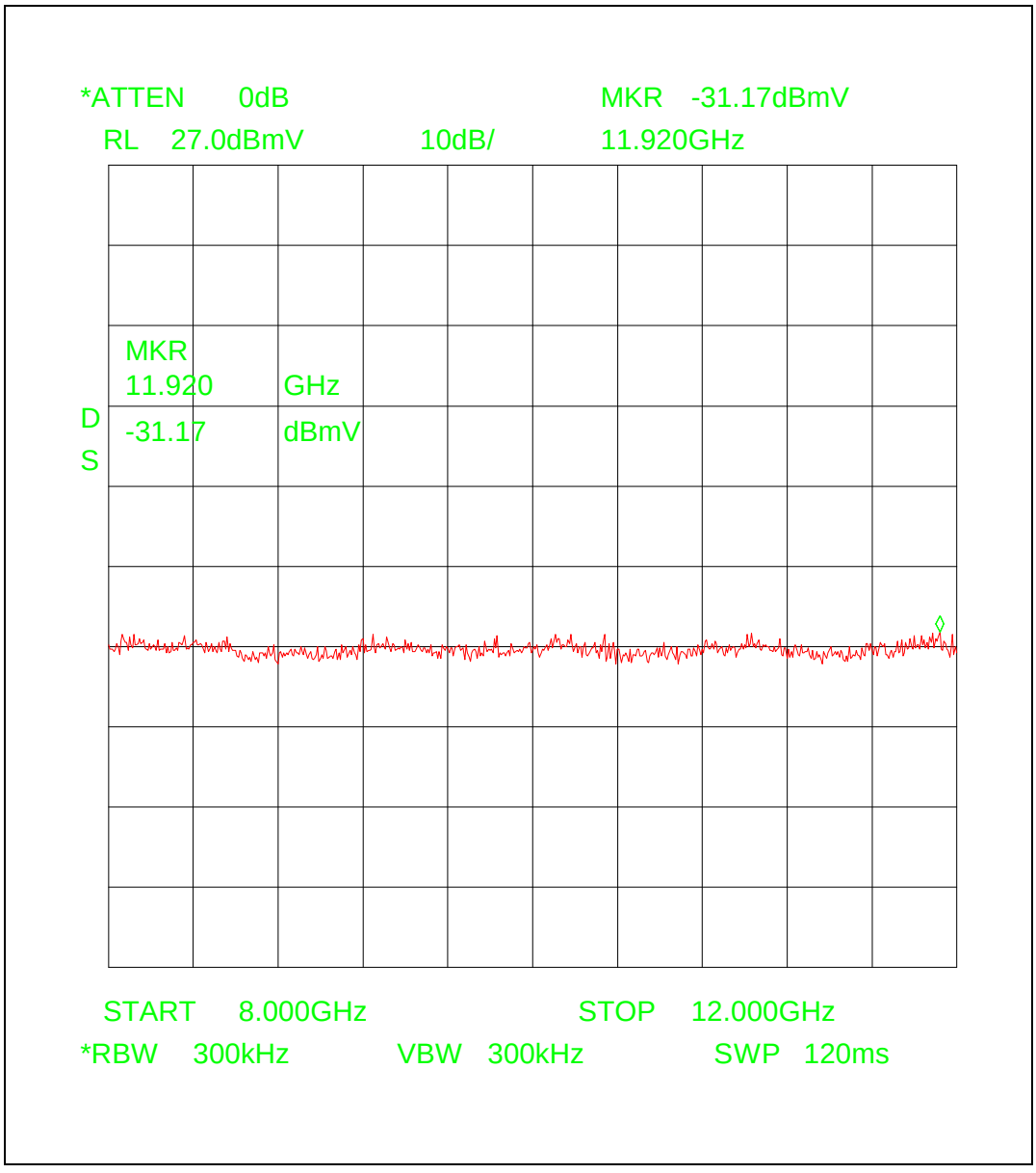
e = -30.33 dBmV + 29.94 dB(1/m) + (- 15.56 dB) + 2.0 dB

e = -13.95 dB(mV/m)

E = 0.20067 mV/m

E = 200.7 µV/m

Plot 5



Measurement distance d = 0.25 m

Calculation : Field strength = Analyser reading + Antenna factor + distance corr. + cable loss

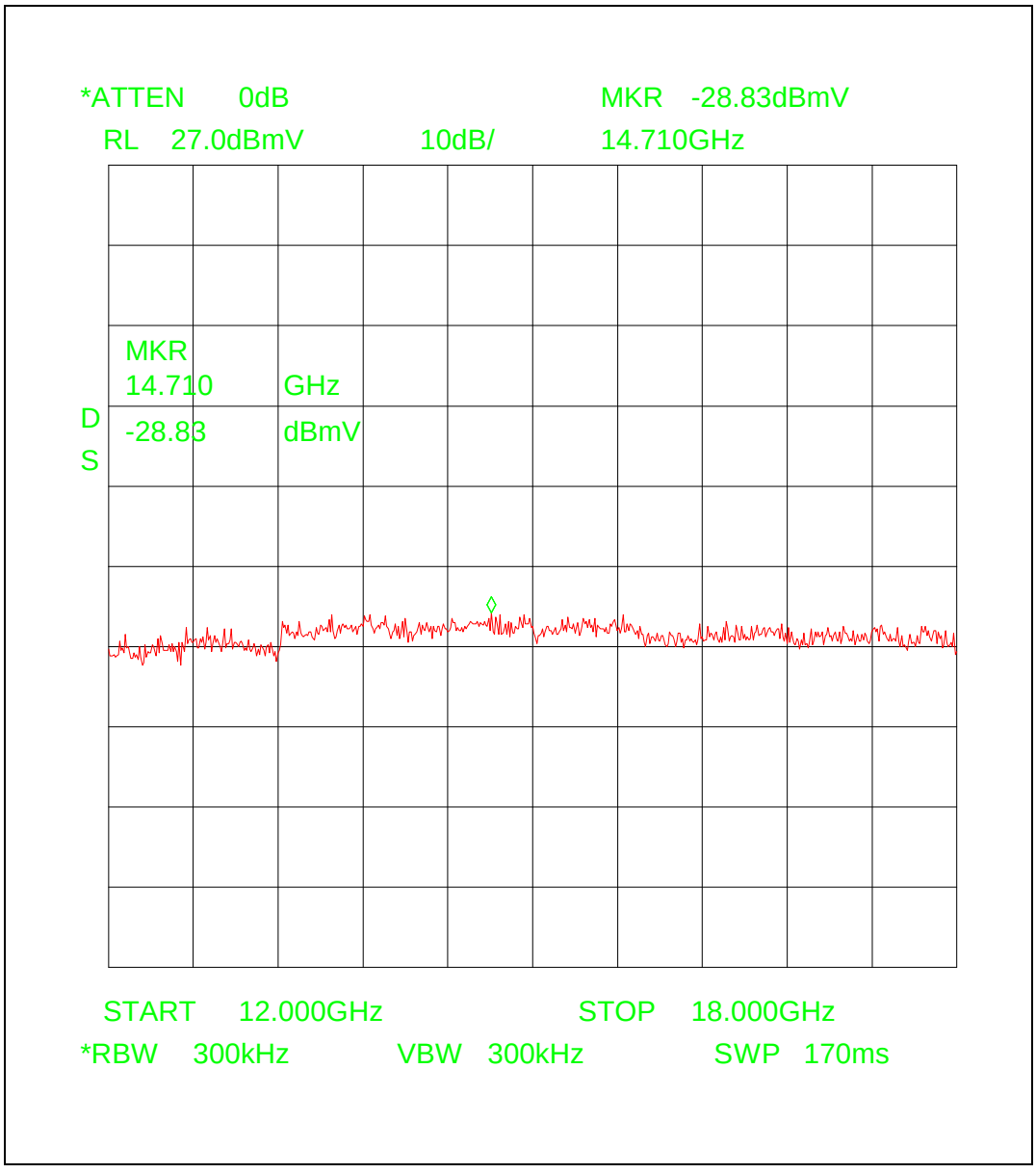
e = -31.17 dBmV + 33.64 dB(1/m) + (- 21.58 dB) + 2.5 dB

e = -16.61 dB(mV/m)

E = 0.1477 mV/m

E = 147.7 µV/m

Plot 6



Measurement distance d = 0.25 m

Calculation : Field strength = Analyser reading + Antenna factor + distance corr. + cable loss

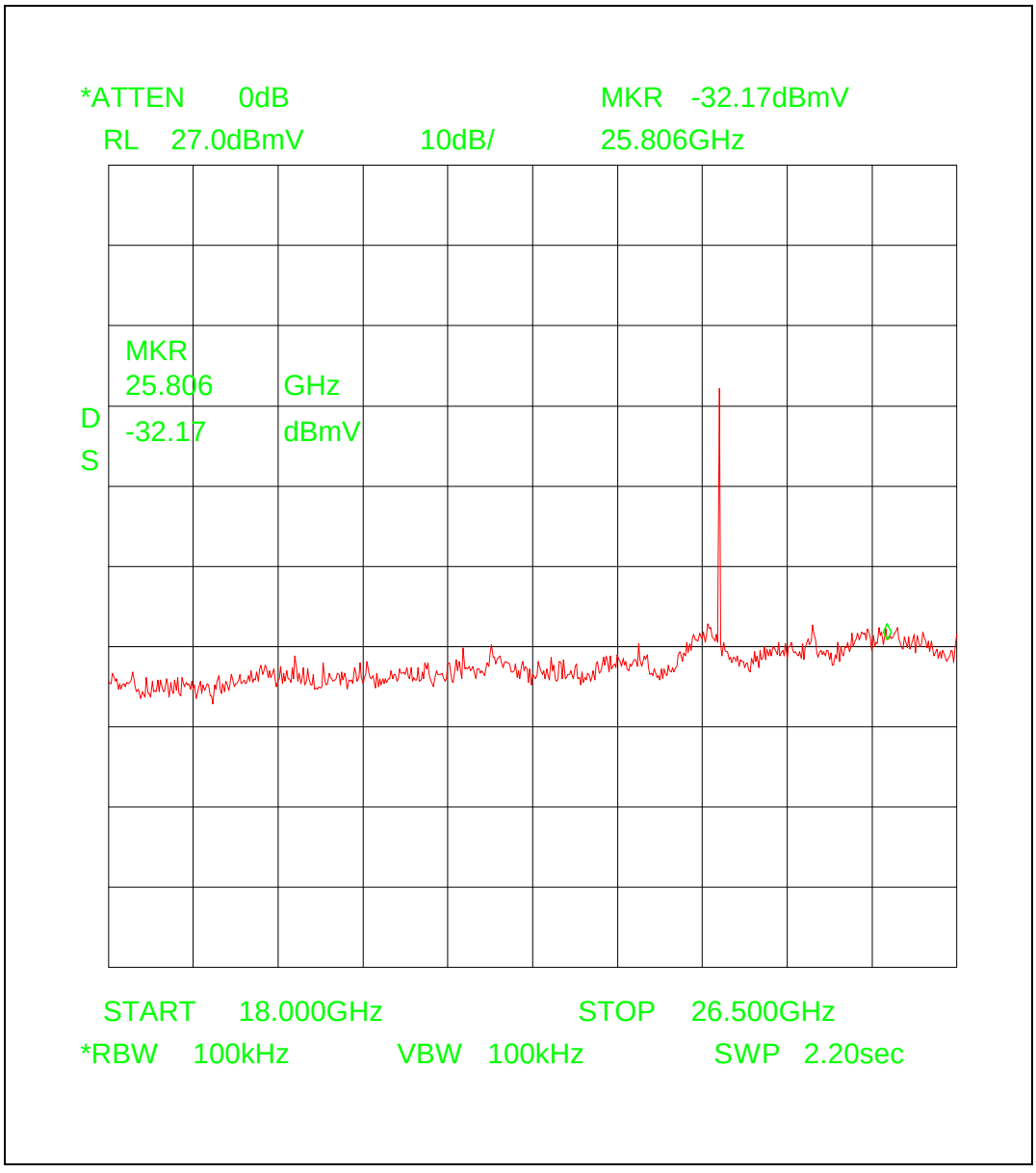
e = -28.83 dBmV + 36.88 dB(1/m) + (- 21.58 dB) + 2.9 dB

e = -10.63 dB(mV/m)

E = 0.2941 mV/m

E = 294.1 µV/m

Plot 7



Measurement distance d = 0.25 m

Calculation : Field strength = Analyser reading + Antenna factor + distance corr. + cable loss

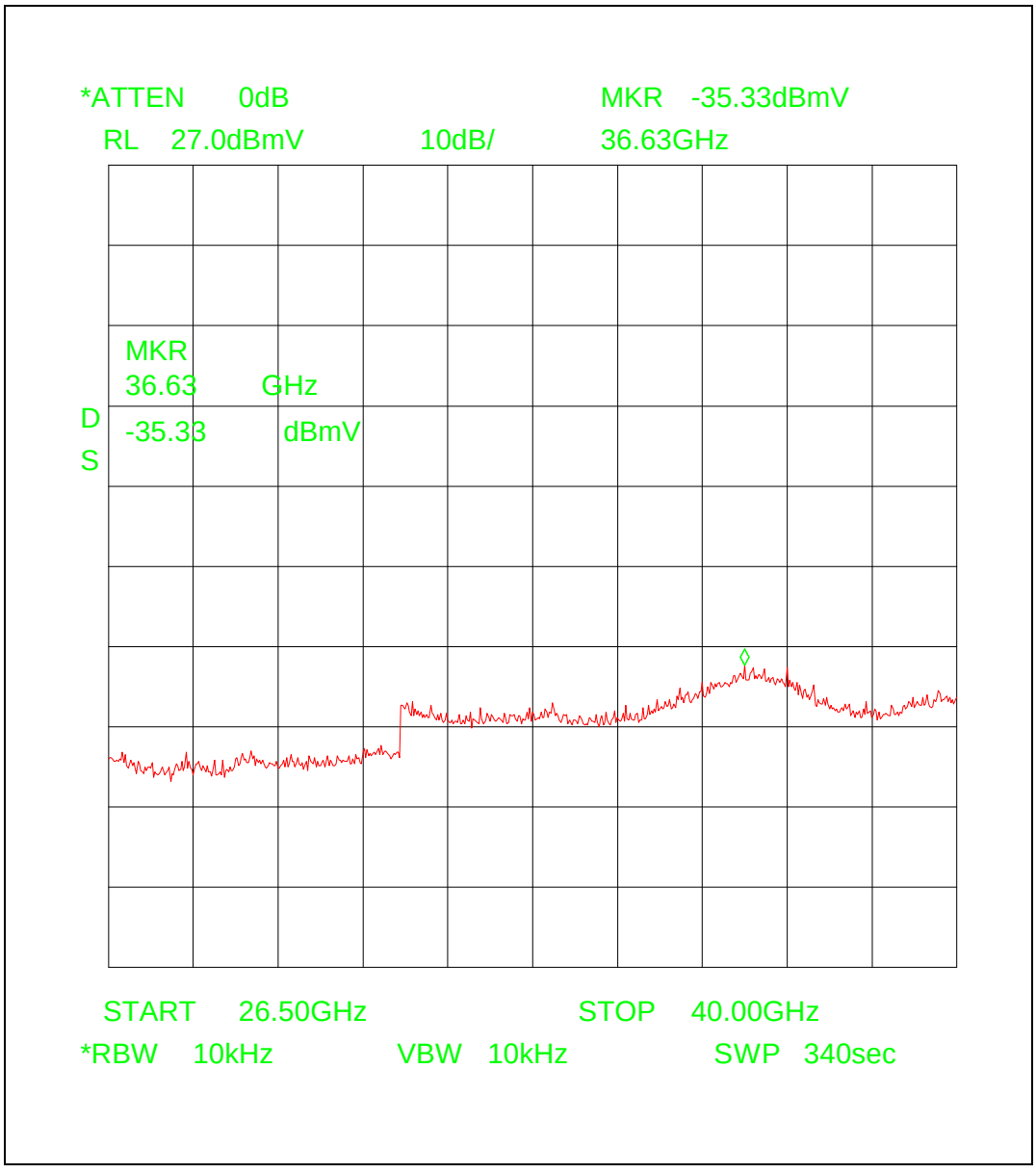
e = -32.17 dBmV + 40.36 dB(1/m) + (- 21.58 dB) + 4.5 dB

e = -8.89 dB(mV/m)

E = 0.3593 mV/m

E = 359.3 µV/m

Plot 8



Measurement distance d = 0.25 m

Calculation : Field strength = Analyser reading + Antenna factor + distance corr. + cable loss

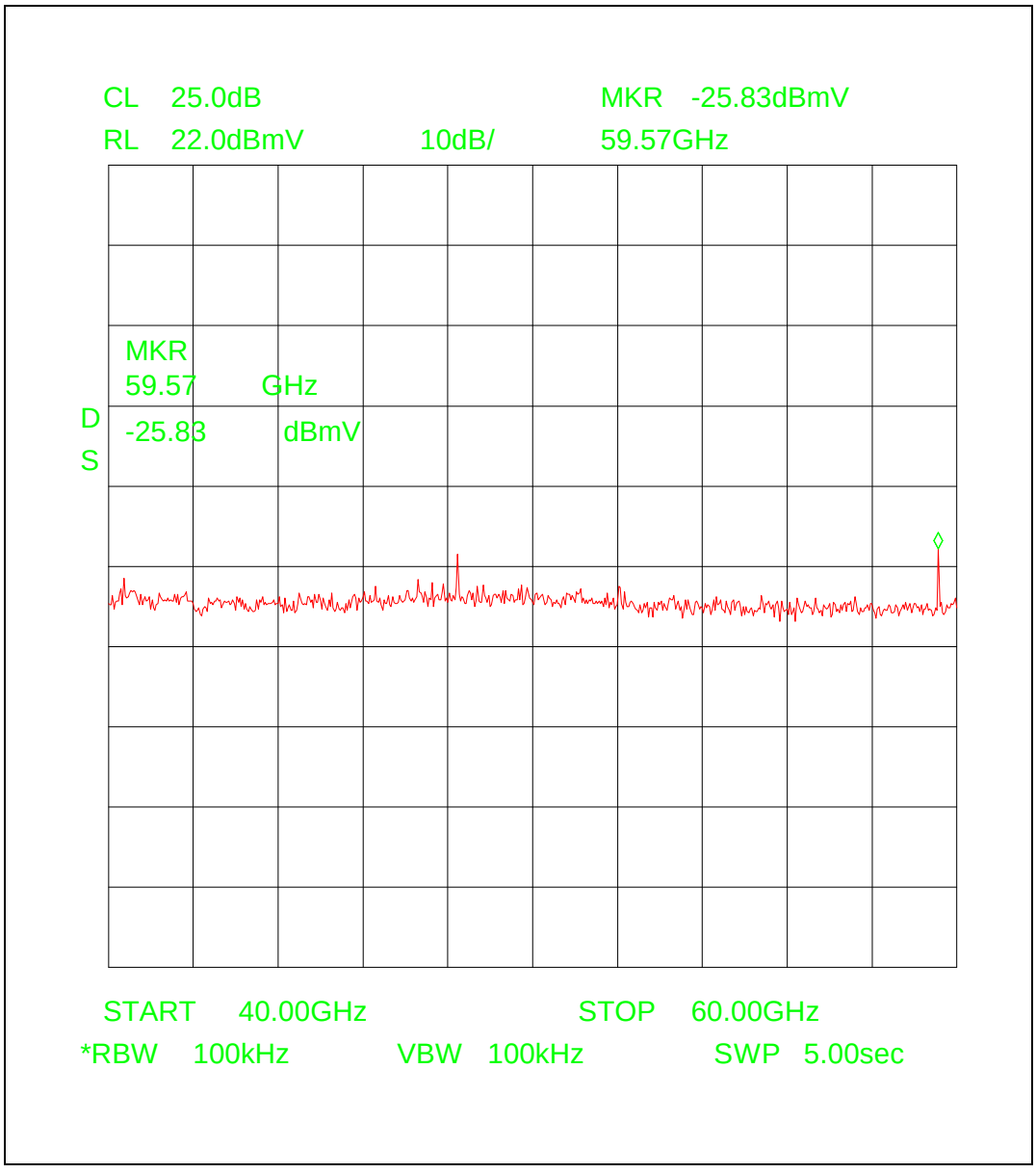
e = -35.33 dBmV + 43.96 dB(1/m) + (- 21.58 dB) + 4.8 dB

e = -8.15 dB(mV/m)

E = 0.4075 mV/m

E = 407.5 µV/m

Plot 9



Measurement distance d = 0.25 m

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

e = -35.50 dBmV + 33.20 dB(1/m) + (- 21.58 dB)

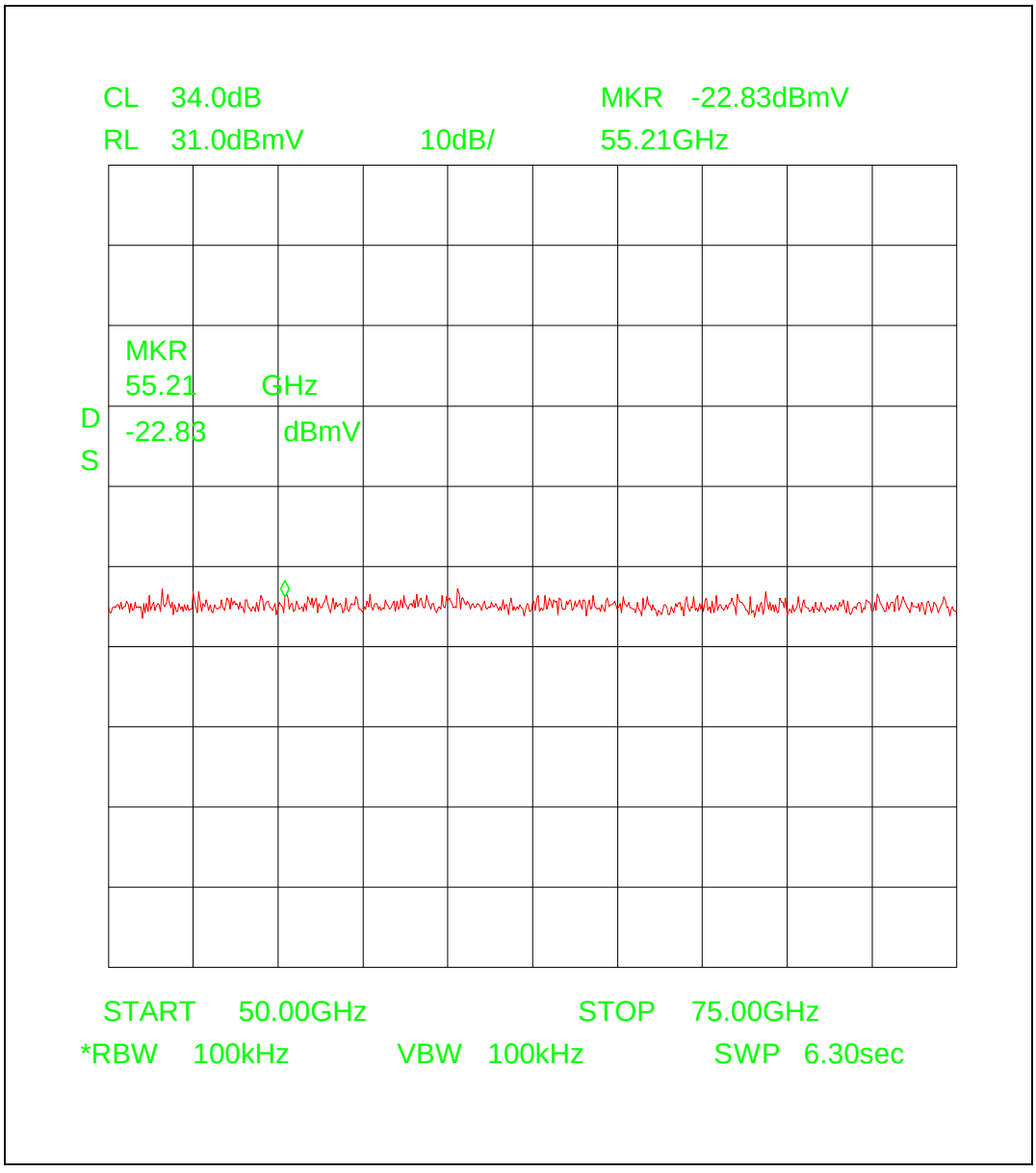
e = -23.88 dB(mV/m)

E = 0.0639 mV/m

E = 63.9 µV/m

Remark: Spurious frequencies e.g. 59.570 GHz are produced by the external mixer.
They are image frequency responses, and can be identified by calling up signal identifier program.

Plot 10



Measurement distance d = 0.25 m

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

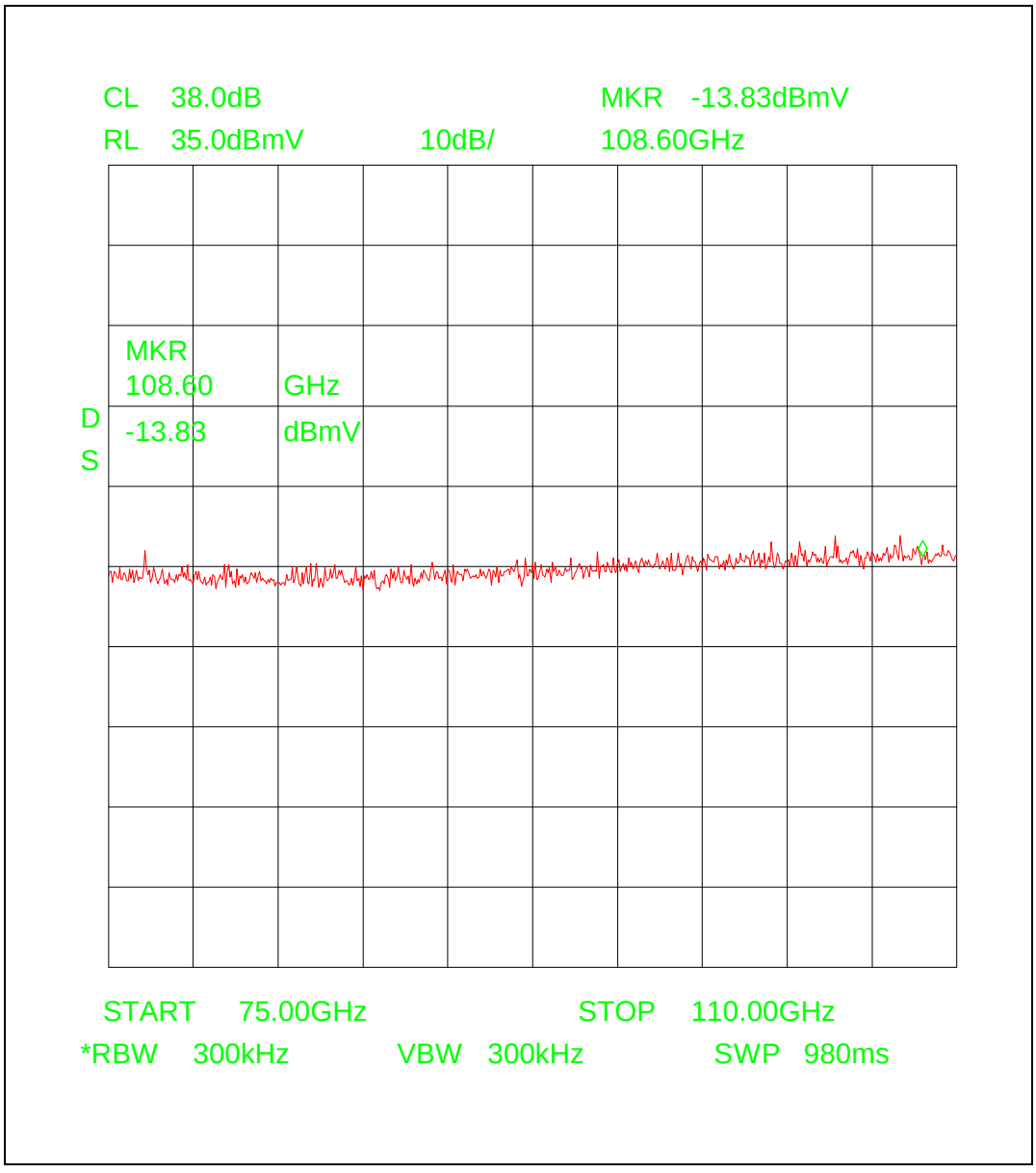
e = -22.83 dBmV + 34.50 dB(1/m) + (- 21.58 dB)

e = -9.91 dB(mV/m)

E = 0.3195 mV/m

E = 319.5 µV/m

Plot 11



Measurement distance d = 0.125 m

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

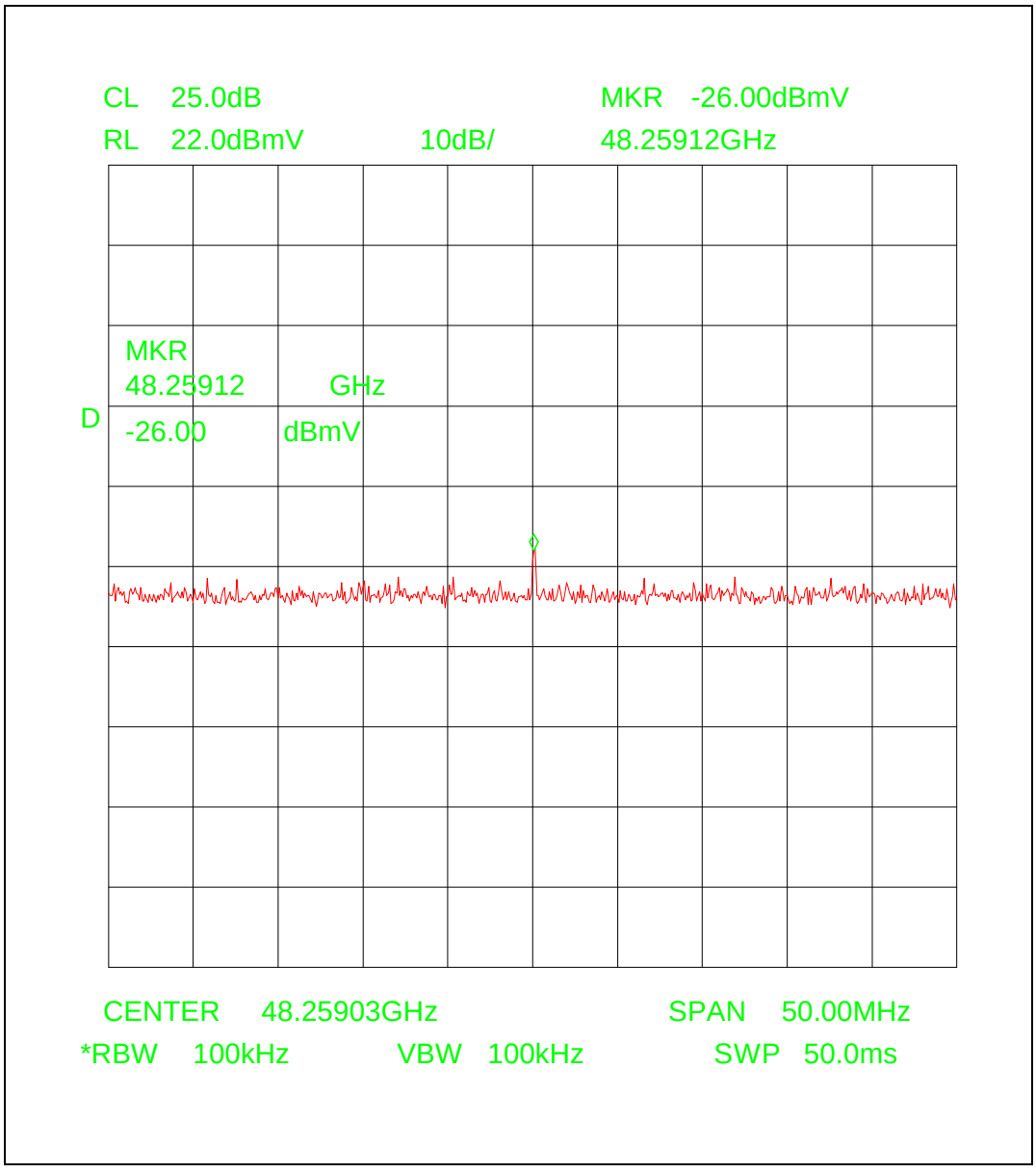
e = -13.83 dBmV + 35.00 dB(1/m) + (- 27.60 dB)

e = - 6.43 dB(mV/m)

E = 0.4769 mV/m

E = 476.9 µV/m

Plot 12



Measurement distance d = 1.0 m

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

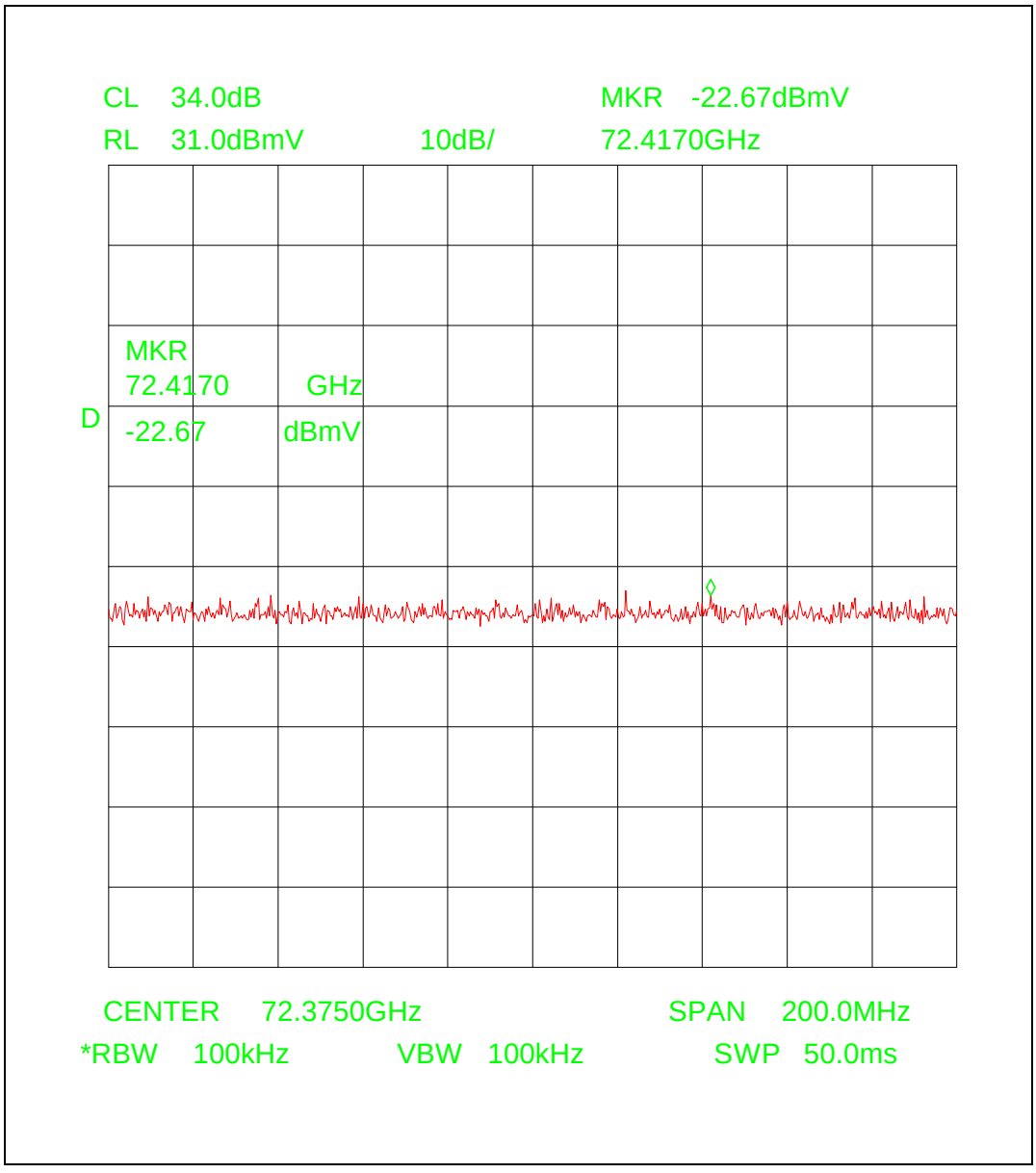
e = -26.00 dBmV + 38.98 dB(1/m) + (- 9.54 dB)

e = 3.44 dB(mV/m)

E = 1.4859 mV/m

E = 1,485 µV/m

Plot 13



Measurement distance d = 0.5 m

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

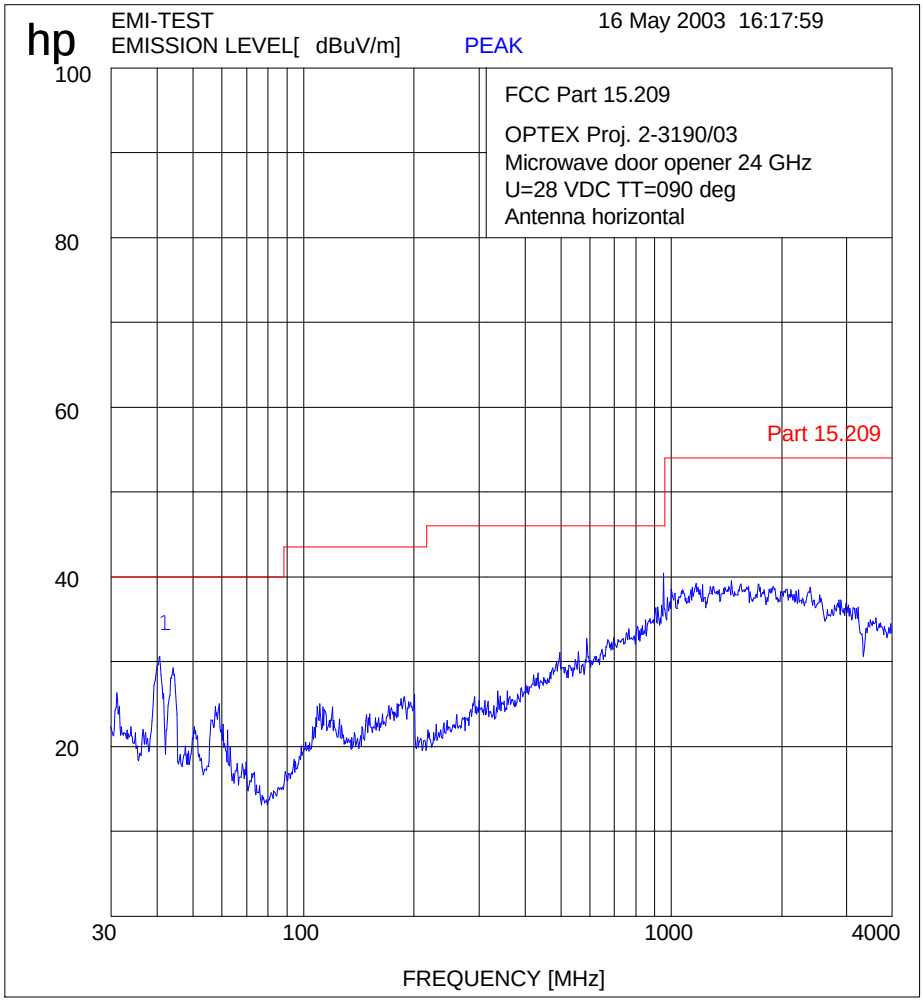
e = -22.67 dBmV + 34.50 dB(1/m) + (- 15.56 dB)

e = -3.75 dB(mV/m)

E = 0.1875 mV/m

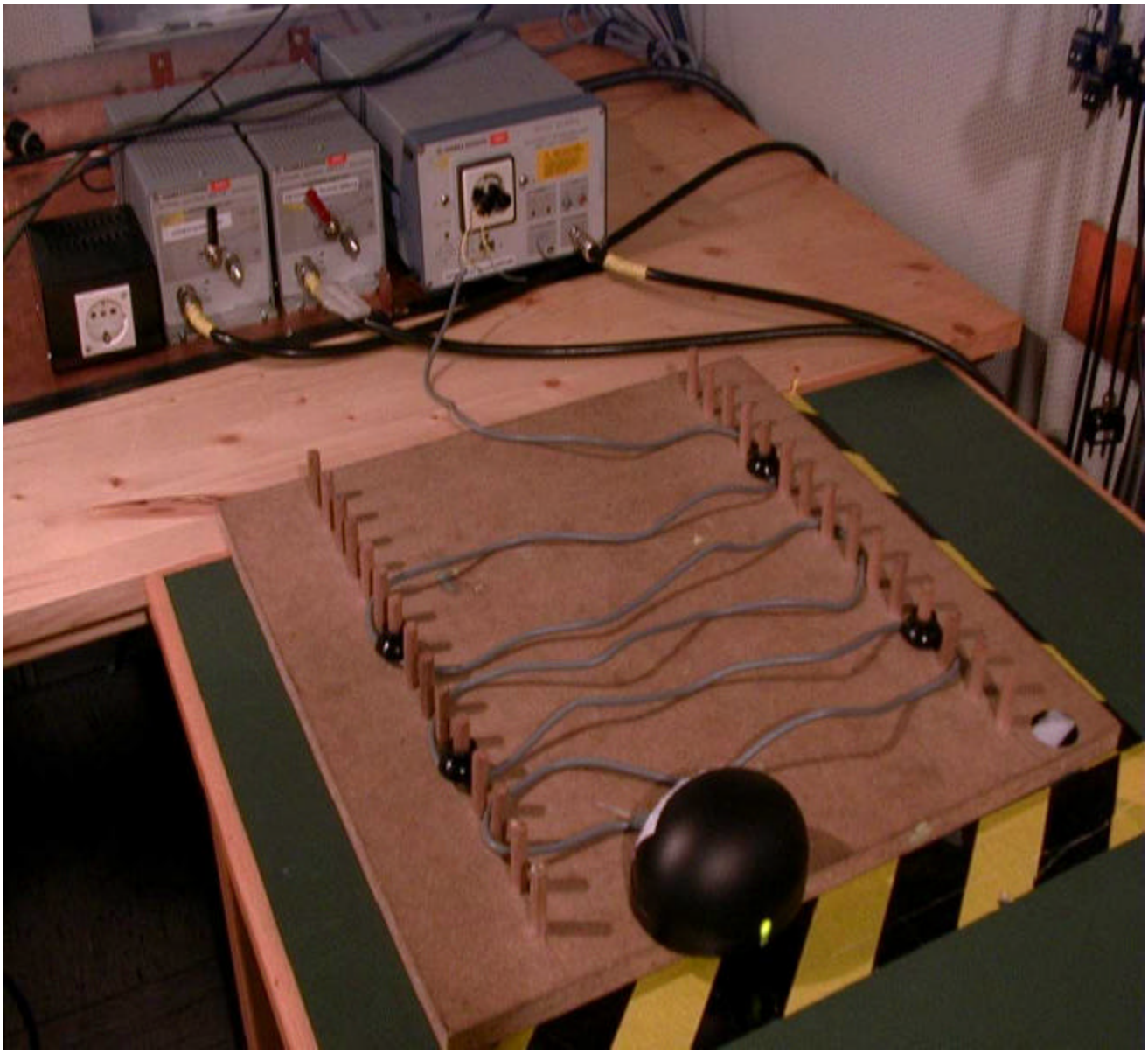
E = 187.5 µV/m

Plot 13


hp
EMI-TEST
16 May 2003 16:17:59
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15.209
OPTEX Proj. 2-3190/03
Microwave door opener 24 GHz
U=28 VDC TT=090 deg
Antenna horizontal
Part 15.209
1
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

4. Photographs

Photo 1



Set–up for conducted and radiated measurements <30 MHz

Photo 2

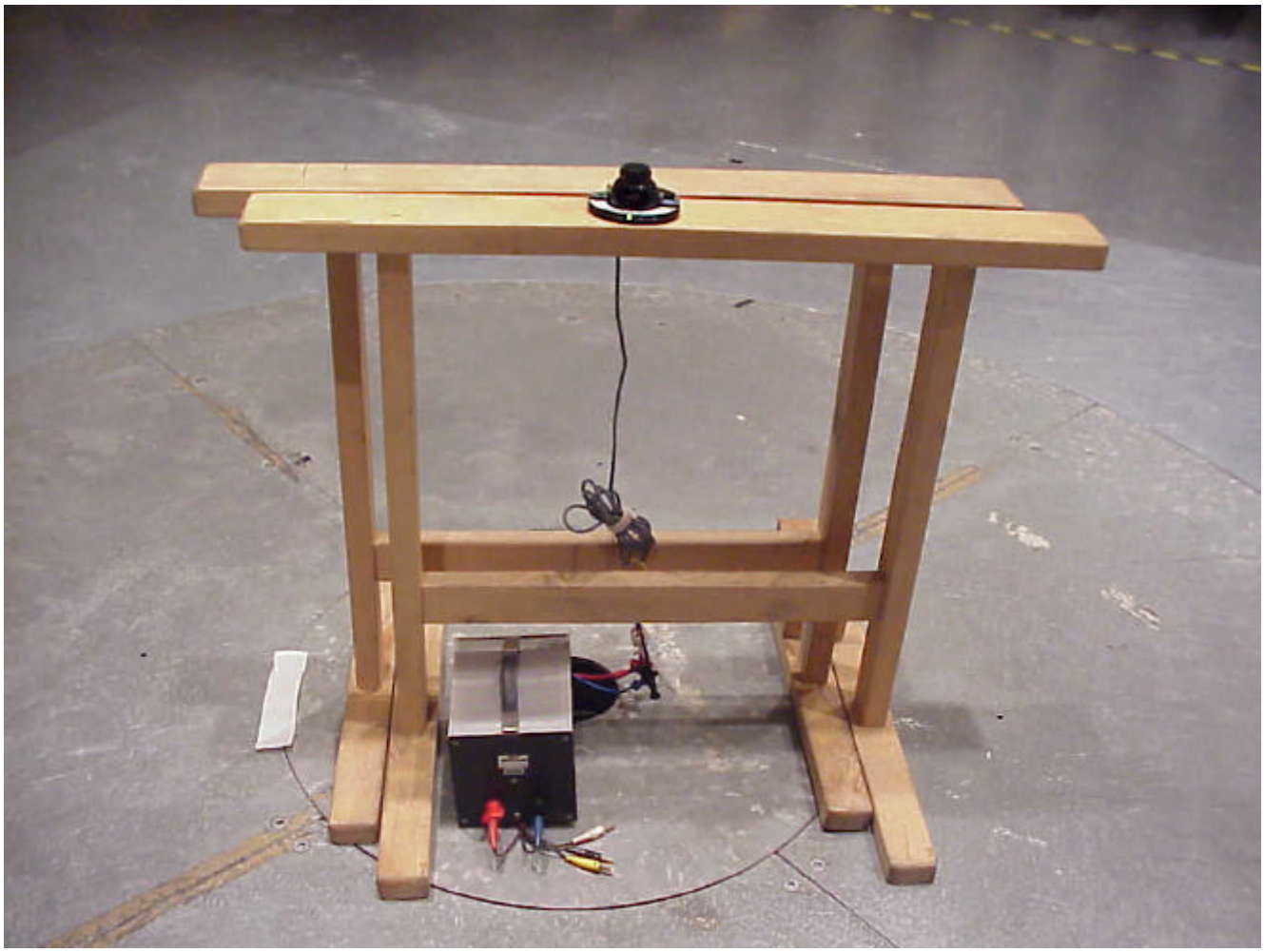
Photo 3


TERMINAL
POWER (Gray)
OUTPUT (Yellow)
POWER INPUT
12 to 30v DC
12 to 24v AC
OPTEX
Microwave Door Sensor EZ
LOT 0311H
ARISTO 1470 GERMANY

Photo 4

Plastic cover with dielectrical lens

Photo 5



Test set–up for radiated measurments >30 MHz

Photo 6