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

Member of RWTÜV Group

Recognized by the
Federal Communications Commission and Industry Canada
Anechoic chamber registration No.: 90462 (FCC)
Anechoic chamber registration No.: 3463 (IC)
TCB ID: DE0001

Federal Communications Commission

Accredited by the
German Accreditation Council
DAR–Registration Number
TTI–P–G 081/94-D0

Deutscher Akkreditierungs Rat DAR

Independent ETSI
compliance test house

ETSI

Test report No. 2-3706-01-02/04
Applicant: Saab Rosemount Tank Radar AB
Type: Rosemount 5400 series K-band radar level transmitter
Test standard : FCC Part 15

RWTÜV

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
23.07.2004	Manfred Paschwitz	

Technical responsibility for area of testing:

Date	Name	Signature
23.07.2004	Klaus Kammerinke	

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

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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	TTI-P-G 081/94-D0
FCC	90462
IC	3463

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

1.3 Details of applicant

Name : Saab Rosemount Tank Radar AB
Street : Gamlestadsvägen 18 B
Town : SE-40251 Göteborg
Country : Sweden
Phone : +46 31 33 70 000
Fax : +46 31 25 30 22

Contact person
Name : Mr. Carl Fjelkner
Phone : +46 31 33 70 000
Fax : +46 31 25 30 22
E–Mail : carl.fjelkner@emersonprocess.com

1.4 Application details

Date of receipt of application : 19.07.2004
Date of receipt of test item : 19.07.2004
Date of test : 20.07..2004 - 21.07.2004
Person(s) who have been present during the test : Mr. Mikael Kleman

1.5 Equipment under test (EUT)

Description	:	Short range device; Tank Radar
Type designation	:	Rosemount 5400 series K-band radar level tranmitter
Manufacturer		
Name	:	Saab Rosemount Tank Radar AB
Street	:	Gamlestadsvägen 18 B
Town	:	SE-40251 Göteborg
Country	:	Sweden

1.6 Technical data

Frequency range	:	23.003 GHz ... 28.008 GHz
Operational frequency	:	25.278 GHz
EIRP (operation for testing)	:	110 nW [-39.5 dBm] (EUT without tanks)
Field strength PEP	:	Radiation not traceable if EUT is operating inside tanks
Type of modulation	:	5G00P0N
Pulse frequency	:	1,8432 MHz
Pulse width	:	0,8 ns
Microwave modules	:	TX / RX – Module employing TDR principle
Antenna	:	4" Cone Antenna, gain 25 dBi (see Photo)
Normal power supply (U nom)	:	24.0 V DC
Extreme power supply (U min)	:	11.0 V DC
(U max)	:	42.0 V DC

1.6.1 Operation conditions

Operation:	:	As soon as the equipment is powered up, TX and RX start operating
Purpose of operation	:	In-tank level (distance) measuring equipment

1.6.2 Test item

Rosemount 5400 series K-band radar level tranmitter with different available antennas

Antennas	Gain
2" Cone	21 dBi
3" Cone	23 dBi
4" Cone	25 dBi

1.7 Test standards

	Code of Federal Regulations (CFR 47) Federal Communications Commission (FCC)
FCC Part 15	Radio Frequency Devices (04/2004)
	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
	SECTION 15.207 Conducted limits

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

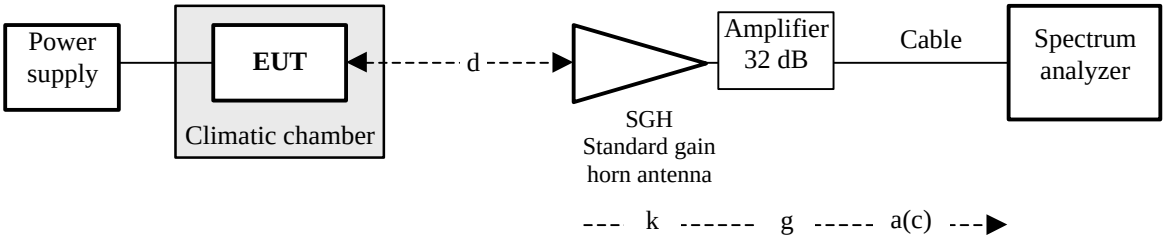
The environmental conditions are documented especially for each test.

2.3 Measurement and test set-up

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

2.4 Test equipment utilized and test set-up

2.4.1 Field strength measurement of fundamental and spurious radiation in the frequency range 0.9 GHz to 26 GHz



Frequency f [GHz]	Distance d [m]	Antenna factor k [dB(1/m)]	Amp.gain g [dB]	Cable loss a(c) [dB]
0.9 to 2.0	3.0	23.45	32.0	0.5 to 0.7
2.0 to 4.0	3.0	23.68	32.0	0.7 to 0.9
4.0 to 6.0	3.0	27.31	32.0	0.9 to 1.3
6.0 to 8.0	3.0	30.06	32.0	1.3 to 1.8
8.0 to 12.0	3.0	33.70	32.0	1.8 to 2.5
12.0 to 18.0	3.0	33.97	32.0	2.5 to 3.5
18.0 ... 27.0	3.0	40.22	32.0 to 28.0	3.5 to 4.7

Calculation :

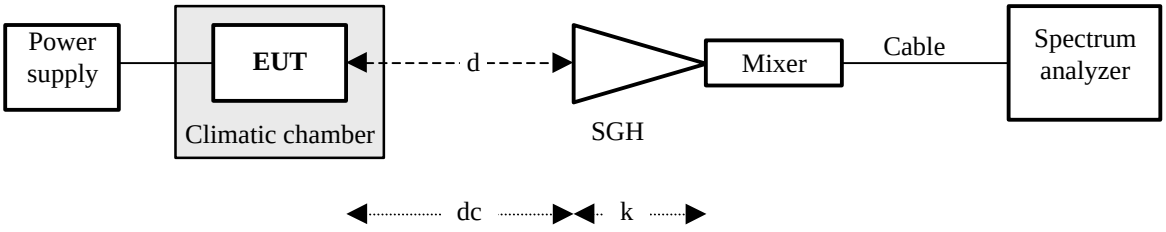
Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]

Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300001665
SGH 1.0 to 2.0 GHz	flann	0624-10	300000225
SGH 2.0 to 4.0 GHz	narda	644	300000769
SGH 4.0 to 6.0 GHz	narda	643	300002447
SGH 6.0 to 8.0 GHz	narda	642	300000767
SGH 8.0 to 12.5 GHz	narda	640	300000784
SGH 12.0 to 18.0 GHz	narda	639	300000787
SGH 18.0 to 26.5 GHz	narda	638	300002442
SGH 26.0 to 40.0 GHz	narda	V637	300000510
Amplifier 0.1 ... 28 GHz	HP	HP 83017A	300002267
Climatic chamber	Vötsch	VUK 04/500	300000297
DC Power supply	HP	HP 6038A	300001174
RF-cable	HP	5061-5359	300002033

Measurement uncertainties

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

2.4.2 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 to 50.0	0.250	-21.58	39.10
50.0 to 75.0	0.125	-27.60	40.67
75.0 to 110.0	0.125	-27.60	45.07

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

e = u + k + dc

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

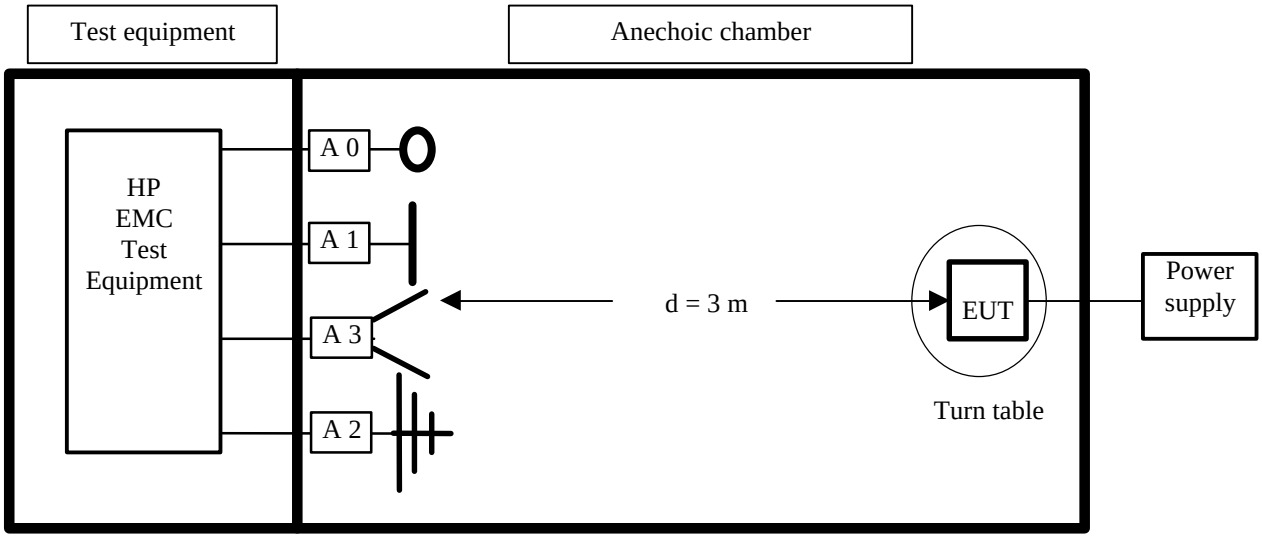
Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300001665
Power supply	HP	6032A	300002115
SGH 33 ... 50 GHz	Thomson	COR 33_50	300000812
Mixer 33 ... 50 GHz	HP	11970Q	300000781j
SGH 50 ... 75 GHz	Thomson	COR 50_75	300000789k
Mixer 50 ... 75 GHz	HP	11970V	300000871o
SGH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

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
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

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 inclusive fixed horn antenna is positioned on top of a portable metal, glass, plastic and concrete tank. This model tank simulates the operation within a normal size metal, glass, plastic and concrete tank. The Radar level gauge plus metal, glass, plastic and concrete tank is fixed on a non-conductive support and can be rotated and tilted in all angles. A variable DC power supply drives the level gauge. The operation of the system is controlled by a service PC that is connected to the system by means of a twisted pair signal wire.

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 26 GHz in a semi-anechoic chamber. 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 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.

<u>1. Measurements of ERP/EIRP at fundamental and spurious frequencies</u>

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 960 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 960 MHz to 22 GHz are carried out in a shielded semi-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 SGH´s. 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.

As a first step the UWB field disturbance sensor (Pulse Radar) is operating without a tank in order to measure the occupied bandwidth and the EIRP of the fundamental frequency and possible harmonic emissions. As a next step the EUT is positioned on top of portable tanks of different material like: PVC, glass, concrete, and closed metal which simulate the operation under real life conditions. This test set-up allows to measure all RF leaking emissions from the EUT plus various tanks. As the FCC requirements for UWB applications are very tight, a broadband linear amplifier (frequency range: 0.1 to 28 GHz with linear gain of 32 dB) is used in the receiver chain just behind the receiving horn antenna.

The EUT was configured to continuously transmit at 100% duty cycle in measurement mode in which the device maintains its full power. The normal operating measurement mode is a radar pulse with a duty cycle less than 1:25. By configuring the unit to transmit continuously in the continuous measurement mode no desensitisation factor was required. This approach was used because the EUT produces extremely low output power, and would otherwise be impossible to measure even with our high sensitivity test equipment.

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

Fundamental frequency

Microwave module : Rosemount 5402 C operating TX and RX ON

Test condition t = 23.0 ° C	EUT operating outside a tank: EUT is rotated in 3 axes in order to receive maximum EIRP			
TX on and RX on **Test operation**	Start Frequency f [GHz]	Stop Frequency f [GHz]	EIRP [dBm]	See plot no.:
U DC = 24.0 V	23.003	28.008	-39.6	1 / 2 / 3

Microwave module : Rosemount 5402 C operating TX and RX ON

Test condition t = 23.0 ° C	EUT with 4" horn antenna operating inside various tanks: Tank material: PVC, glass, concrete, steel			
TX on and RX on **Normal operation**	Start Frequency f [GHz]	Stop Frequency f [GHz]	E [µV/m]	See plot no.:
U DC = 24.0 V	23.003	28.008	3.75 to 3.89	4

REFERENCE OF TEST EQUIPMENT USED : see test set-up on page 8 / 9

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	124.0	2 500 mV/m
Harmonics	3	68.0	25,000

Verdict :	Field strength limits and frequency band are kept if EUT is operating inside tanks No leaking radiation traceable

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 : Rosemount 5402 C operating TX and RX ON

Test condition t = 23.0 ° C	EUT operating inside various tanks Test set-up see pages 8, 9, 10			
Frequency range [GHz]	Spurious frequencies [GHz]	S A u [dBmV]	E [µV/m]	See plot no.:
0.009 to 30.0 MHz (h + v) horizontal and vertical plane	Nothing found above noise floor	Noise	Noise	5 6
0.030 to 4.0 (h + v)	0.950 (max.)7	35.2 dB(µV/m)	17.3	7 / 8 / 9 / 10
4.0 to 6.0 (h + v)	4.073	-12.3 (PK)	158.5	11
6.0 to 8.0 (h + v)	7.227	-12.0 (PK)	237.1	12
8.0 to 12.0 (h + v)	8.300	-13.7 (PK)	338.8	13
12.0 to 18.0 (h + v)	noise	-16.8 (PK)	254.1	14
18.0 to 22.0 (h + v)	21.833	-18.3 (PK)	467.7	15
20.25 to 30.25 (h + v)	25.250	-65.4 dBm (PK)	noise	22 / 23
27.0 to 40.0 (h + v)	30.660	-18.3 (PK)	229.1	16
33.0 to 50.0 (h + v)	noise	-23.0 (PK)	537.0	17
33.0 to 50.0 (h + v)	noise	-36.0 (AV)	120.2	18
50.0 to 75.0 (h + v)	noise	-14.6 (PK)	831.7	19
50.0 to 75.0 (h + v)	noise	-23.8 (AV)	288.4	20
75.0 to 110.0 (h + v)	noise	-29.8 (PK)	239.8	21

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 :	Spurious field strength limits are kept if EUT is operating inside tanks

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

TRANSMITTER PARAMETERS SECTION 15.245
CONDUCTED SPURIOUS FREQUENCIES SECTION 15.207

Microwave module : Rosemount 5402 C

Test condition t = 23.0 ° C AC Power supply	Conducted spurious voltages Measurement with LISN outside a tank			
Frequency range [MHz]	Spurious frequencies [MHz]	S A u [dBµV]	U [µV]	See plot on page
0.150 – 30.000 (L1 + N)	Noise	nothing found	n. f.	24 / 25 / 26 / 27

The measurement were performed in TX and RX mode,
L1 and N floating and grounded , max values was hold.

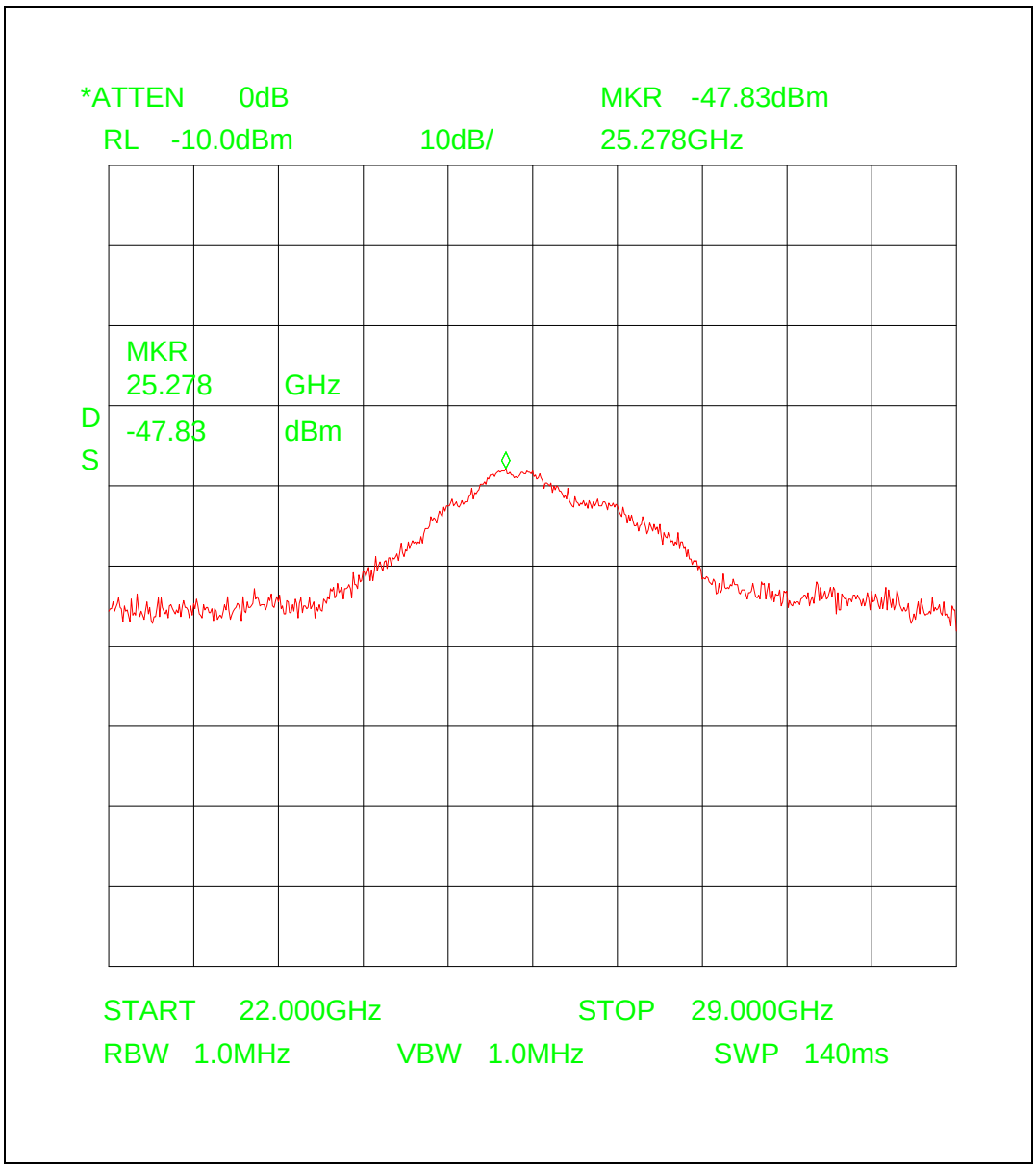
LIMITS: SECTION 15.207

Frequency of emission (MHz)	Conducted limits [dBµV]	
	Quasi-peak (QP)	Average (Av.)
0.150 – 0.500	66.0 – 56.0	56.0 – 46.0
0.500 – 5.000	56.0	46.0
5.000 – 30.000	60.0	50.0

Verdict :	Spurious limits are kept

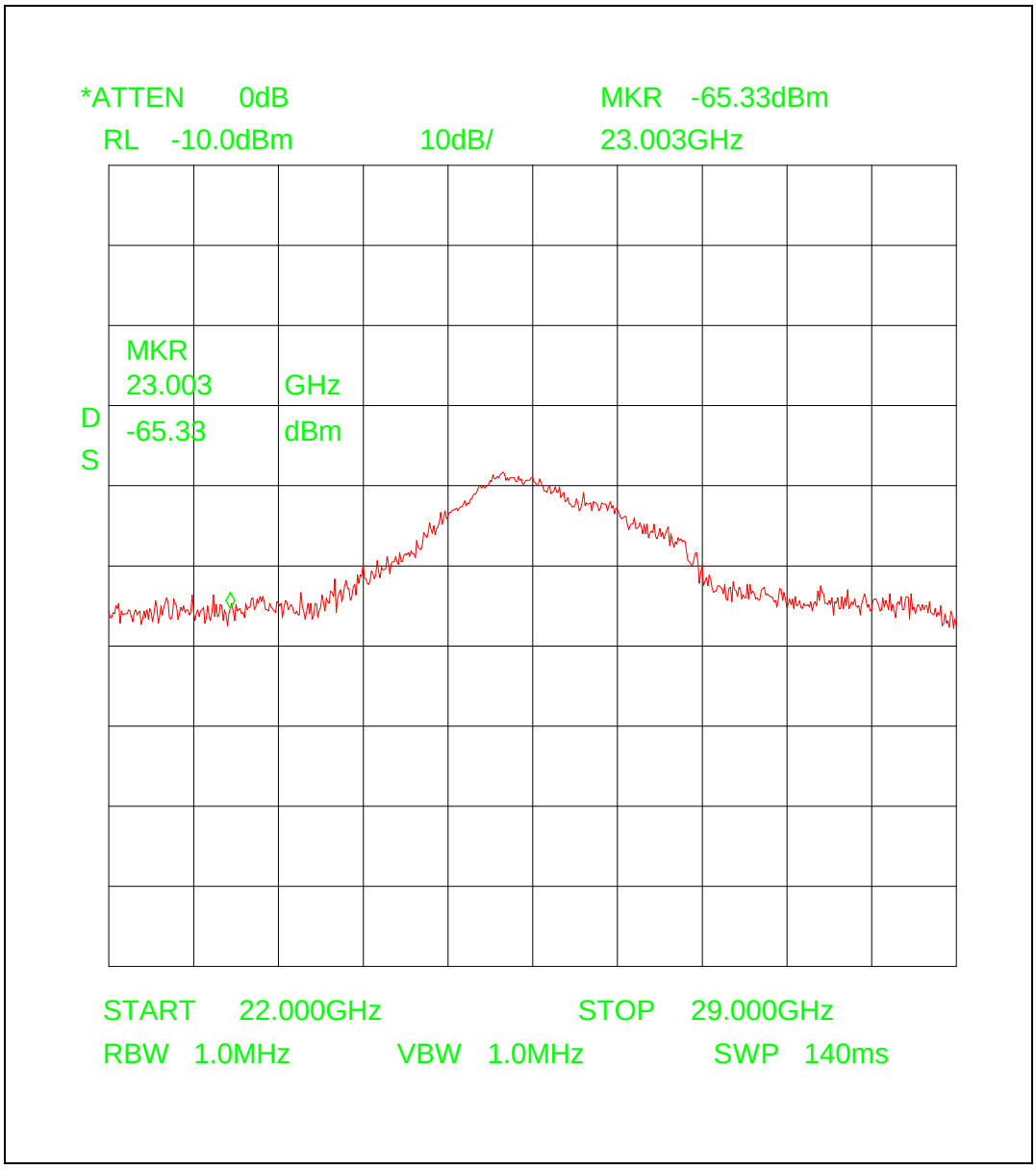
3 Plots, graphs and data sheets

Plot 1



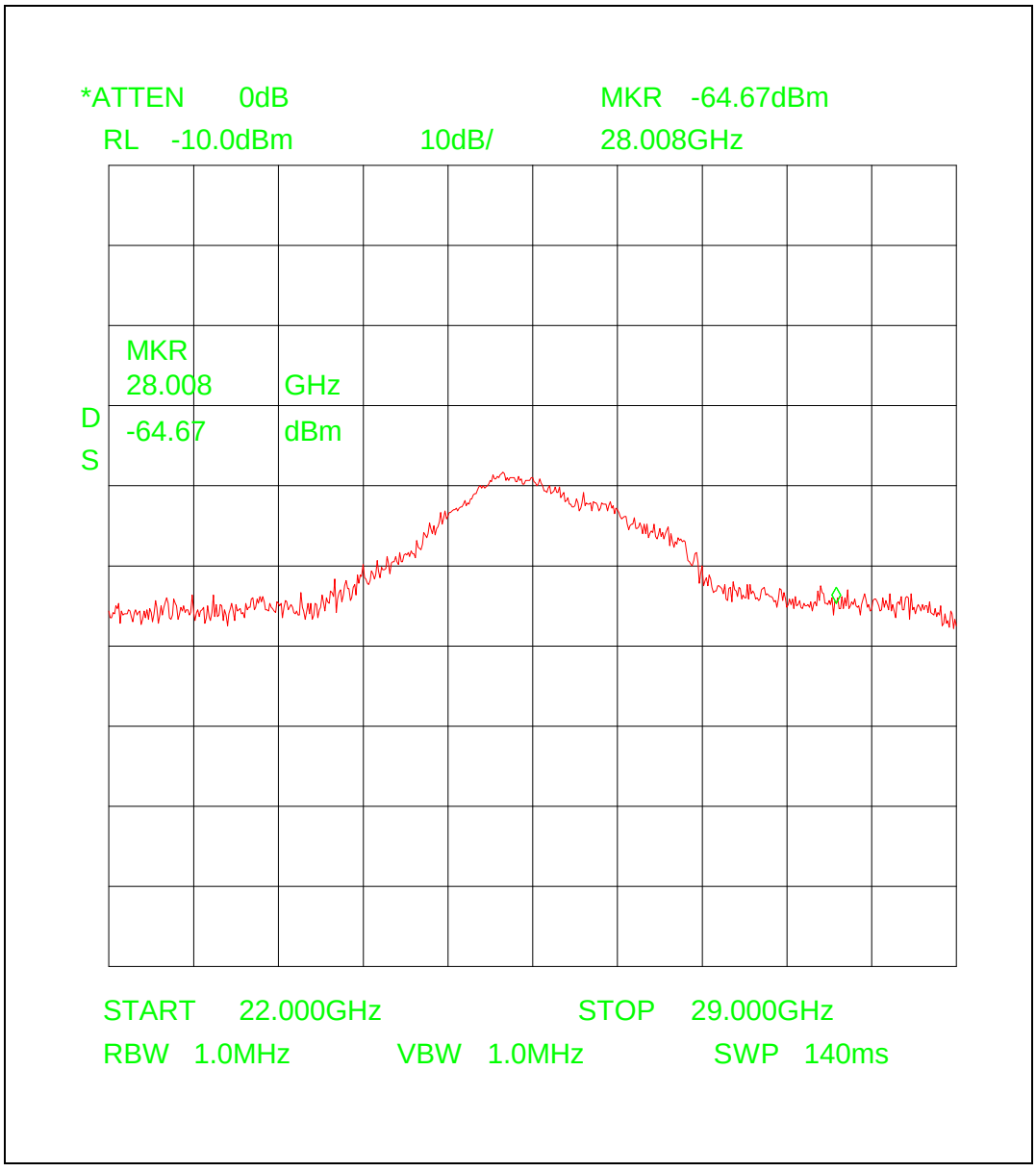
EUT in test operation outside the tank
Measurement distance d = 1.0 m System attenuation (a sys) = 8.3 dB
eirp = -39.6 dBm
EIRP = 112 nW

Plot 2



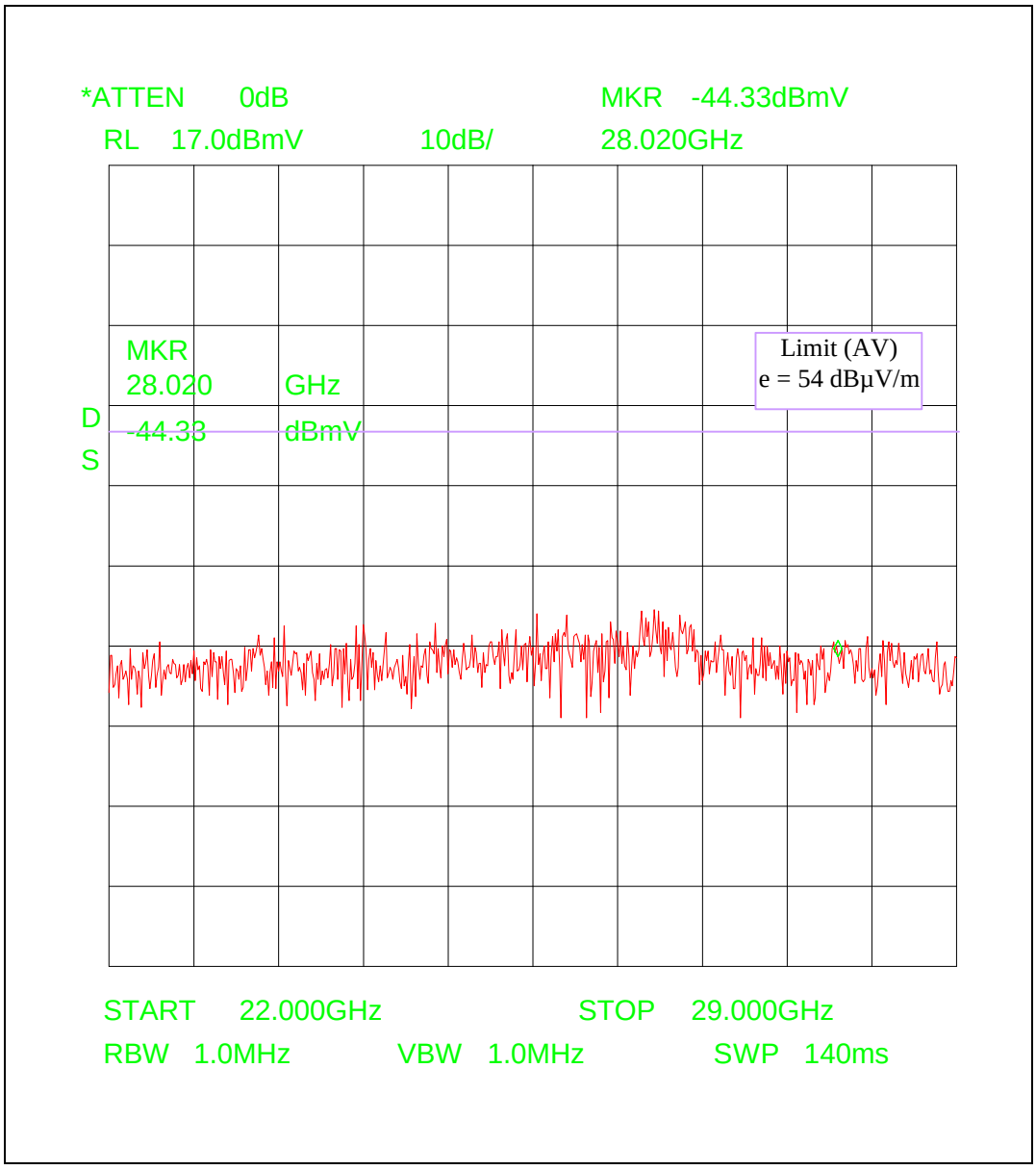
EUT in test operation outside the tank
F start = 23.003 000 GHz

Plot 3



EUT in test operation outside the tank
F stop = 28.008 000 GHz

Plot 4



Measurement distance d = 0.50 m

F start = 23.003 GHz

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor	+	dist. corr
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]	+	d.c.[dB]
e	=	-44.6	+	3.5	-	32.0	+	40.2	+	(-15.6)

e = -48.5 dB(mV/m)

e = 11.5 dB(µV/m)

E = 3.75 µV/m (F start)

F stop = 28.008 GHz

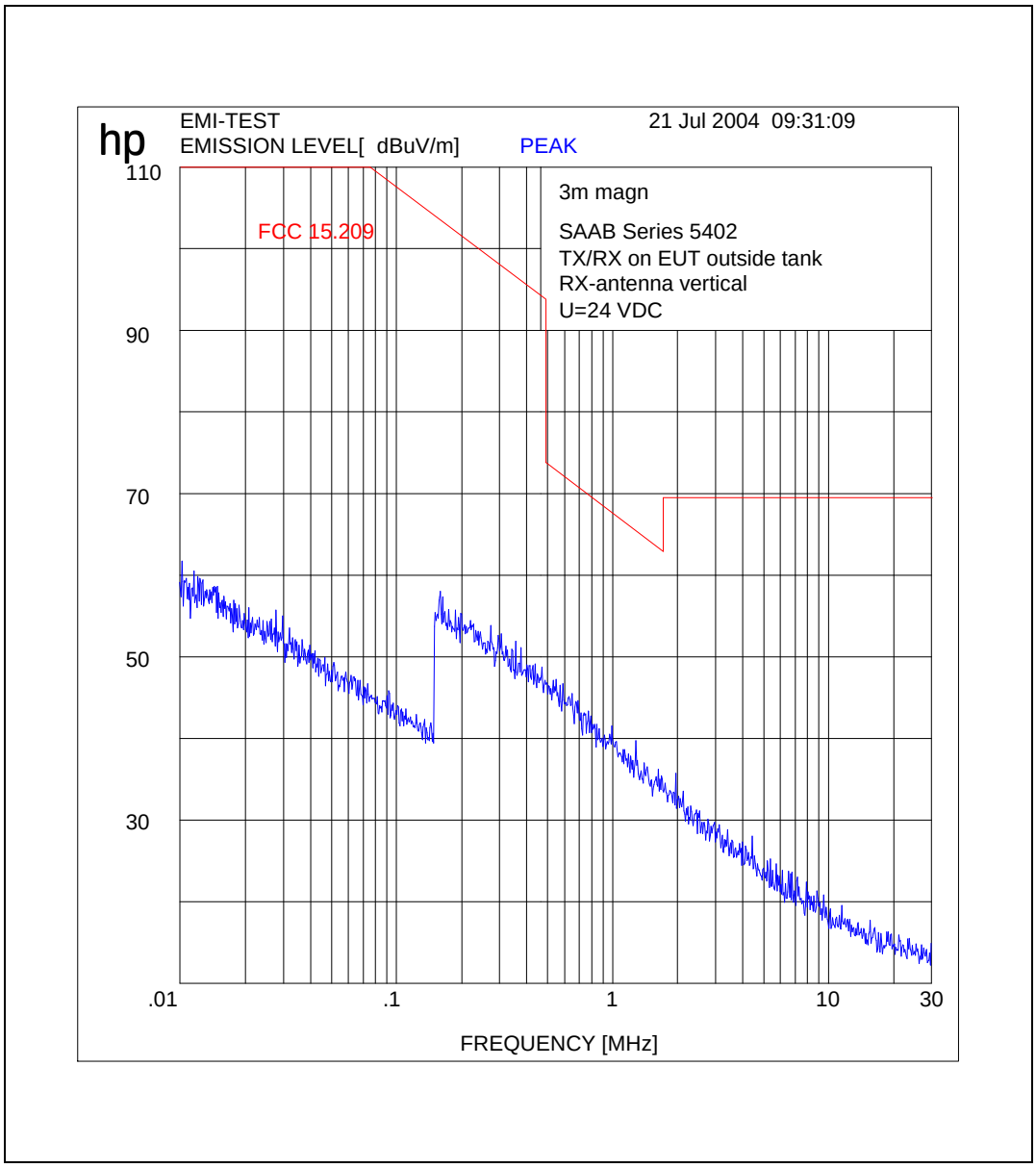
e	=	-44.3	+	3.5	-	32.0	+	40.2	+	(-15.6)

e = -48.2 dB(mV/m)

e = 11.8 dB(µV/m)

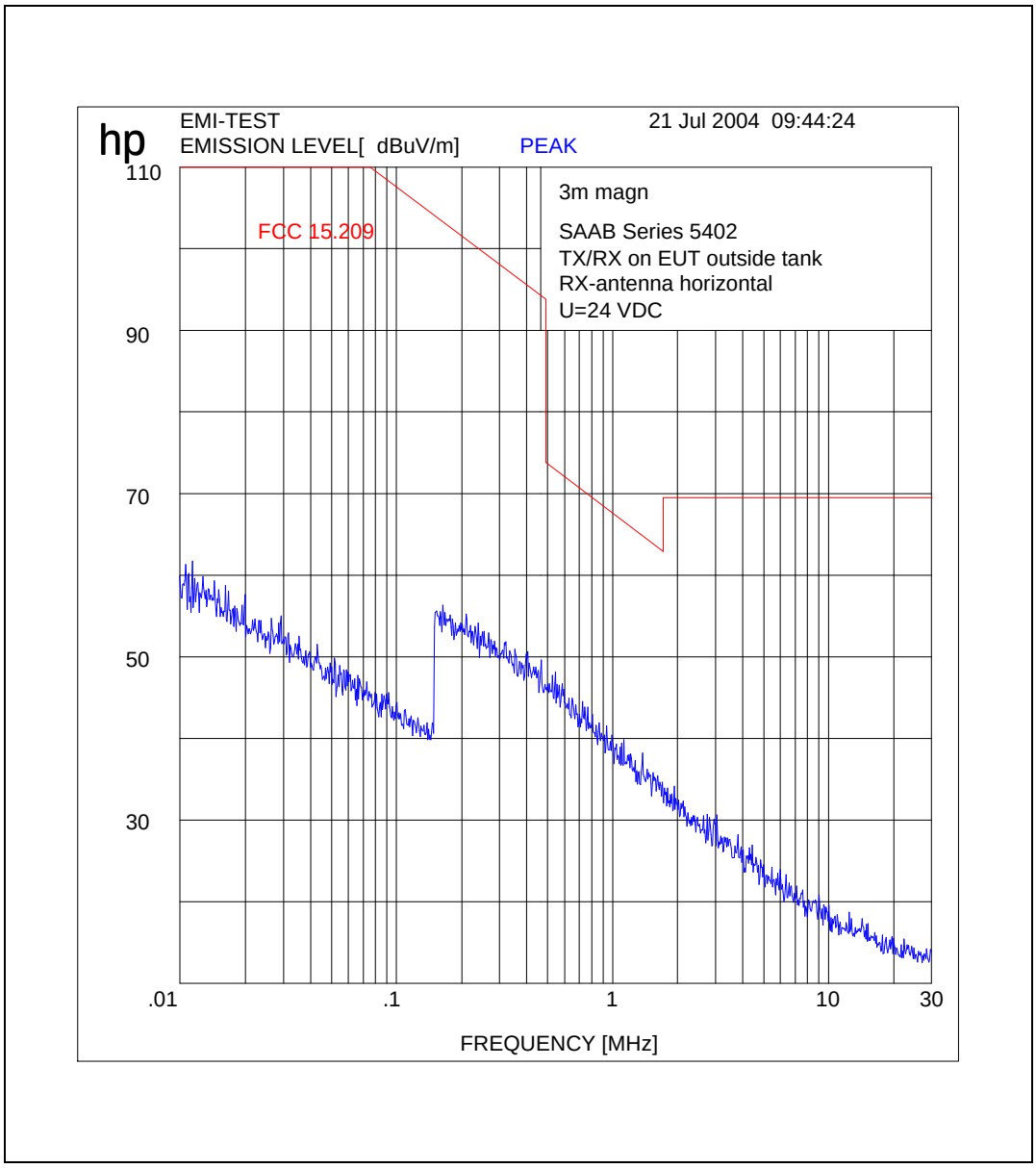
E = 3.89 µV/m (F stop)

Plot 5



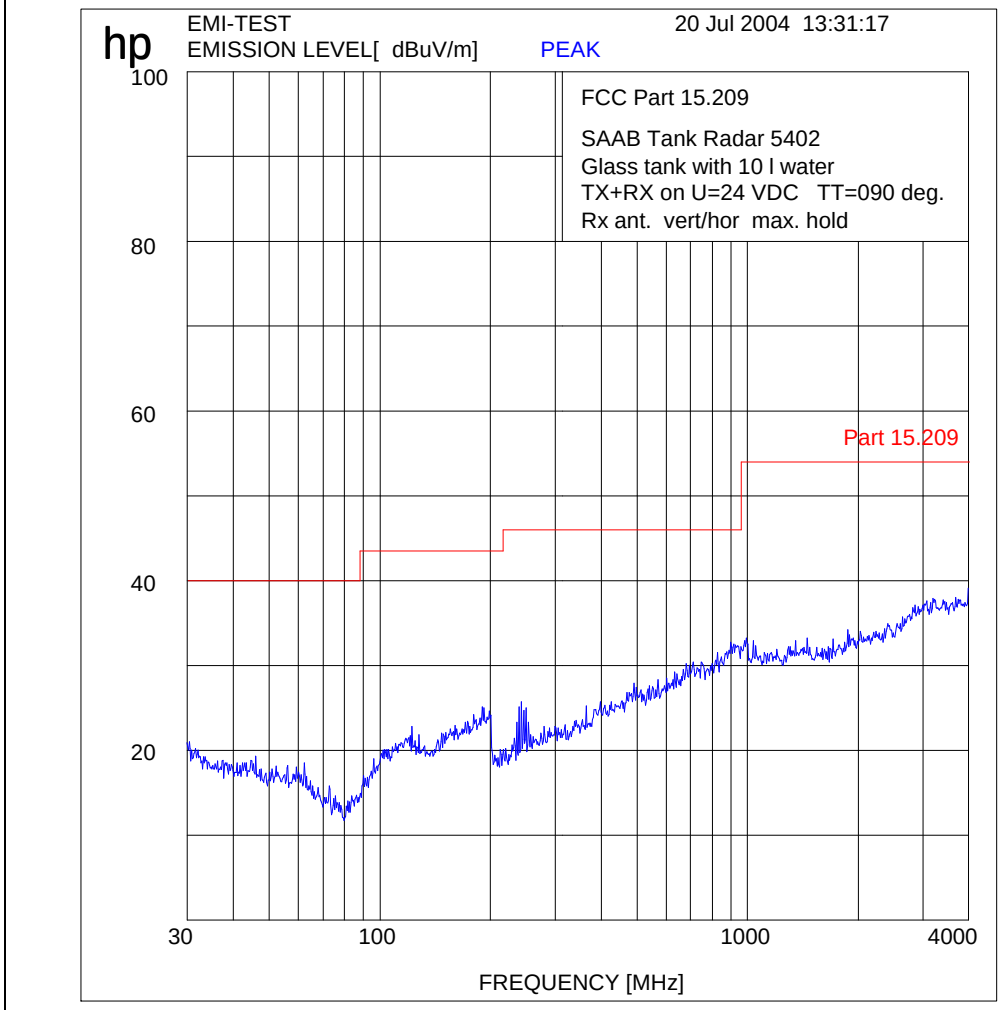
RX-Antenna vertical

Plot 6

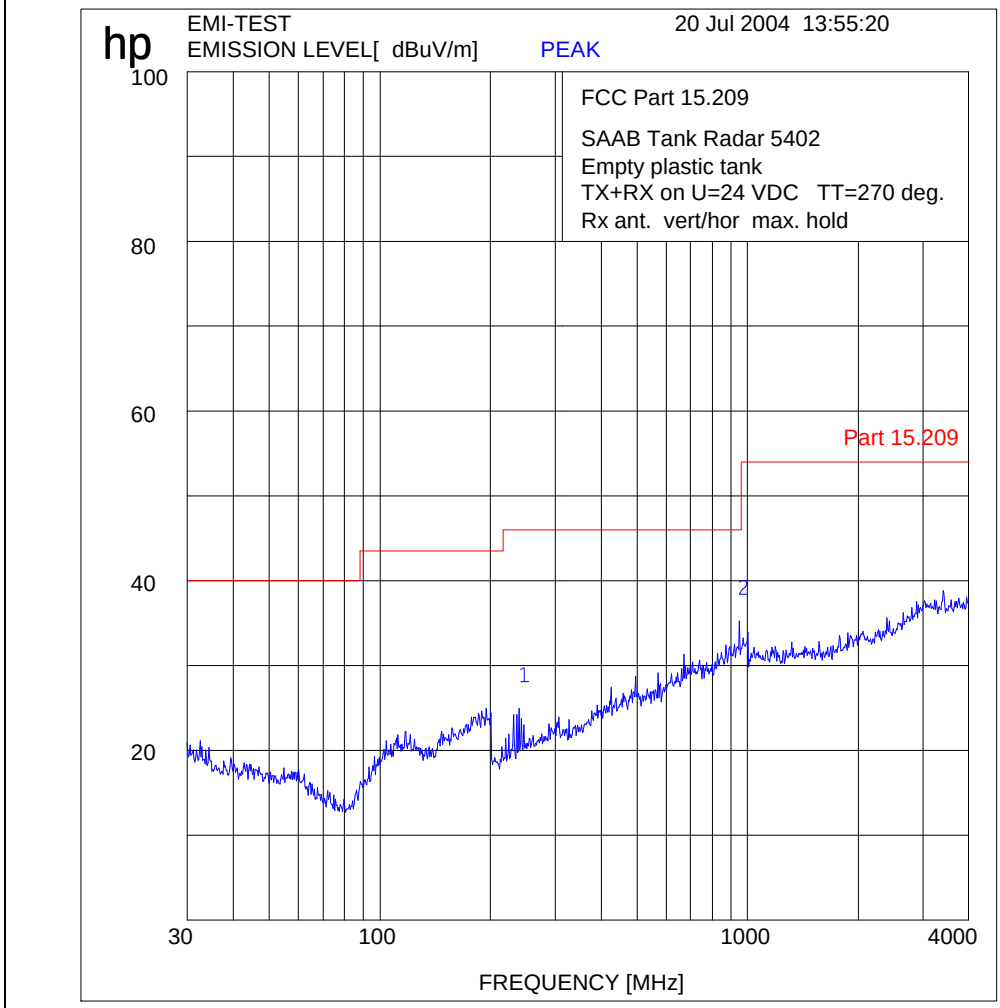


RX-Antenna horizontal

Plot 7

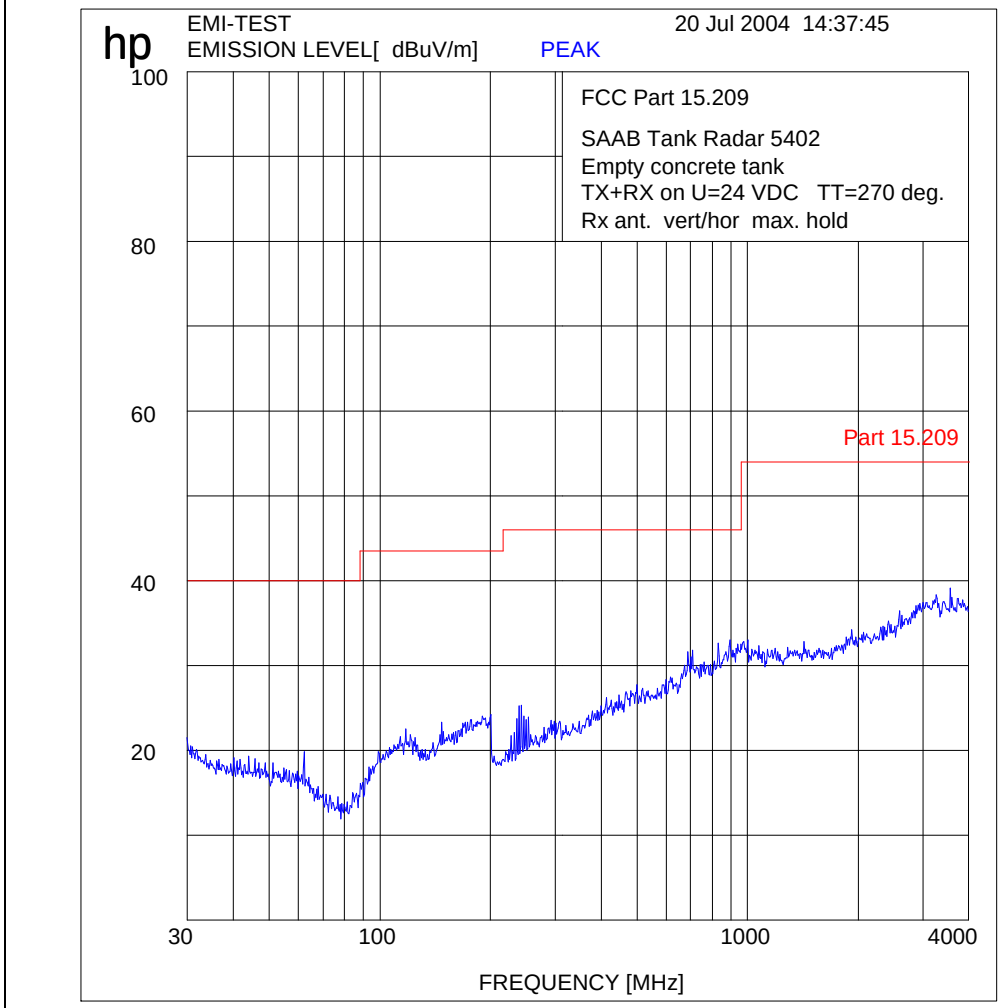

hp
EMI-TEST
20 Jul 2004 13:31:17
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15.209
SAAB Tank Radar 5402
Glass tank with 10 l water
TX+RX on U=24 VDC TT=090 deg.
Rx ant. vert/hor max. hold
Part 15.209
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

Plot 8

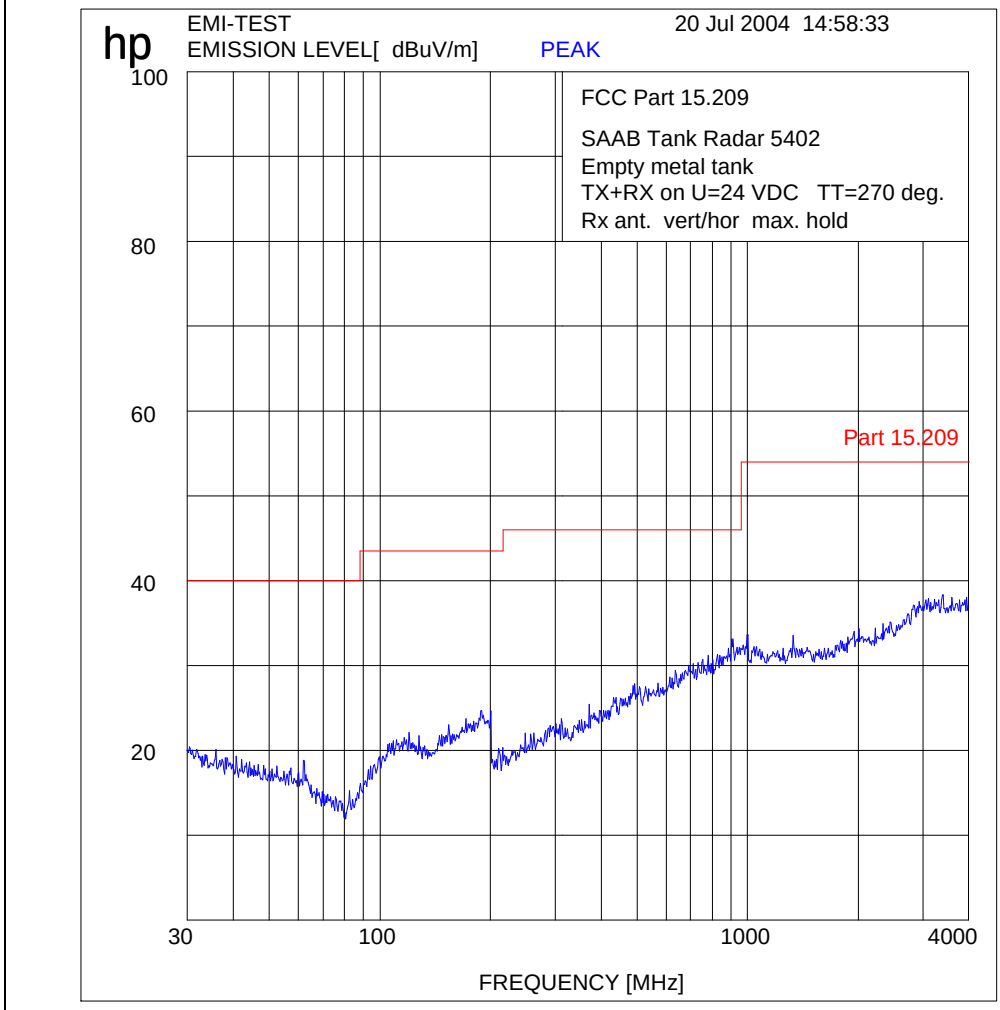


Marker 1	239.507 MHz	e = 24.9 dBµV/ m
Marker 2	950.500 MHz	e = 35.2 dBµV/ m

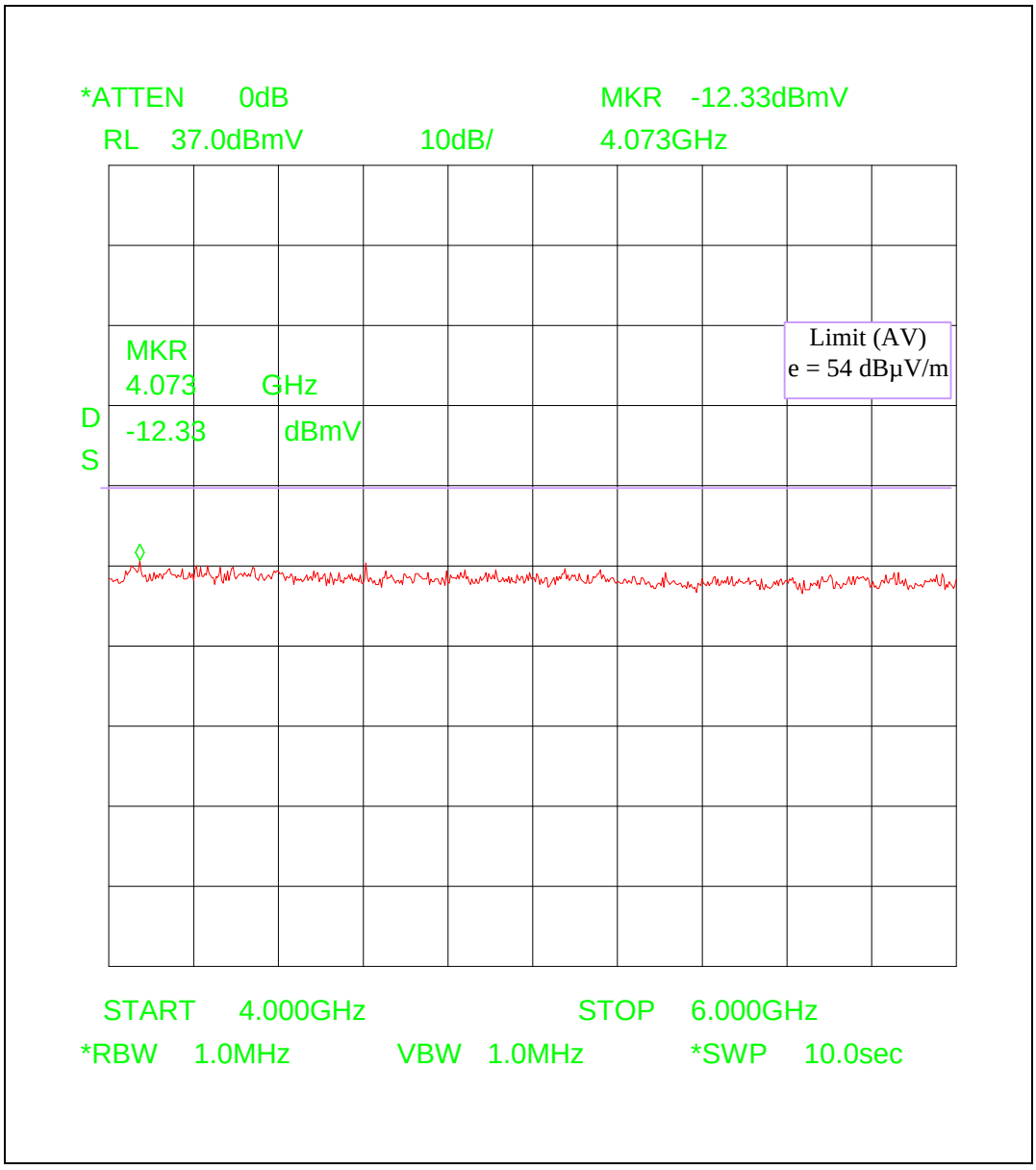
Plot 9


hp
EMI-TEST
20 Jul 2004 14:37:45
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15.209
SAAB Tank Radar 5402
Empty concrete tank
TX+RX on U=24 VDC TT=270 deg.
Rx ant. vert/hor max. hold
Part 15.209
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

Plot 10


hp
EMI-TEST
20 Jul 2004 14:58:33
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15.209
SAAB Tank Radar 5402
Empty metal tank
TX+RX on U=24 VDC TT=270 deg.
Rx ant. vert/hor max. hold
Part 15.209
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

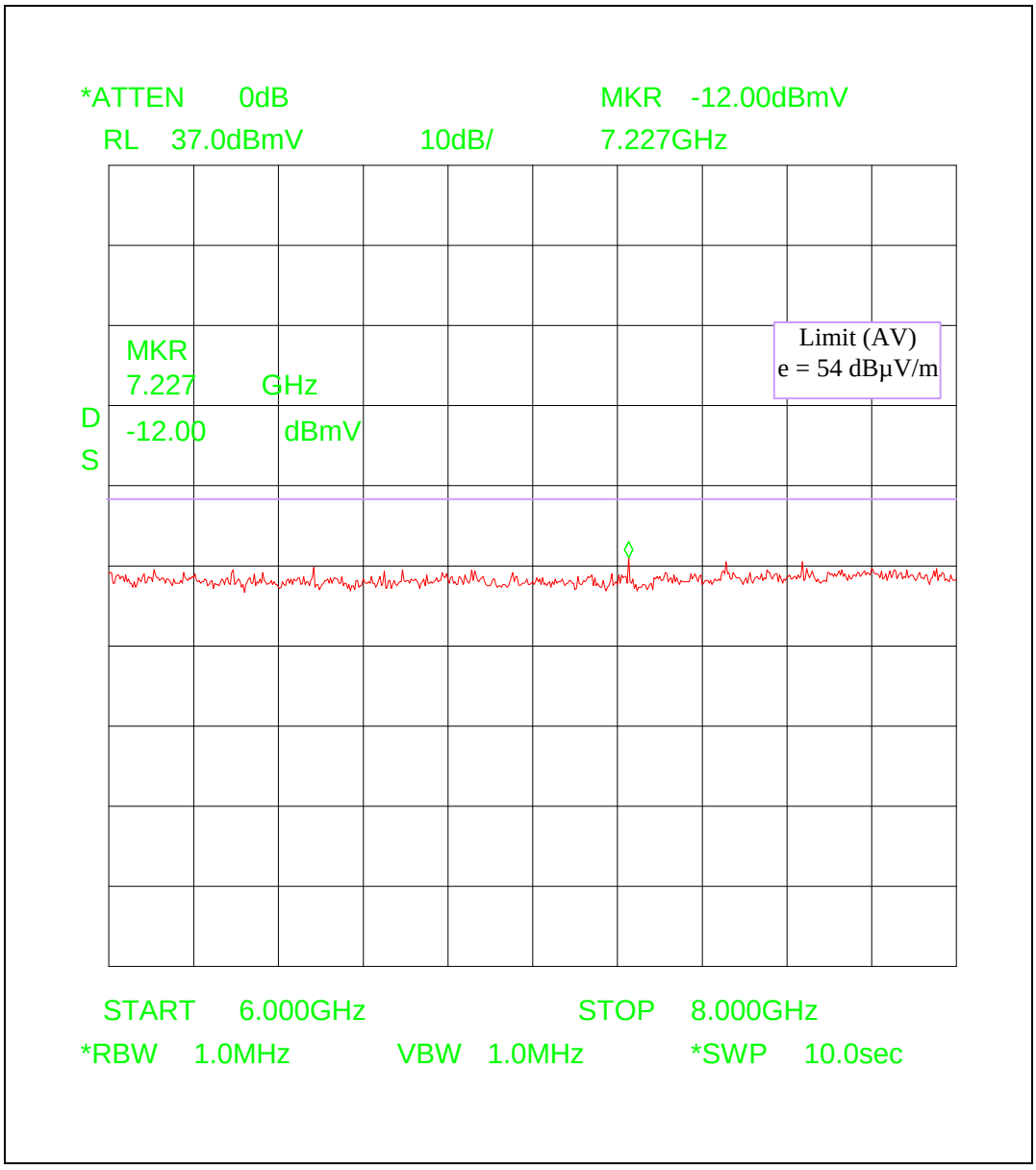
Plot 11



Measurement distance d = 3.0 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]
e	=	-12.3	+	1.0	-	32.0	+	27.3
e	=	-16.0 dB(mV/m)						
e	=	44.0 dB(µV/m)						
E	=	158.49 µV/m	PEAK measurement, 10 sweeps, MAX. HOLD					

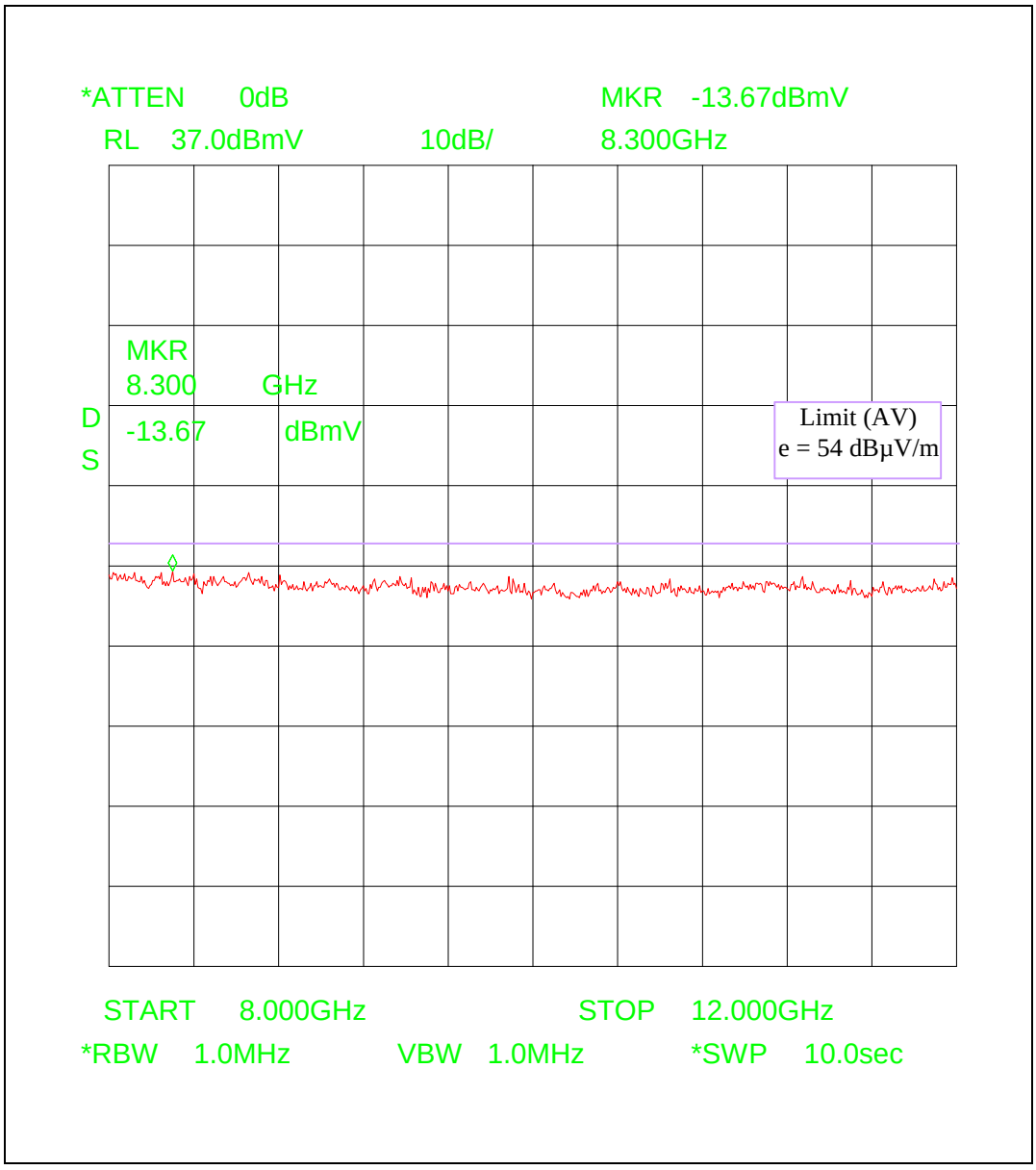
Plot 12



Measurement distance d = 3.0 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]
e	=	-12.0	+	1.5	-	32.0	+	30.0
e	=	-12.5 dB(mV/m)						
e	=	47.5 dB(µV/m)						
E	=	237.1 µV/m	PEAK Measurement, 10 sweeps, MAX HOLD					

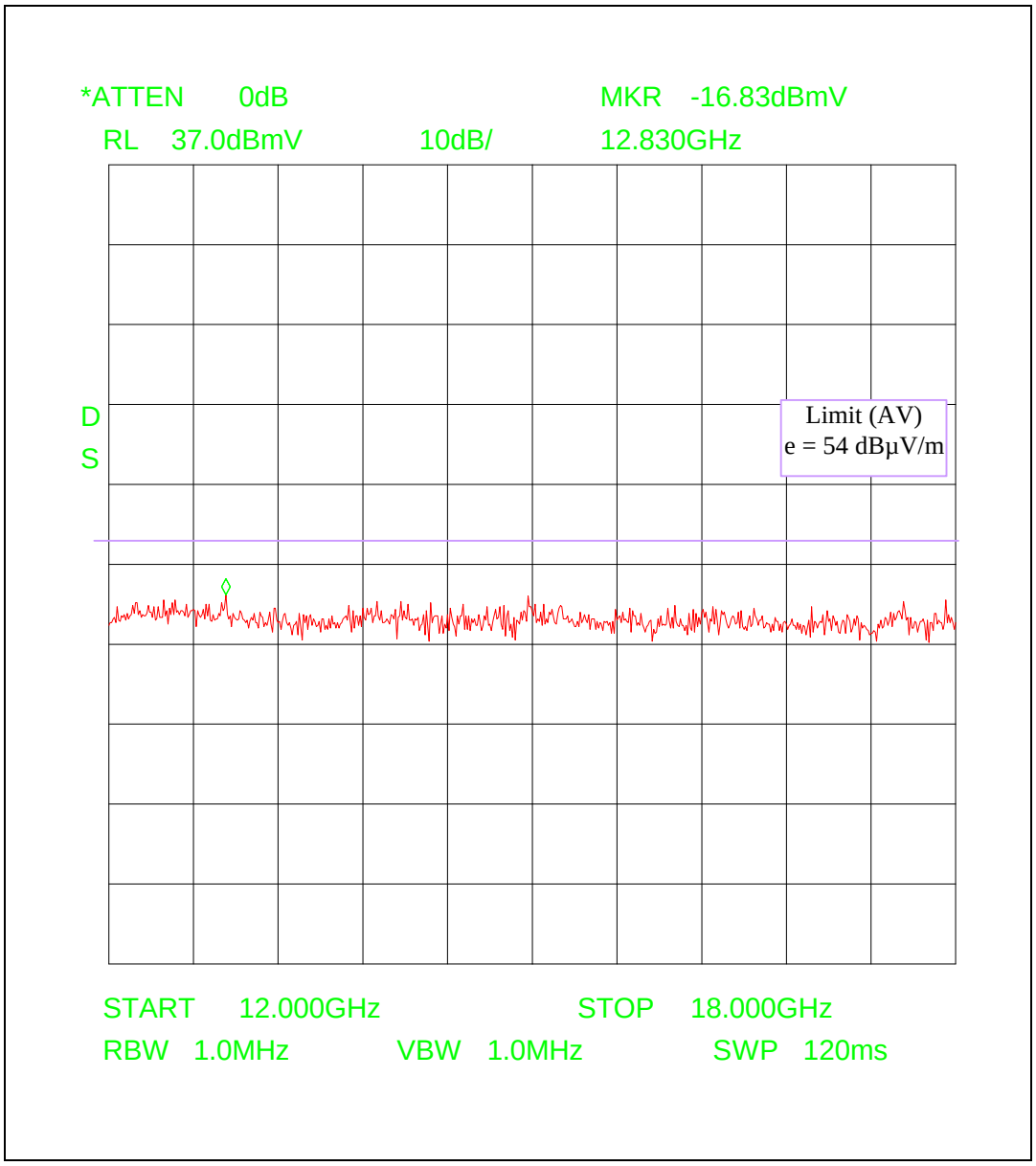
Plot 13



Measurement distance d = 3.0 m

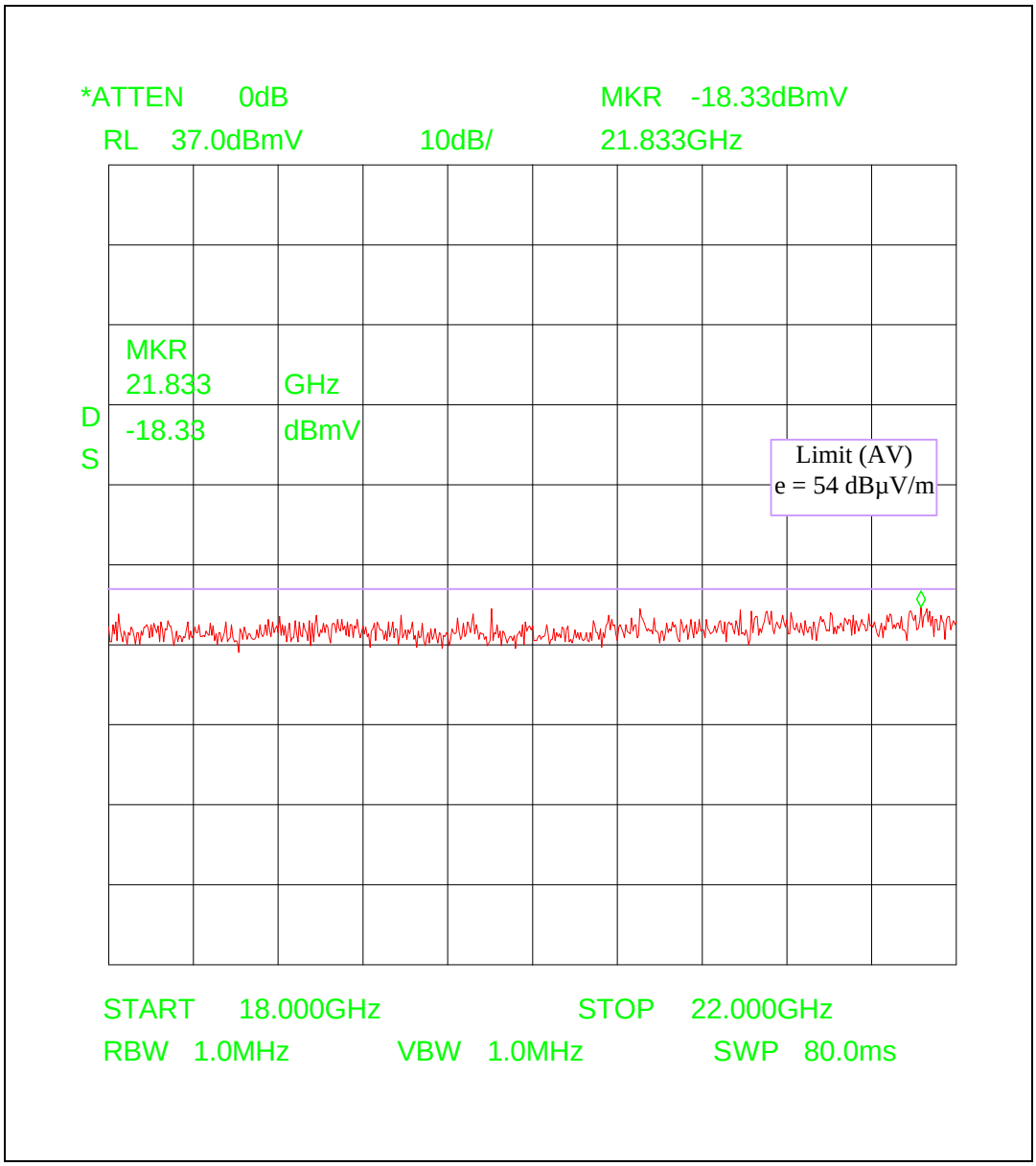
Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]
e	=	-13.6	+	2.5	-	32.0	+	33.7
e	=	-9.4 dB(mV/m)						
e	=	50.6 dB(µV/m)						
E	=	338.8 µV/m	PEAK measurement 10 sweeps, MAX HOLD					

Plot 14



Measurement distance		d	=	3.0 m				
Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]
e	=	-16.8	+	3.0	-	32.0	+	33.9
e	=	-11.9 dB(mV/m)						
e	=	48.1 dB(µV/m)						
E	=	254.1 µV/m	PEAK measurement, 100 sweeps, MAX HOLD					

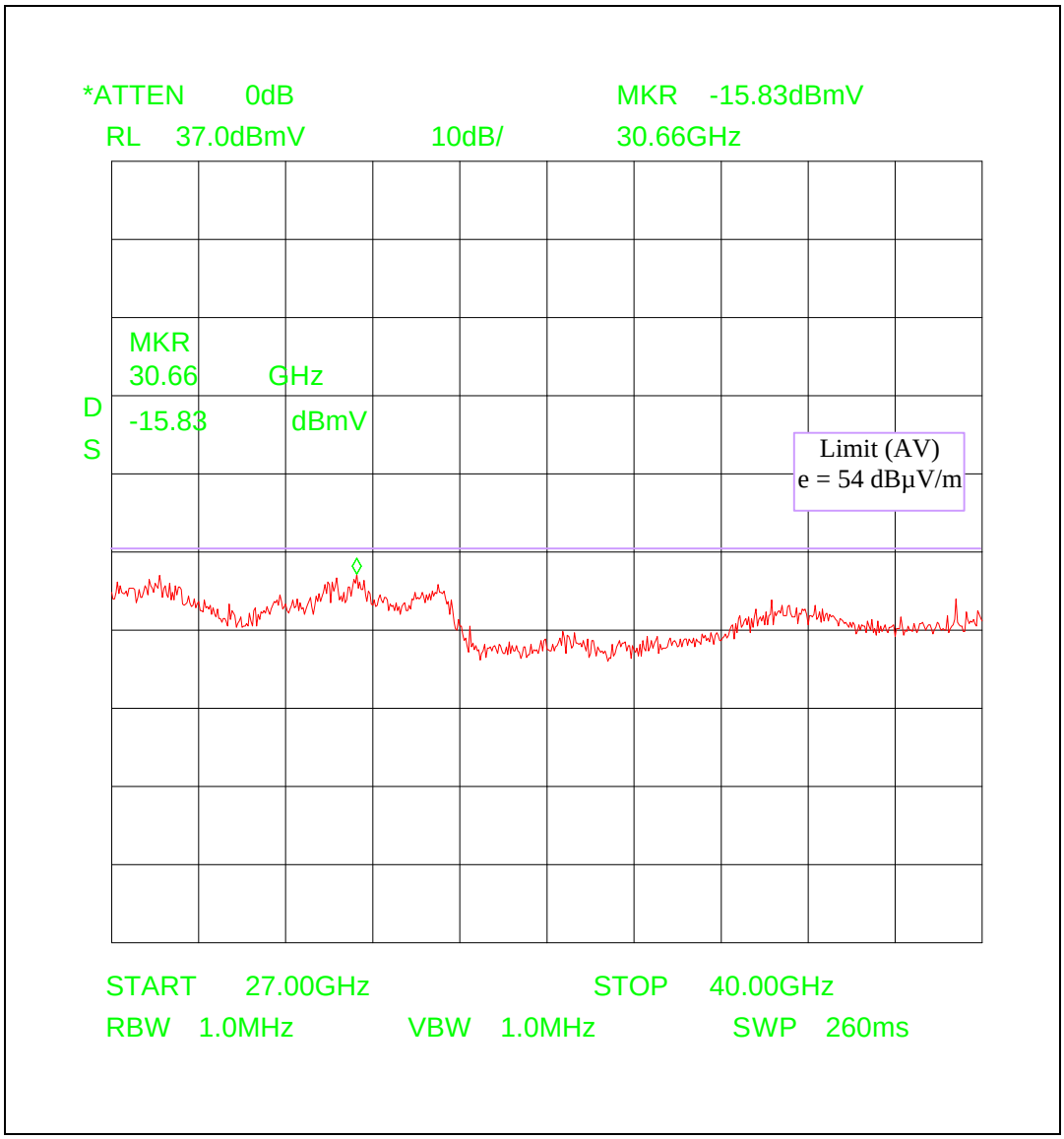
Plot 15



Measurement distance d = 3.0 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]
e	=	-18.3	+	3.5	-	32.0	+	40.2
e	=	-6.6 dB(mV/m)						
e	=	53.4 dB(µV/m)						
E	=	467.7 µV/m (Noise)	PEAK measurement, 100 sweeps, MAX HOLD					

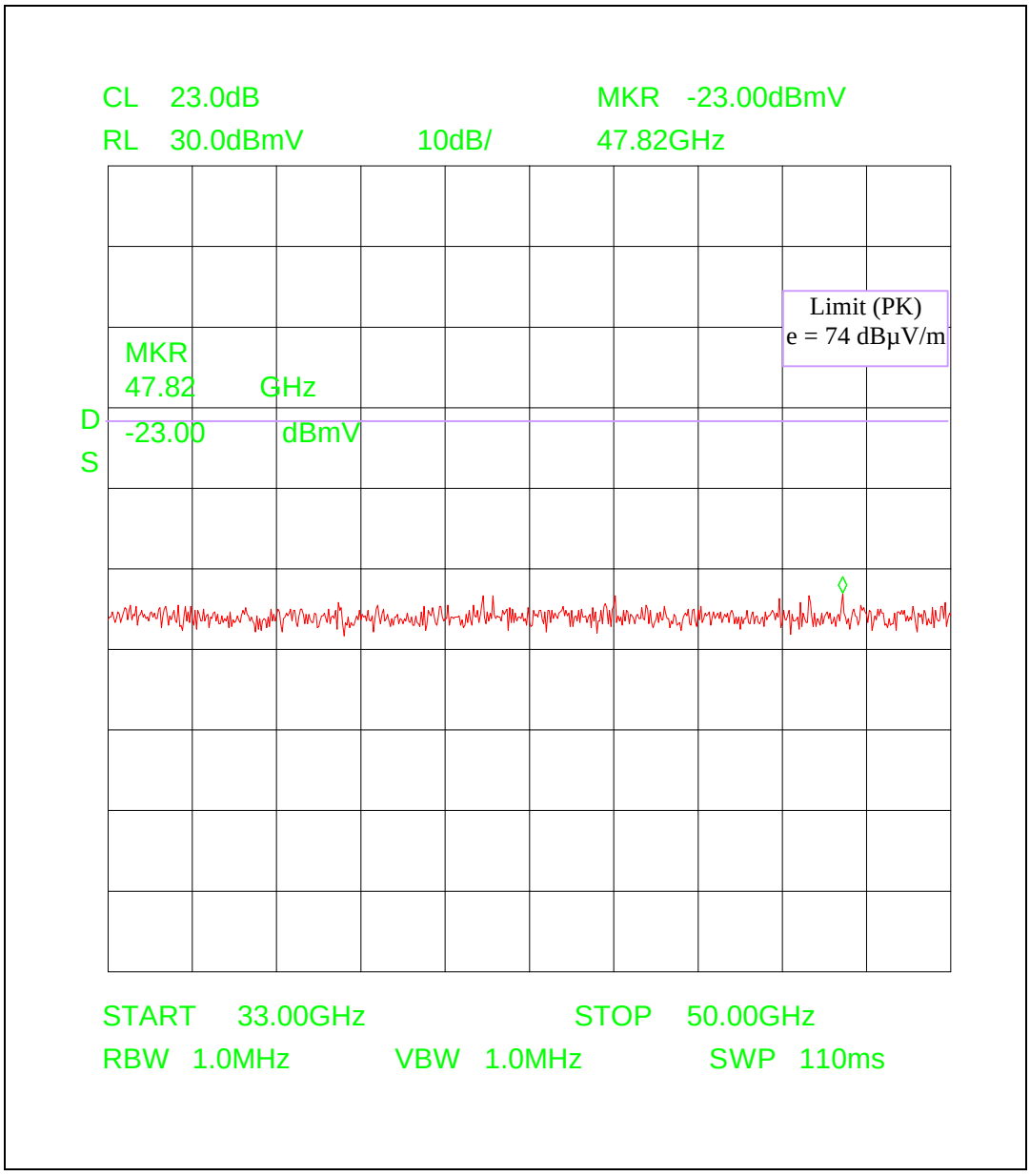
Plot 16



Measurement distance d = 1.0 m

Field strength	=	analyser reading	+	cable loss	-	amplifier gain	+	antenna factor	-	distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	a [dB]	-	g [dB]	+	k [dB(1/m)]	-	d [dB]
e	=	-18.3	+	4.5	-	28.0	+	38.5	-	9.5
e	=	-12.8 dB(mV/m)								
e	=	47.2 dB(µV/m)								
E	=	229.1 µV/m PEAK measurement, 100 sweeps, MAX HOLD								

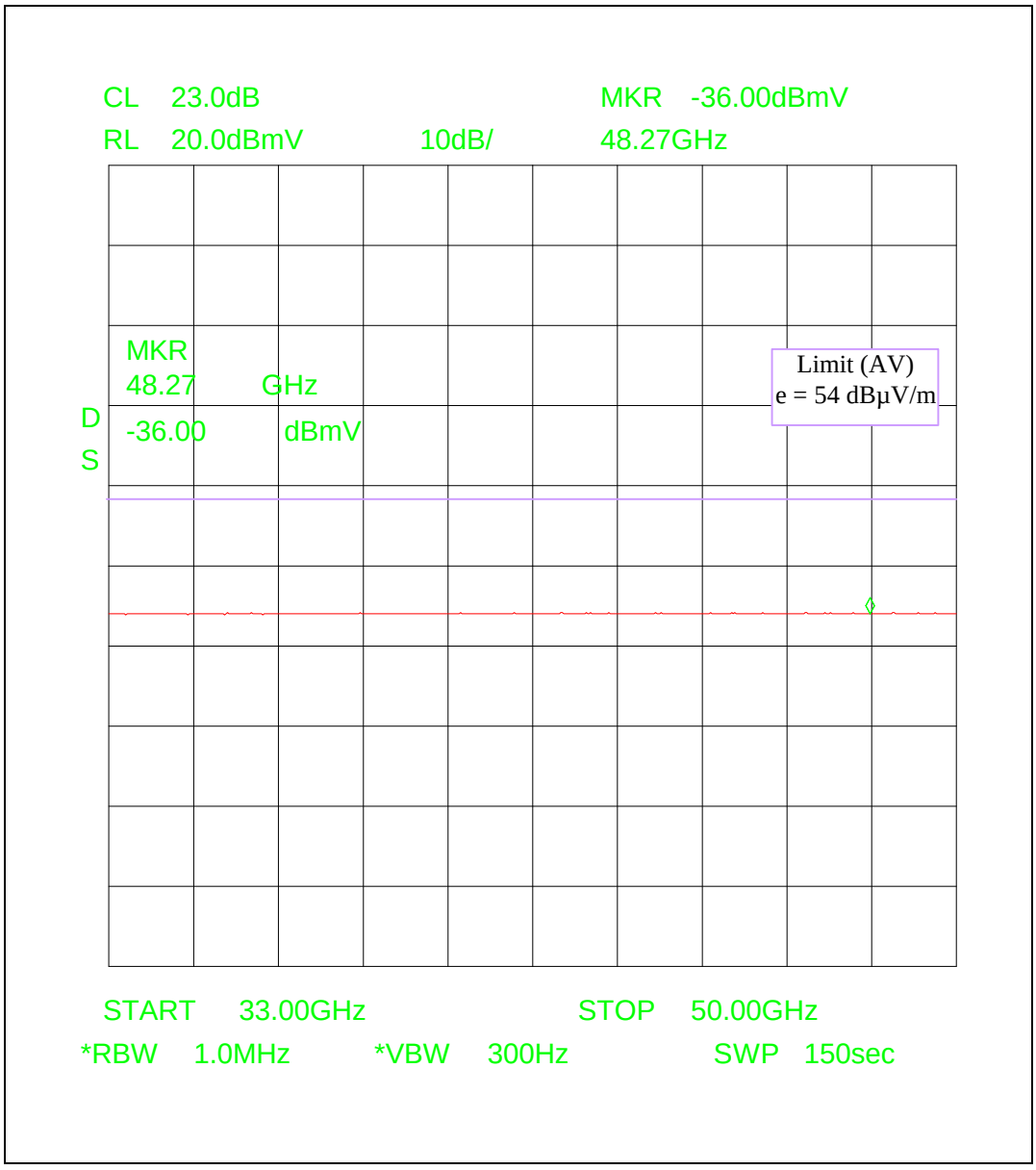
Plot 17



Measurement distance d = 0.25 m

Field strength	=	analyser reading	+	antenna factor	-	distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	k [dB(1/m)]	-	dc [dB]
e	=	-23.0	+	39.1	-	21.5
e	=	-5.4 dB(mV/m)				
e	=	54.6 dB(µV/m)				
E	=	537.0 µV/m (Noise)	PEAK measurement, 100 sweeps, MAX HOLD			

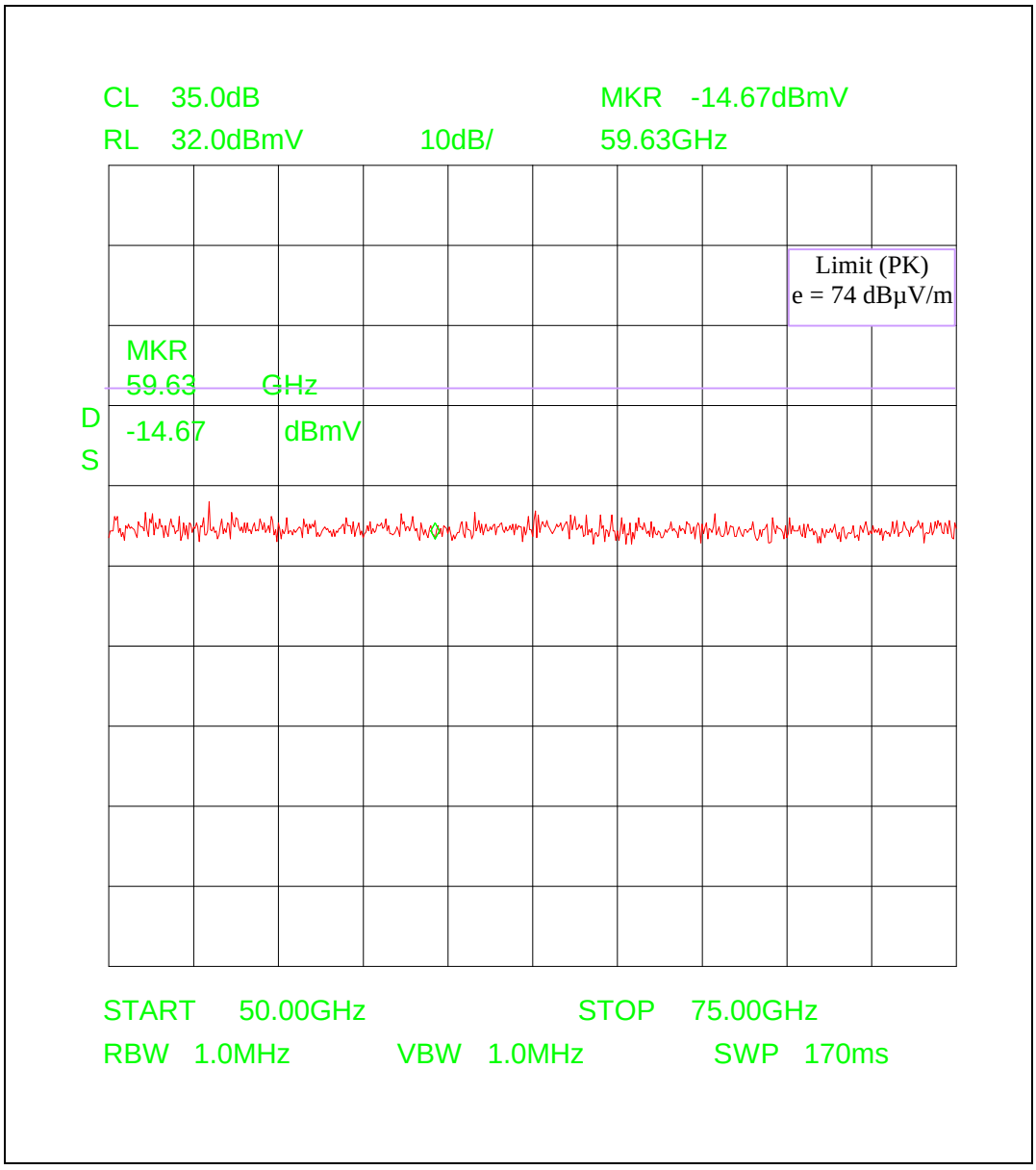
Plot 18



Measurement distance d = 0.25 m

Field strength	=	analyser reading	+	antenna factor	-	distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	k [dB(1/m)]	-	dc [dB]
e	=	-36.0	+	39.1	-	21.5
e	=	-18.4 dB(mV/m)				
e	=	41.6 dB(µV/m)				
E	=	120.2 µV/m (Noise)		AV measurement, 3 sweeps, MAX HOLD		

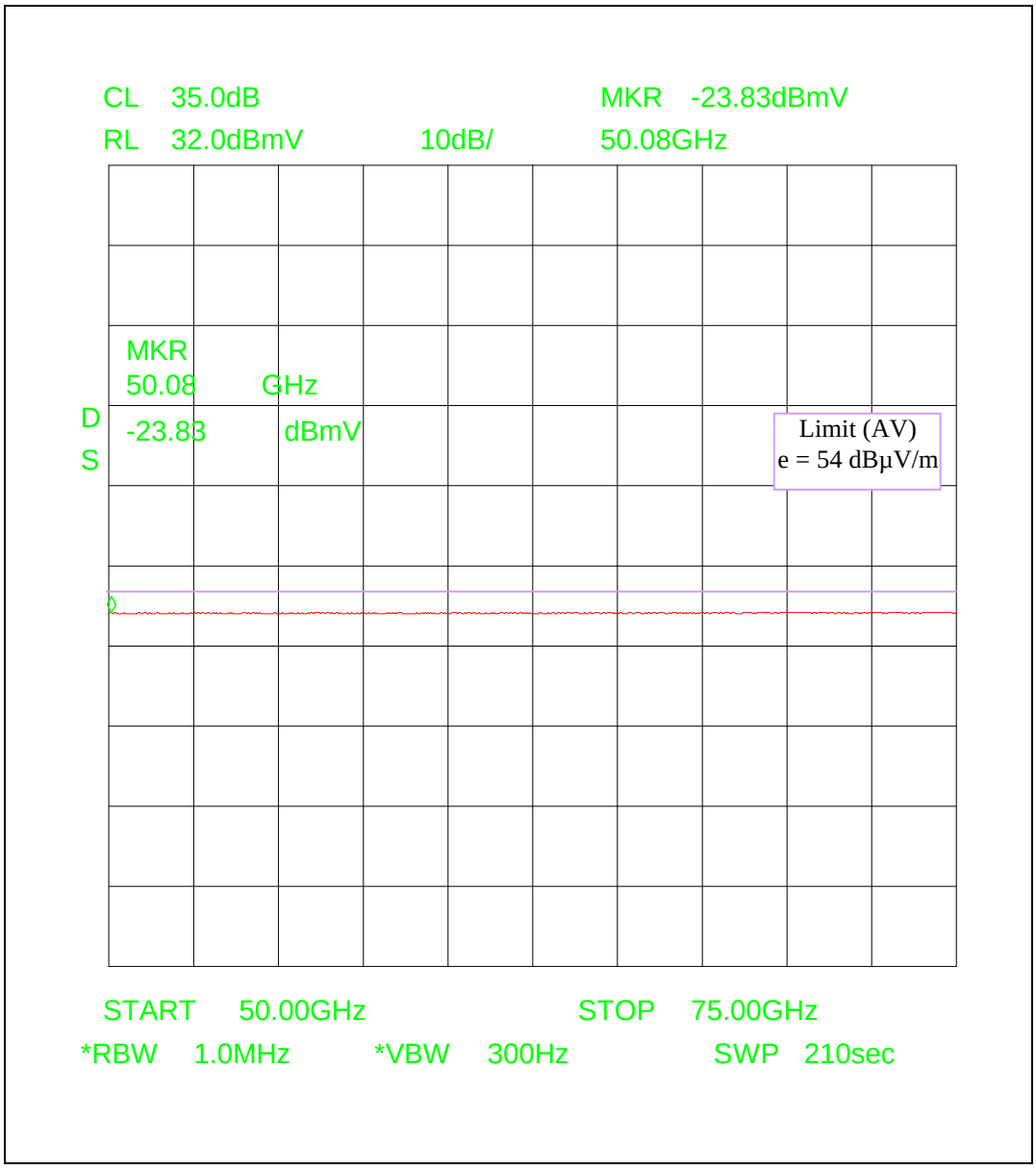
Plot 19



Measurement distance d = 0.125 m

Field strength	=	analyser reading	+	antenna factor	-	distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	k [dB(1/m)]	-	d [dB]
e	=	-14.6	+	40.6	-	27.6
e	=	-1.6 dB(mV/m)				
e	=	58.4 dB(µV/m)				
E	=	831.7 µV/m (Noise)	PEAK measurement, 100 sweeps, MAX HOLD			

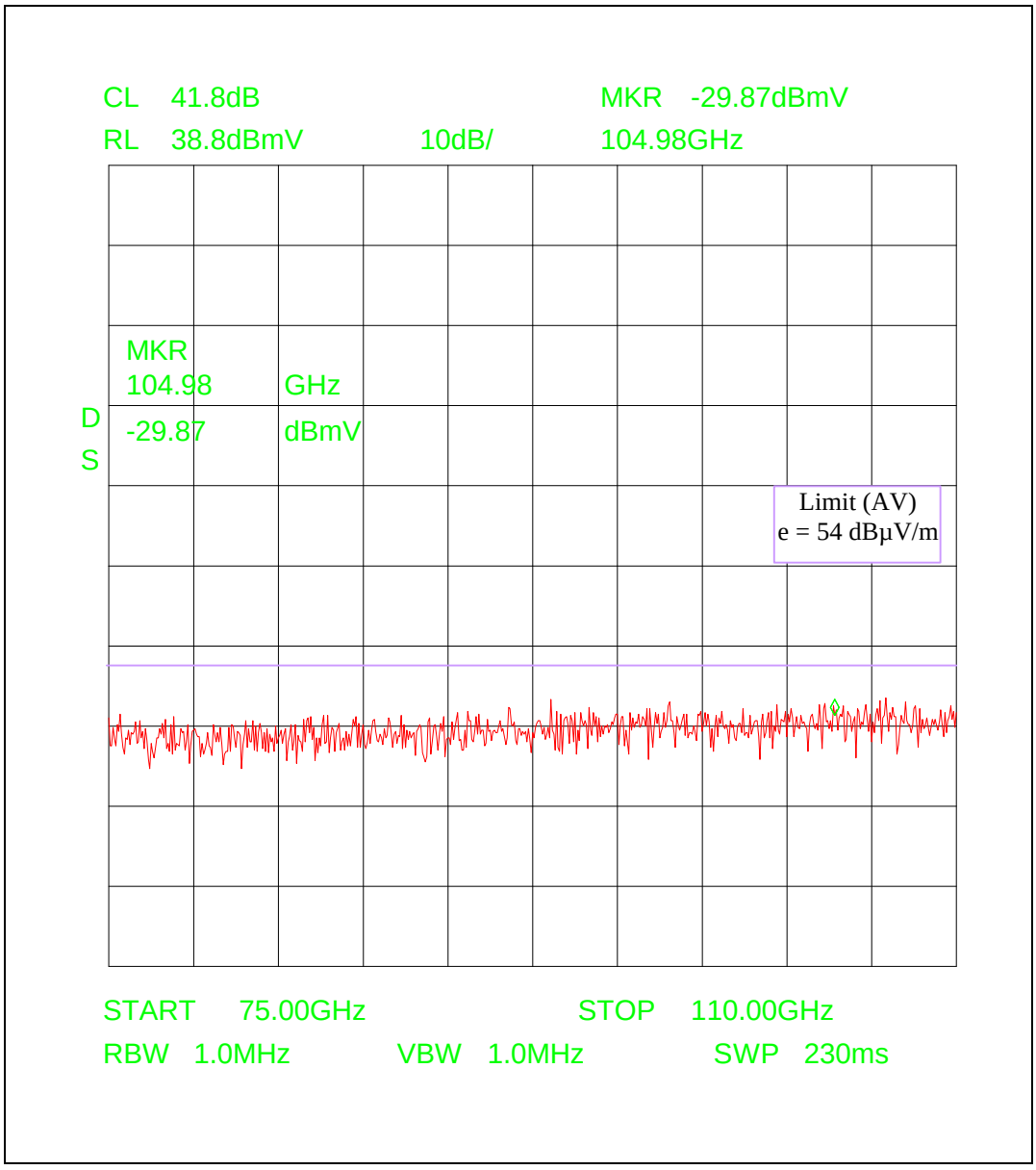
Plot 20



Measurement distance d = 0.125 m

Field strength	=	analyser reading	+	antenna factor	-	distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	k [dB(1/m)]	-	d [dB]
e	=	-23.8	+	40.6	-	27.6
e	=	-10.8 dB(mV/m)				
e	=	49.2 dB(µV/m)				
E	=	288.4 µV/m (Noise)				

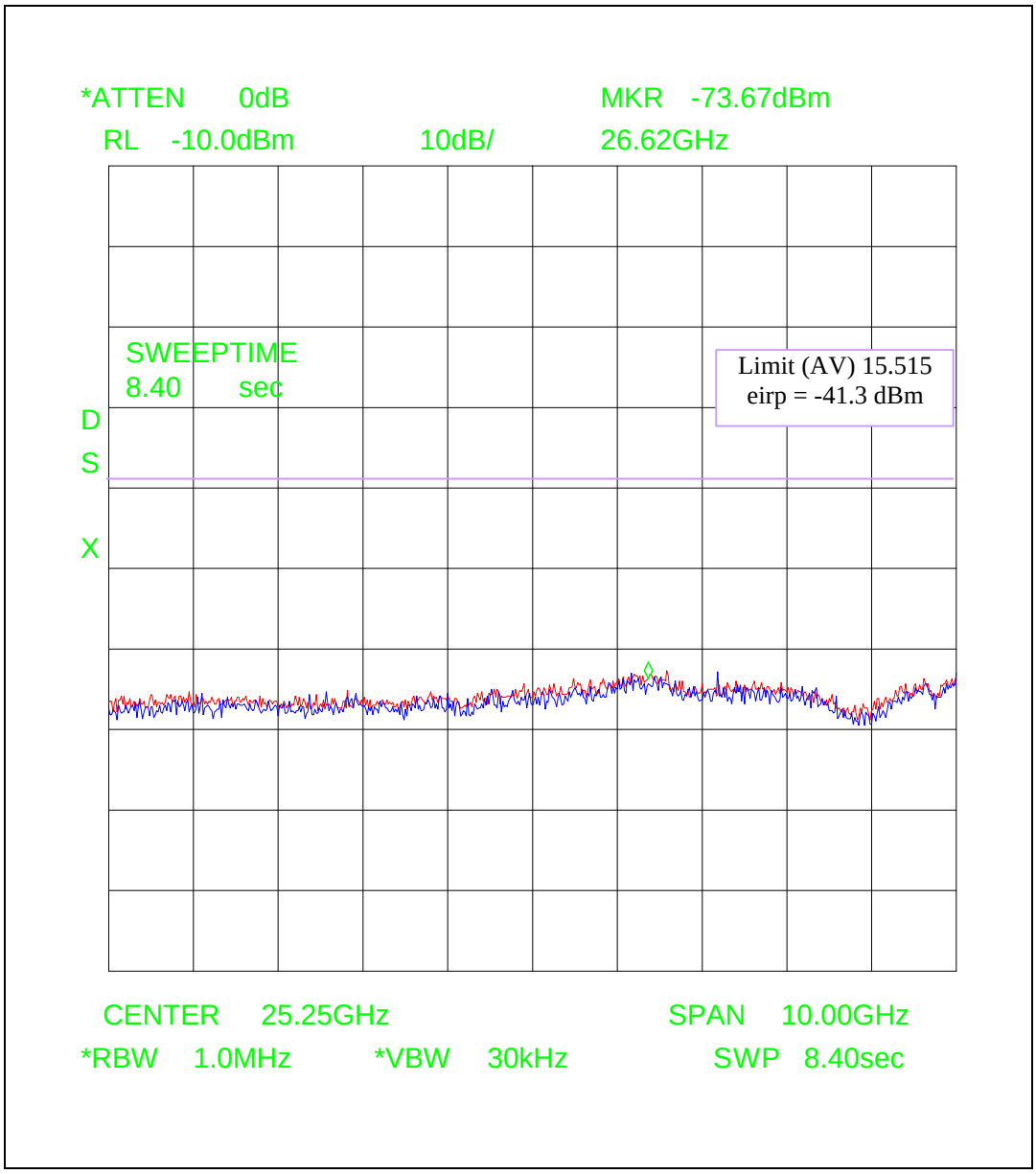
Plot 21



Measurement distance d = 0.125 m

Field strength	=	analyser reading	+	antenna factor	-	distance corr.
e [dB(mV/m)]	=	u [dB(mV)]	+	k [dB(1/m)]	-	d [dB]
e	=	-29.8	+	45.0	-	27.6
e	=	-12.4 dB(mV/m)				
e	=	47.6 dB(µV/m)				
E	=	239.8 µV/m (Noise)				

Plot 22

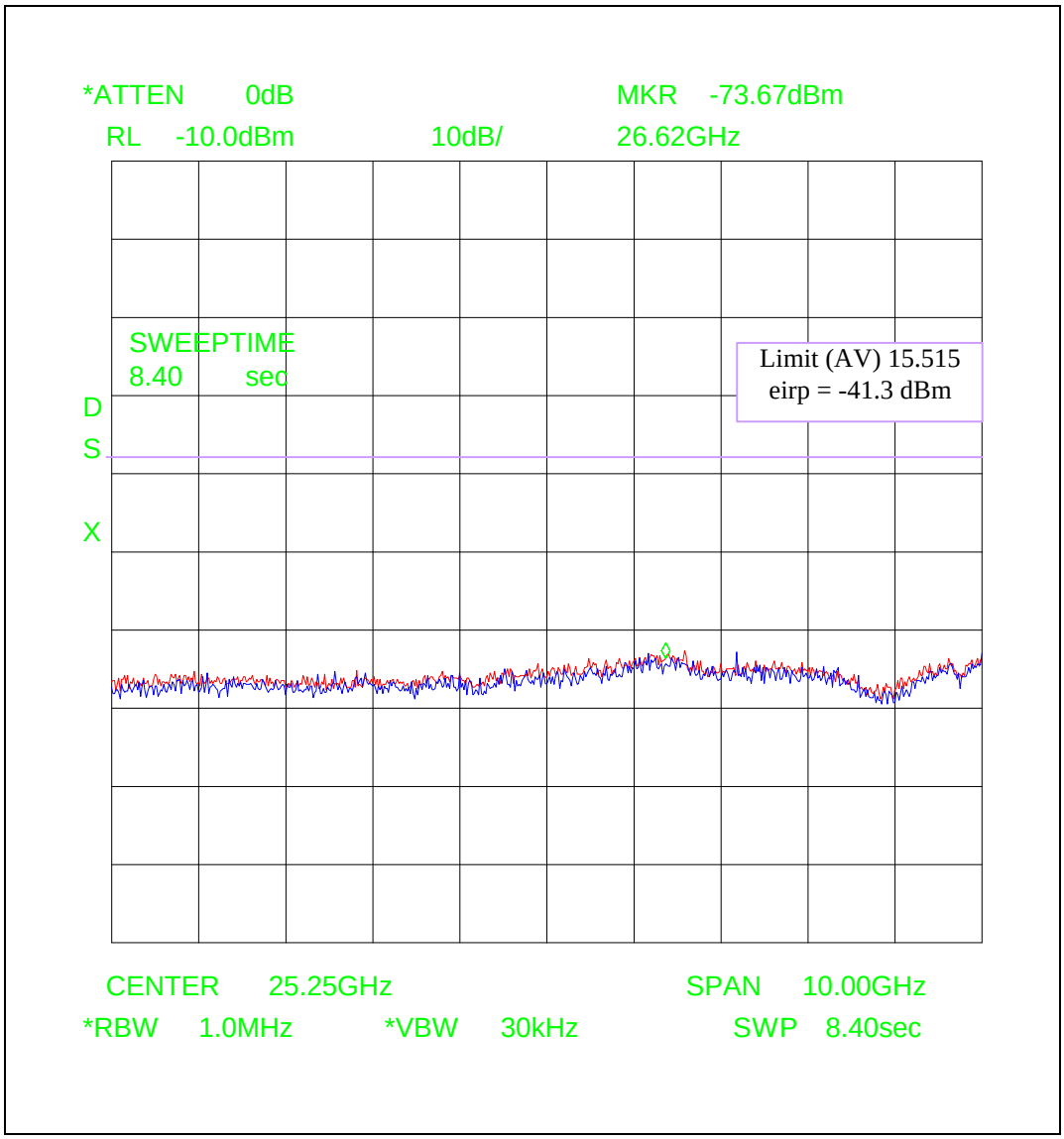


Measurement distance	d	=	0.5 m	EUT on top of an empty metal tank (best case)	
Calculation **:**	eirp	=	Analyser reading	+	System attenuation
	eirp	=	-73.7 dBm	+	8.3 dB
	eirp	=	-65.4 dBm		

Trace A (red): EUT operating PEAK measurement, 10 sweeps, MAX HOLD

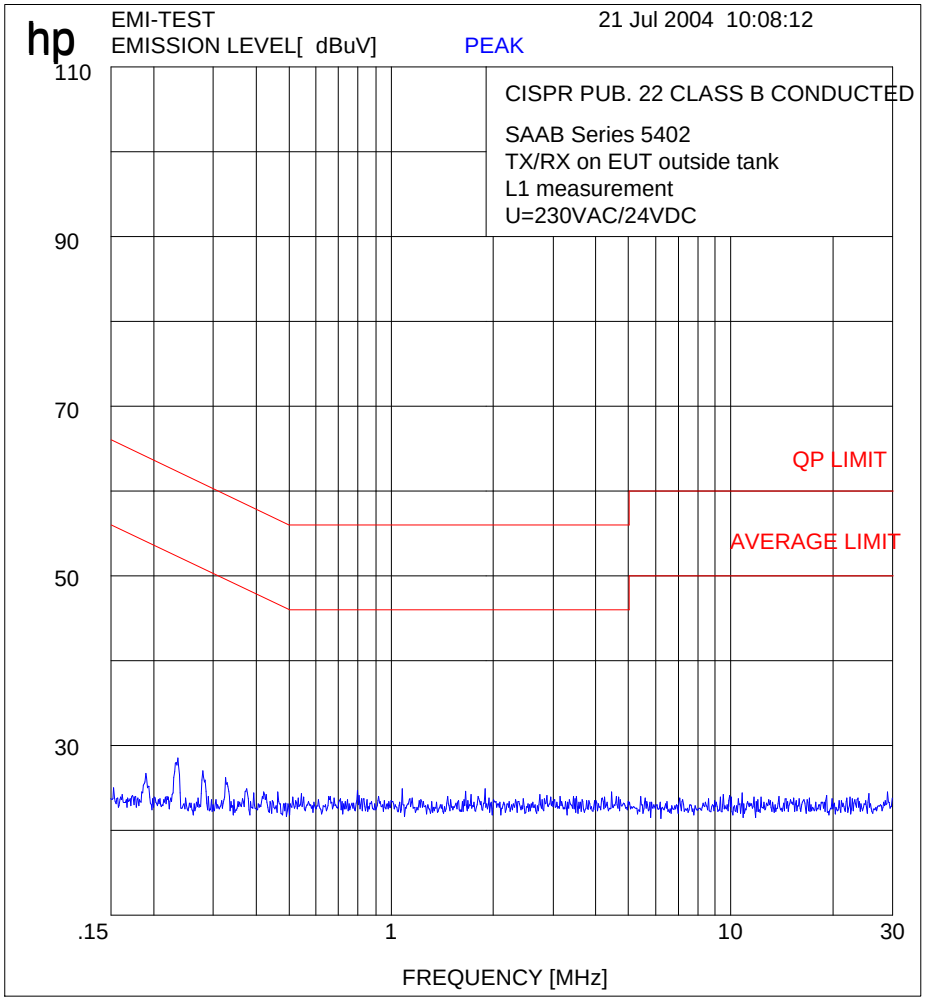
Trace B (blue) EUT off

Plot 23

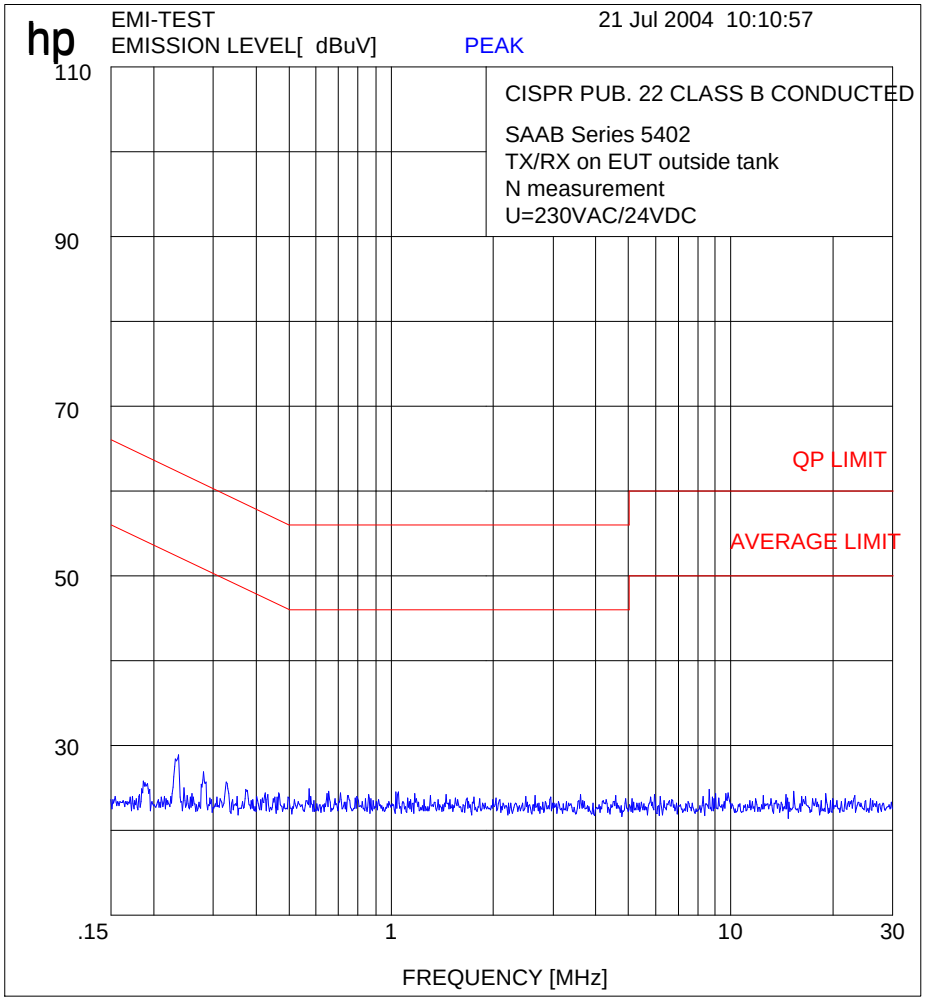


Measurement distance	d	=	0.5 m	EUT on top of an empty PVC tank (worst case)		
Calculation **:**	eirp	=	Analyser reading	+	System attenuation	
	eirp	=	-73.7 dBm	+	8.3 dB	
	eirp	=	-65.4 dBm			
Trace A (red):	EUT	operating	PEAK measurement, 10 sweeps, MAX HOLD			
Trace B (blue)	EUT	off				

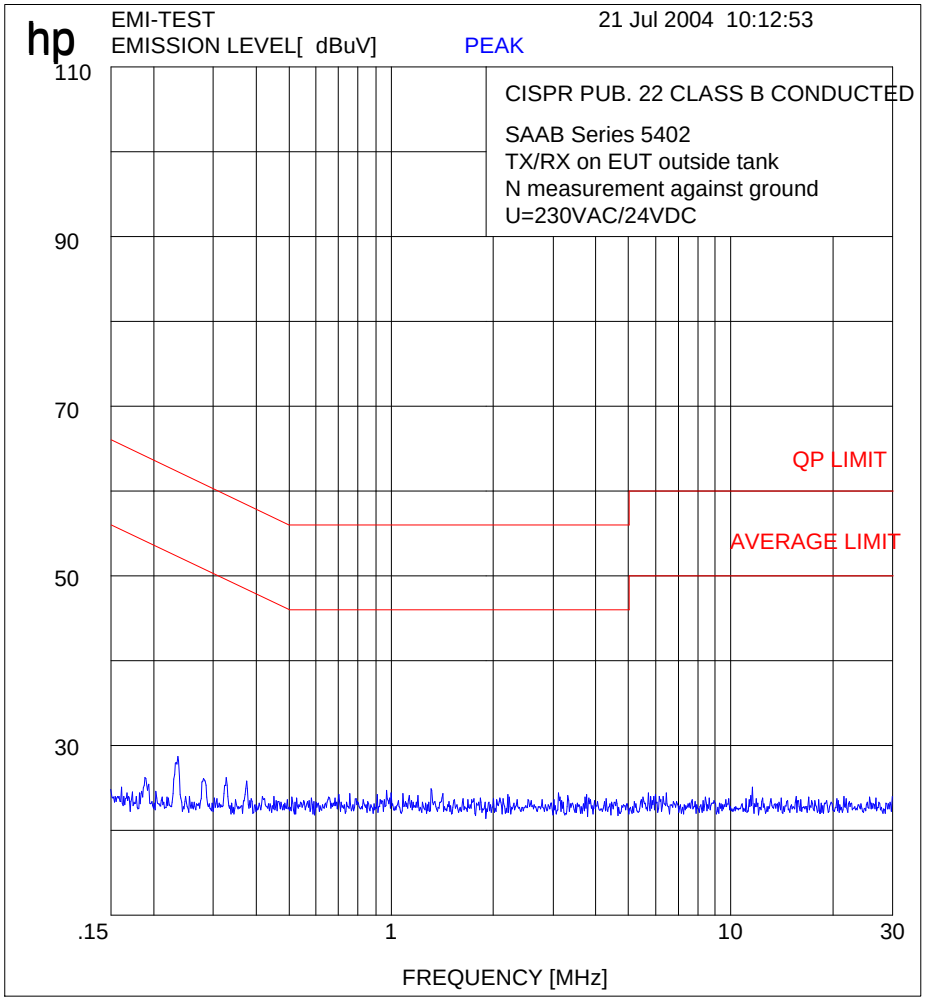
Plot 24


hp
EMI-TEST
21 Jul 2004 10:08:12
EMISSION LEVEL[dBuV]
PEAK
CISPR PUB. 22 CLASS B CONDUCTED
SAAB Series 5402
TX/RX on EUT outside tank
L1 measurement
U=230VAC/24VDC
QP LIMIT
AVERAGE LIMIT
110
90
70
50
30
.15
1
10
30
FREQUENCY [MHz]

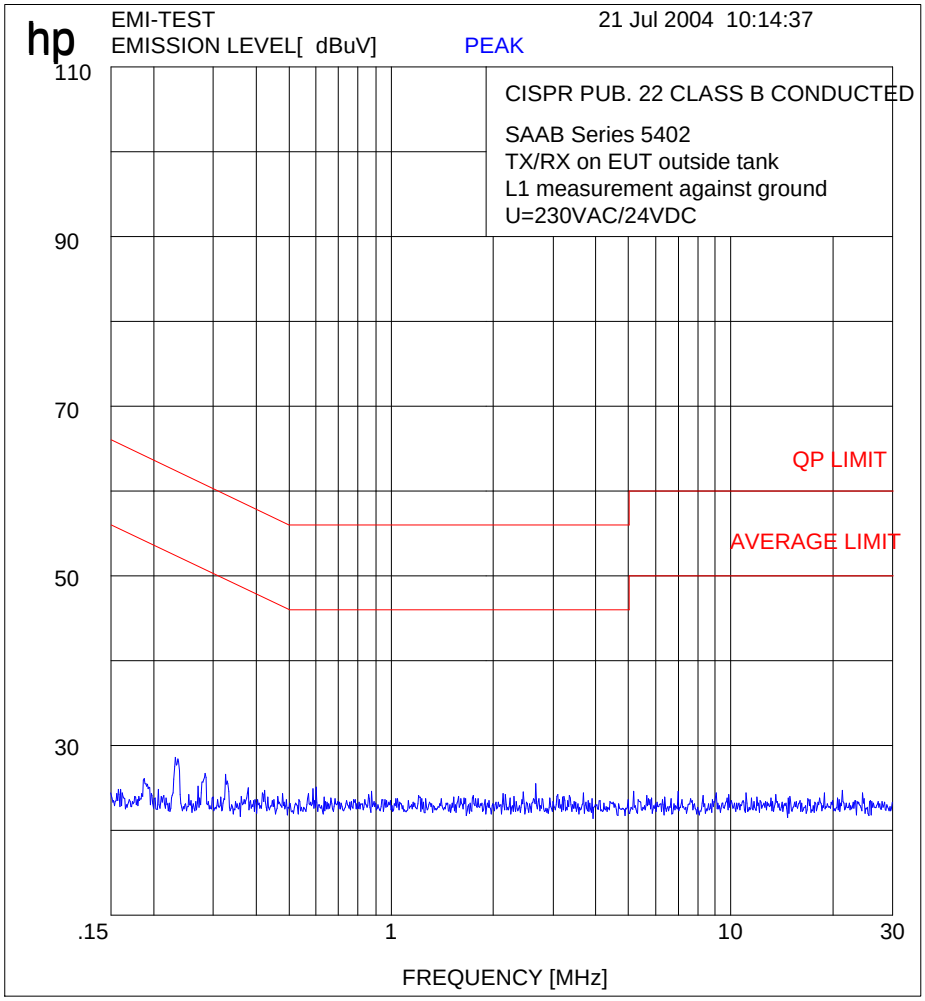
Plot 25


hp
EMI-TEST
21 Jul 2004 10:10:57
EMISSION LEVEL[dBuV]
PEAK
CISPR PUB. 22 CLASS B CONDUCTED
SAAB Series 5402
TX/RX on EUT outside tank
N measurement
U=230VAC/24VDC
QP LIMIT
AVERAGE LIMIT
110
90
70
50
30
.15
1
10
30
FREQUENCY [MHz]

Plot 26


hp
EMI-TEST
21 Jul 2004 10:12:53
EMISSION LEVEL[dBuV]
PEAK
CISPR PUB. 22 CLASS B CONDUCTED
SAAB Series 5402
TX/RX on EUT outside tank
N measurement against ground
U=230VAC/24VDC
QP LIMIT
AVERAGE LIMIT
110
90
70
50
30
.15
1
10
30
FREQUENCY [MHz]

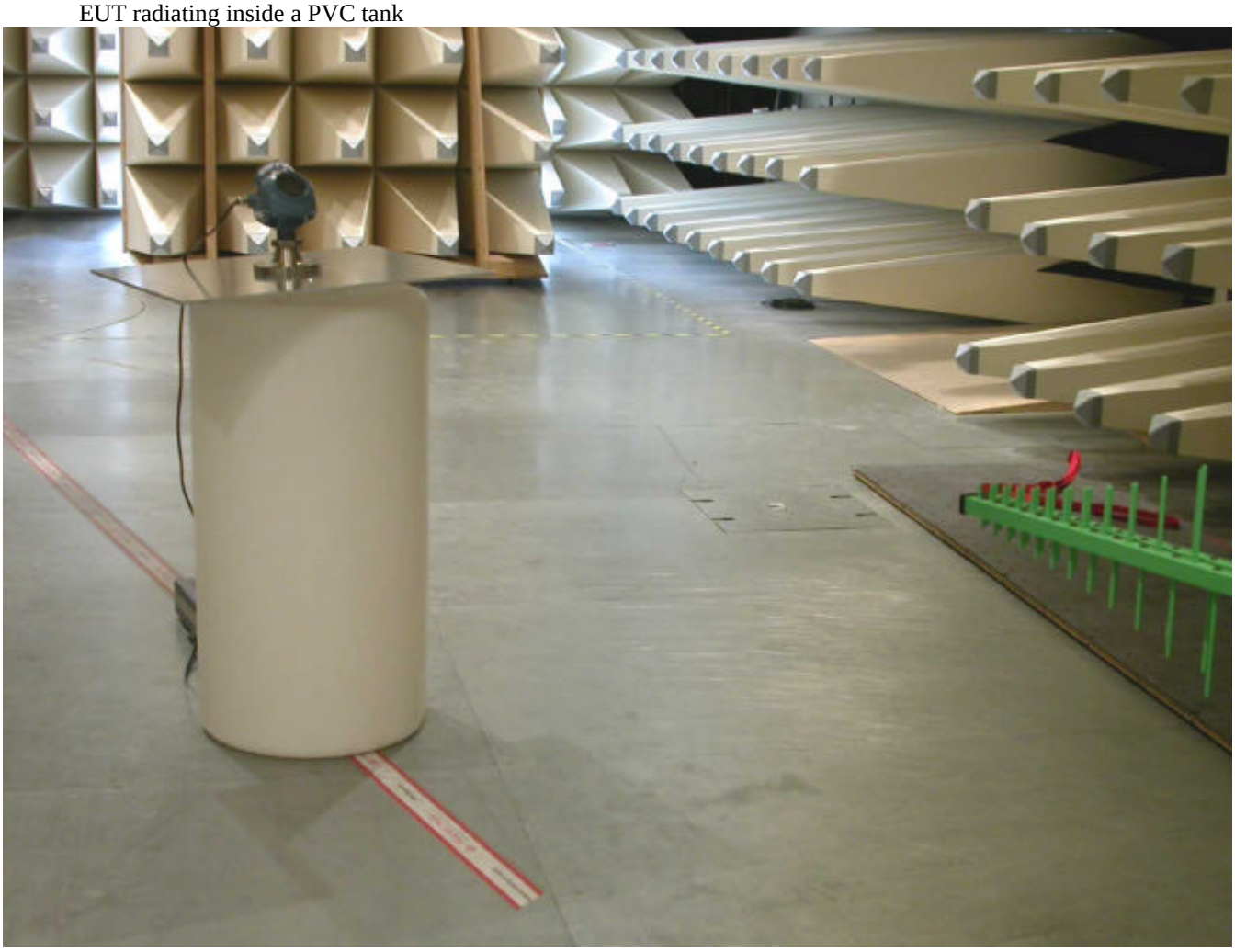
Plot 27


hp
EMI-TEST
21 Jul 2004 10:14:37
EMISSION LEVEL[dBuV]
PEAK
CISPR PUB. 22 CLASS B CONDUCTED
SAAB Series 5402
TX/RX on EUT outside tank
L1 measurement against ground
U=230VAC/24VDC
QP LIMIT
AVERAGE LIMIT
110
90
70
50
30
.15
1
10
30
FREQUENCY [MHz]

4 Photographs

Photograph 1

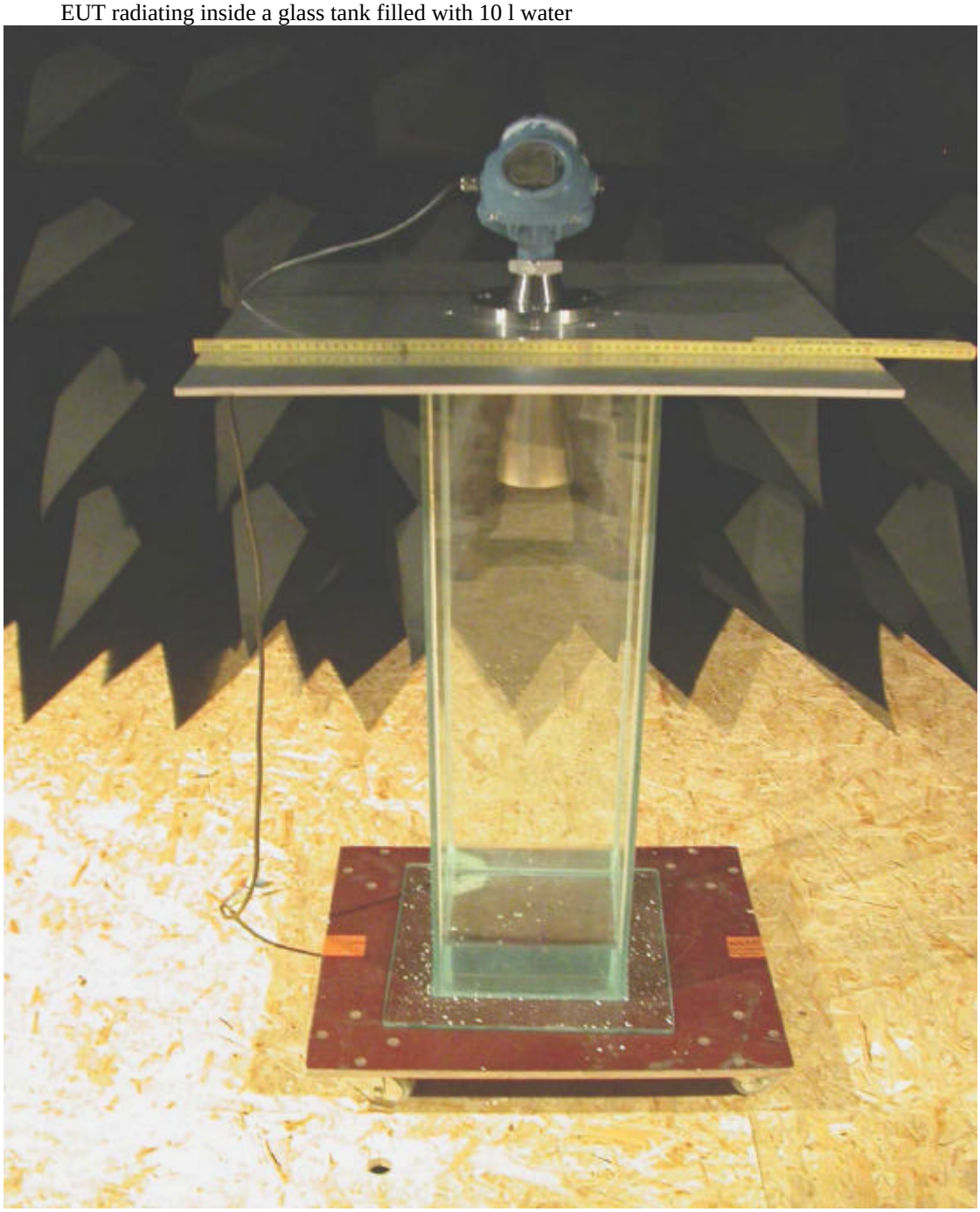
EUT radiating inside a PVC tank



Photograph 2

Photograph 3

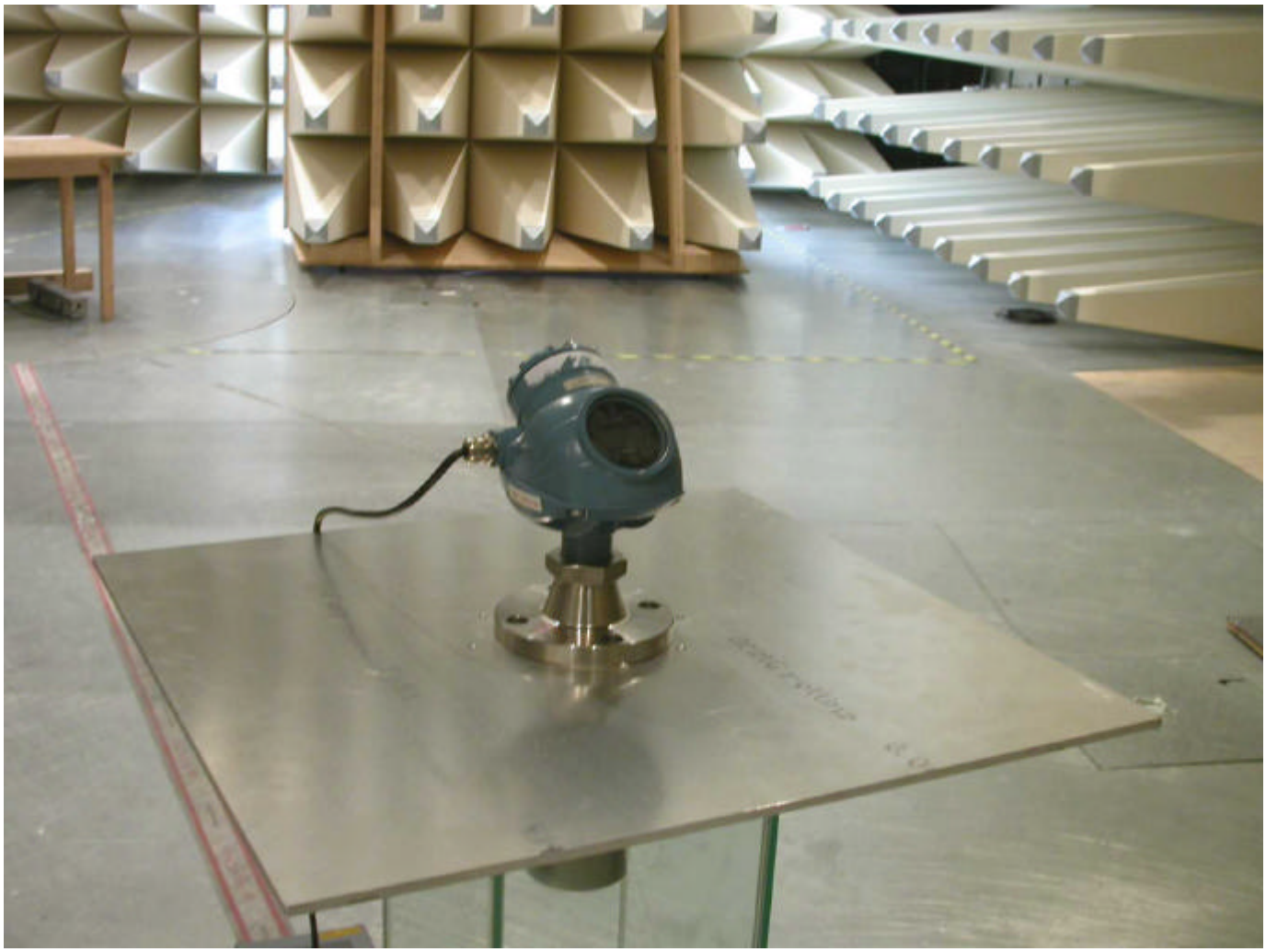
EUT radiating inside a glass tank filled with 10 l water



Photograph 4

Photograph 5

Photograph 6

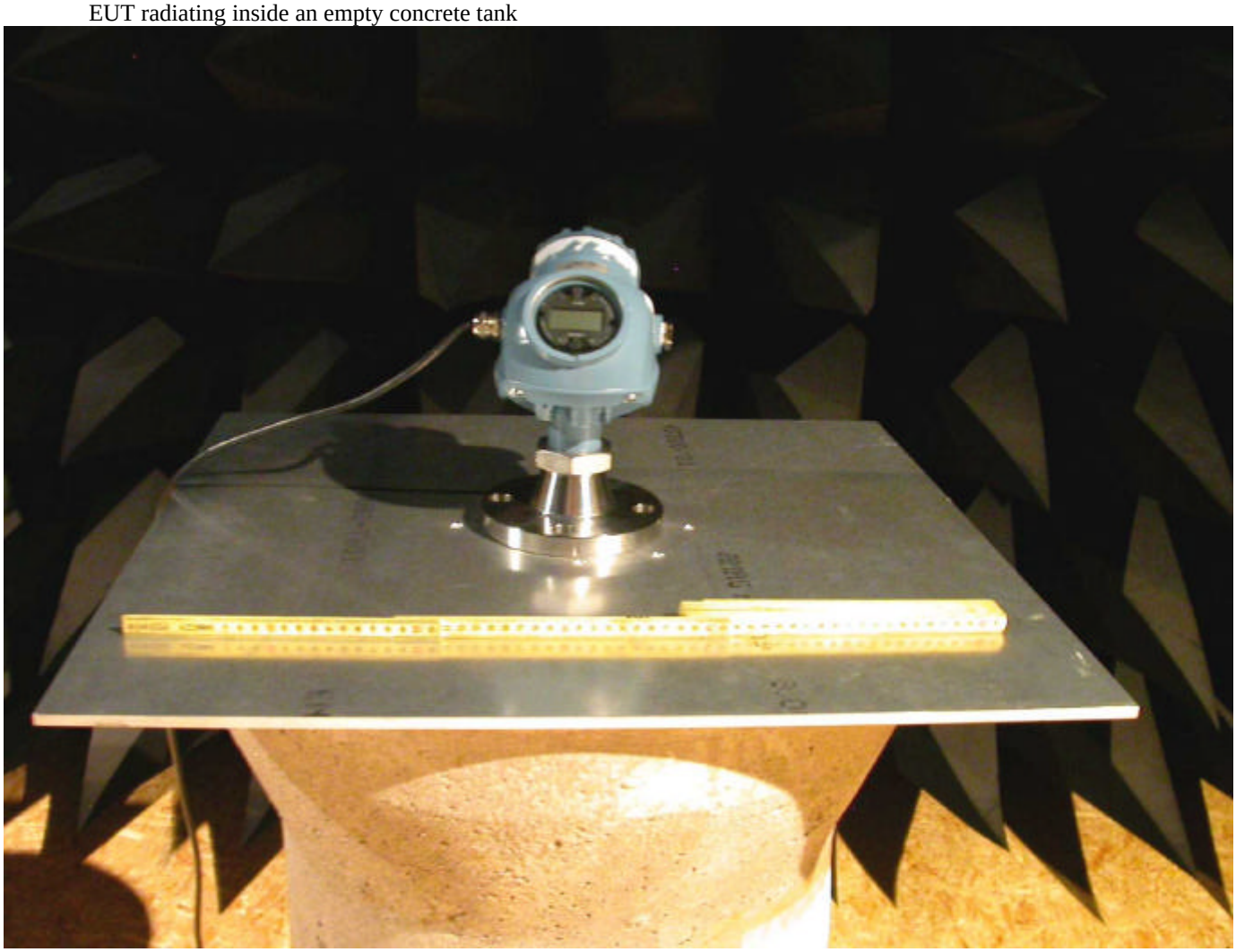


Photograph 7

EUT radiating inside an empty concrete tank

Photograph 8

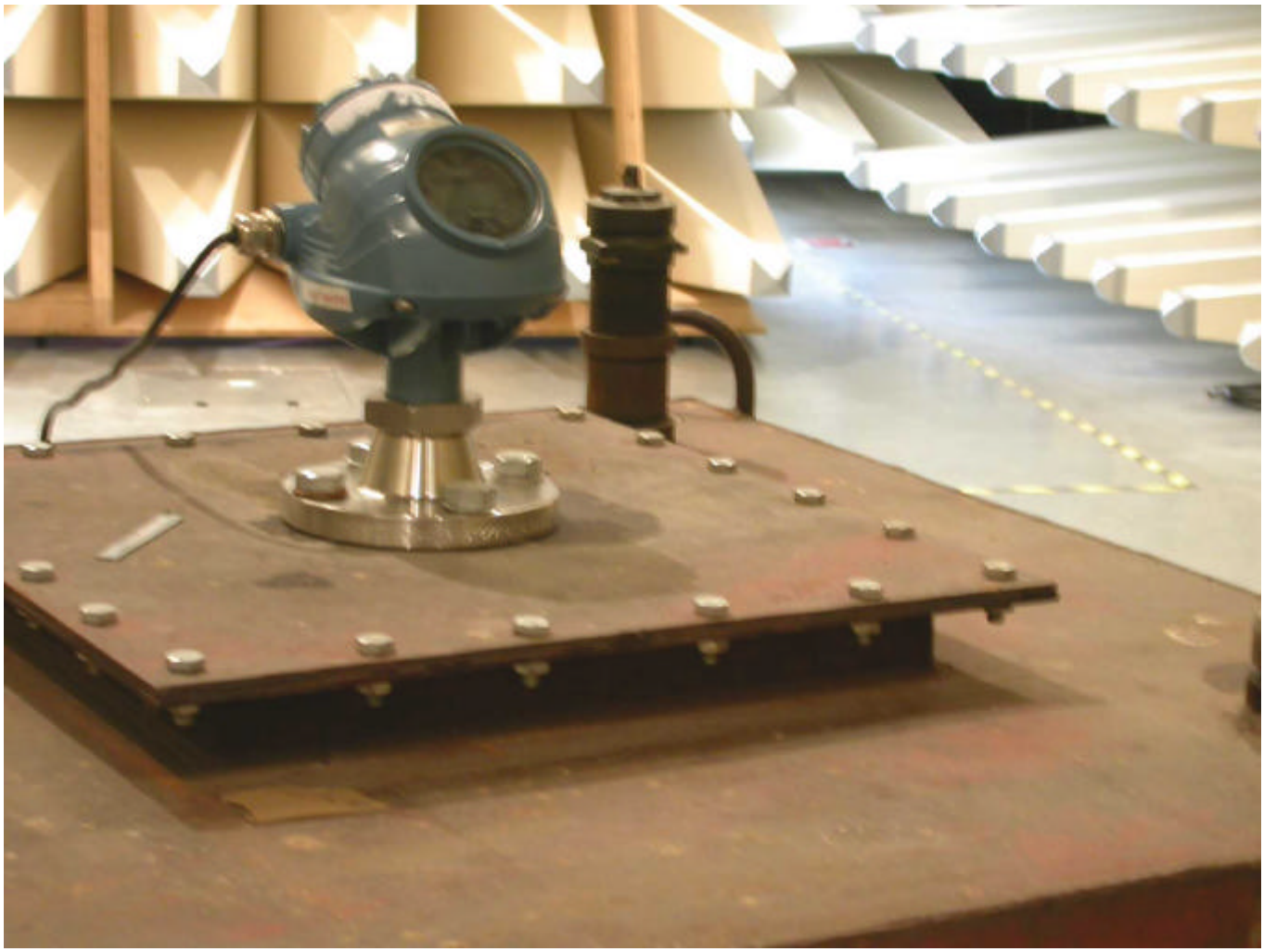
EUT radiating inside an empty concrete tank



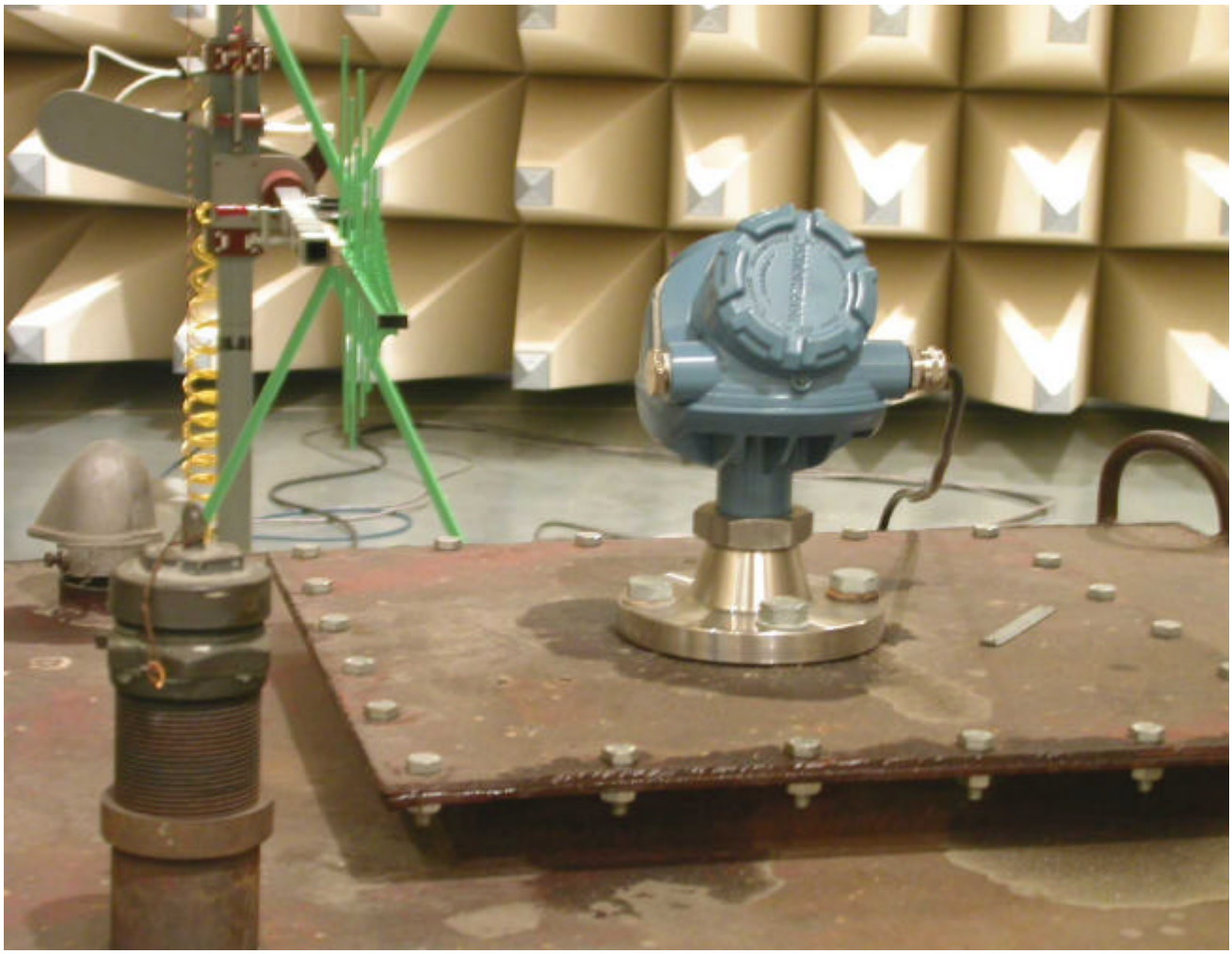
Photograph 9

EUT radiating inside an empty steel tank

Photograph 10



Photograph 11



Photograph 12

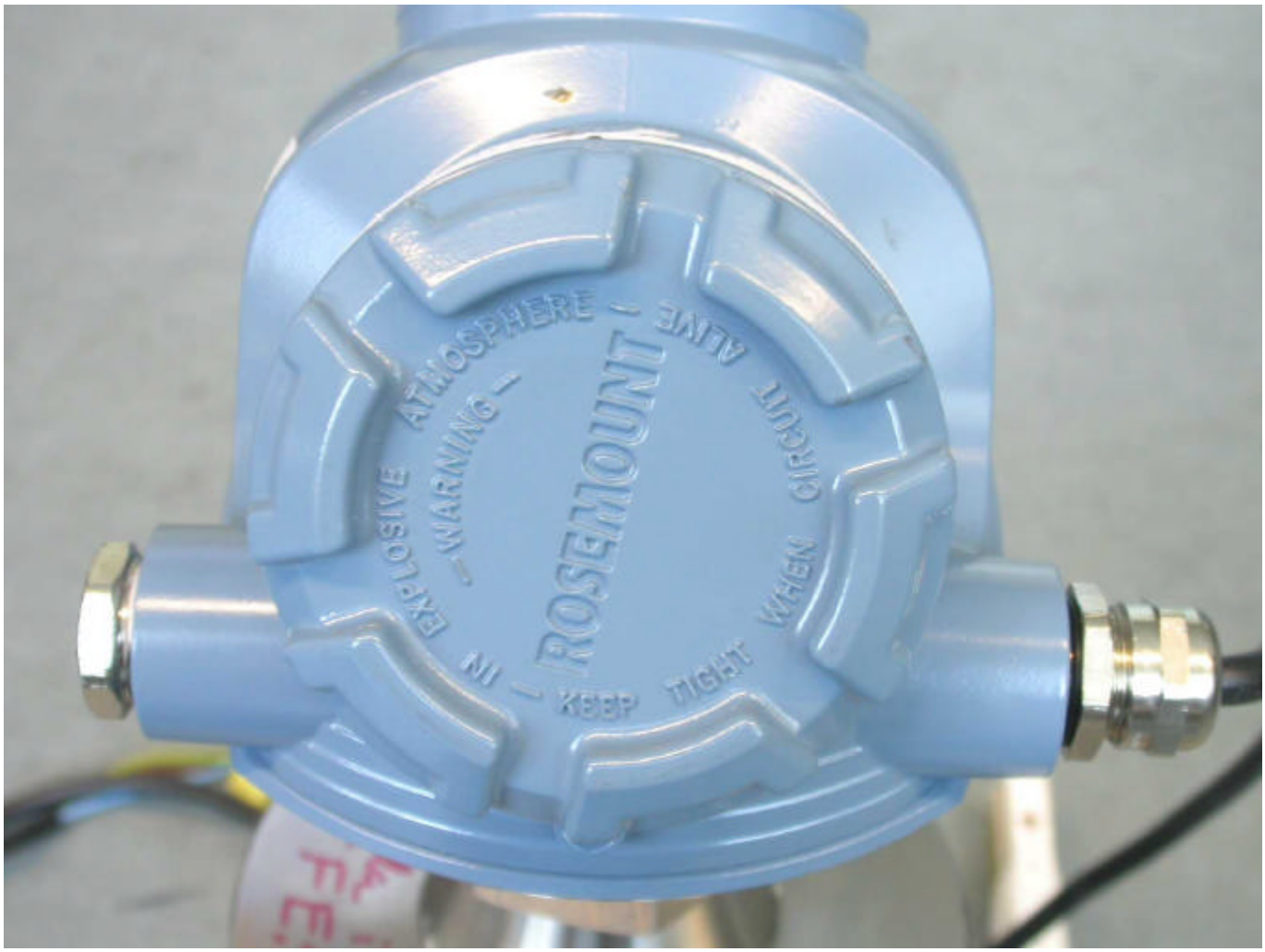
EUT with 4“ cone antenna

Photograph 13

EUT top view with display window

Photograph 14

EUT side view



Photograph 15

4“ cone antenna

Photograph 16

Various attachable antennas: 4“ cone, 3“ cone, 2“ cone

Photograph 17

Photograph 18

Photograph 19