CETECOM ICT Services GmbH

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

Accredited by the
German Accreditation Council
DAR–Registration Number
DAT–P-176/94-D1

Independent ETSI
compliance test house

Test report No.: 2-3882-01-03/05
Applicant : Autocruise S.A.
Type : AC 20
Test standards : FCC Part 15 (06/2005) / RSS210 Issue 6
FCC ID : S9IAC20
IC : 5860A-AC20

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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
2005-09-21	Detlev Gillmann	.....

Technical responsibility for area of testing:

Date	Name	Signature
2005-09-21	Harro Ames	.....

1.2 Testing laboratory

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

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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	3463

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

1.3 Details of applicant

Name : Autocruise S.A.
Street : Avenue du Technopôle
Town : 29280 Plouzané
Country : France
Telephone : + 33 (0) 298 45 92 96
Fax : + 33 (0) 298 49 56 55

Contact
Name : Patrice Mallejac
Telephone : + 33 (0) 298 45 92 96
Fax : + 33 (0) 298 49 56 55
Mobile : + 33 (0) 675 09 55 79
mailto : Patrice.mallejac@trw.com

1.4 Application details

Date of test : 2005-03-14 – 2005-09-15

1.5 Test item (EUT)

Description of EUT	:	Microwave Radar sensor; Vehicle mounted field disturbance sensor
System designation	:	Automatic cruise control system
Type designation	:	AC 20
Manufacturer	:	Autocruise S.A. Avenue du Technopôle 29280 Plouzané France

1.6 Technical data

Frequency range	:	76.000 GHz ... 77.000 GHz
Operational frequency	:	76.400 GHz
Power Density (PEP)	:	1.6 µW/cm ^{2} at extreme conditions
Type of modulation	:	1M200F0N (FSK)
Antenna modules	:	TX / RX - Module with di-electrical lens
Normal DC power supply	:	12.0 V
Extreme DC power supply	:	10.80 ... 15.60 V

1.6.1 Operation conditions

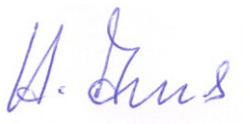
Operation:	:	As soon as the equipment is addressed via CAN-Bus, TX and RX start operation
Purpose of operation	:	Automatic distance measurement and cruise control for vehicle application

1.6.2 Test Report Cover Sheet / Performance Test Data

Equipment Model Number:	AC 20
Certification Number:	5860A-AC20
Manufacturer:	Autocruise S.A. Avenue du Technopôle 29280 Plouzané France Mr. Patrice Mallejac + 33 (0) 298 45 92 96
Tested to Radio Standards Specification (RSS) No.:	RSS210 Issue 6
Open Area Test Site Industry Canada Number:	3463
Frequency Range (or fixed frequency):	76.400 GHz
Power Density:	1.6 µW/cm² @ 3m in extreme conditions
Occupied Bandwidth (99% BW):	1.2 MHz
Type of Modulation:	FSK
Emission Designator (TRC-43):	1M200FXN
Transmitter Spurious (worst case):	469 µV/m @ 3m
Receiver Spurious (worst case):	Not applicable
Antenna Type:	Dielectrical Lens

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.

Signature:



Date: 2005-09-21

Test engineer: Harro Ames

1.7 Test standards

Code of Federal Regulations (CFR 47)
Federal Communications Commission (FCC)

FCC Part 15	Radio Frequency Devices (06/2005) Section 15.253 Operation within the band 76.0 to 77.0 GHz. Section 15.209 Radiation emission limits, general requirements Section 15.205 Restricted bands of operation.

Industry Canada
Radio Standards Specification

RSS - 210	Low Power Licence-Exempt Radio communication Devices for Cat I equipment Annex 13 Vehicle -Mounted Field Disturbance Sensors RSS210 Issue 6

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

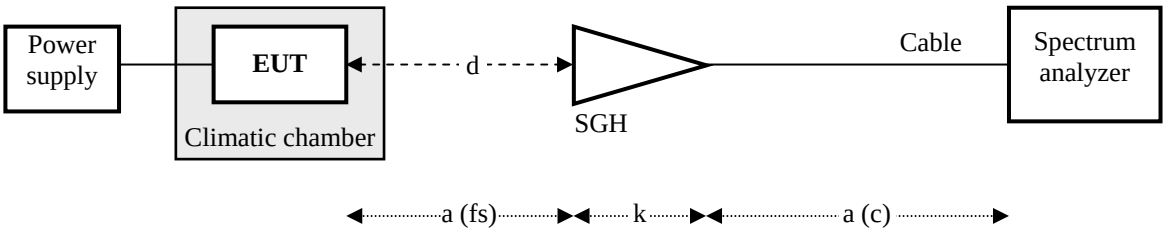
The environmental conditions are documented especially for each test.

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 and spurious radiation in the frequency range 4 GHz to 40 GHz



Frequency f [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]
4.0 to 8.0	0.5	EMCO 3115	-15.56	33.6 ... 38.0	1.8
8.0 ... 18.0	0.5	EMCO 3115	-15.56	38.0 ... 47.0	2.0
18 ... 26	0.25	narda 638	-21.58	40.4	2.8
26 ... 40	0.25	narda V637	-21.58	44.0	3.0

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

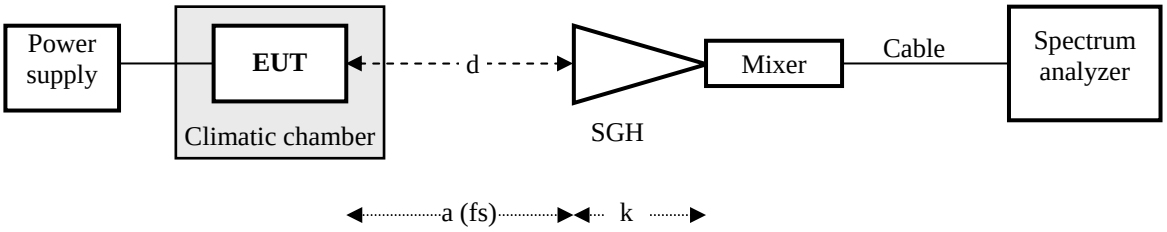
e = u + a + k + dc

Test equipment	Manufacturer	Type	CETECOM reference	cal. / verf. date
Spectrum Analyser	HP	HP 8565E	300001665	15.05.2003
SGH 1.0 ... 26.0 GHz	EMCO	3115	300001604	not required
SGH 18 ... 27 GHz	narda	638	300002442	not required
SGH 27 ... 40 GHz	narda	V637	300000510	not required
SGH 27 ... 40 GHz	Thomson	COR 27_40	300000797a	not required
Power supply	HP	6032A	300002115	04.06.2003
RF-cable	HP	5061-5359	300002033	15.05.2003

Measurement uncertainties

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

2.4.2 Power density and spurious radiation in the frequency range 33 GHz to 325 GHz



Frequency f [GHz]	Distance d [m]	Distance correction dc (3 m/Xm) [dB]	Antenna factor k [dB 1/m]	Antenna aperture area A [cm^2]
40 ... 60	3.00	n.a.	39.27	11.6 (10.64 dB)
50 ... 75	3.00	n.a.	40.69	7.92 (8.98 dB)
75 ... 110	1.00	-9.54	45.12	2.85 (4.55 dB)
110 ... 170	0.50	-15.56	49.54	1.03 (0.13 dB)
140 ... 220	0.25	-21.58	54.10 ... 56.22	0.95 (-0.22 dB)
220 ... 325	0.125	-27.60	56.22 ... 59.50	0.95 (-0.22 dB)

Calculation : Power density = EIRP / Antenna aperture area x distance correction
pd = eirp - a + dc

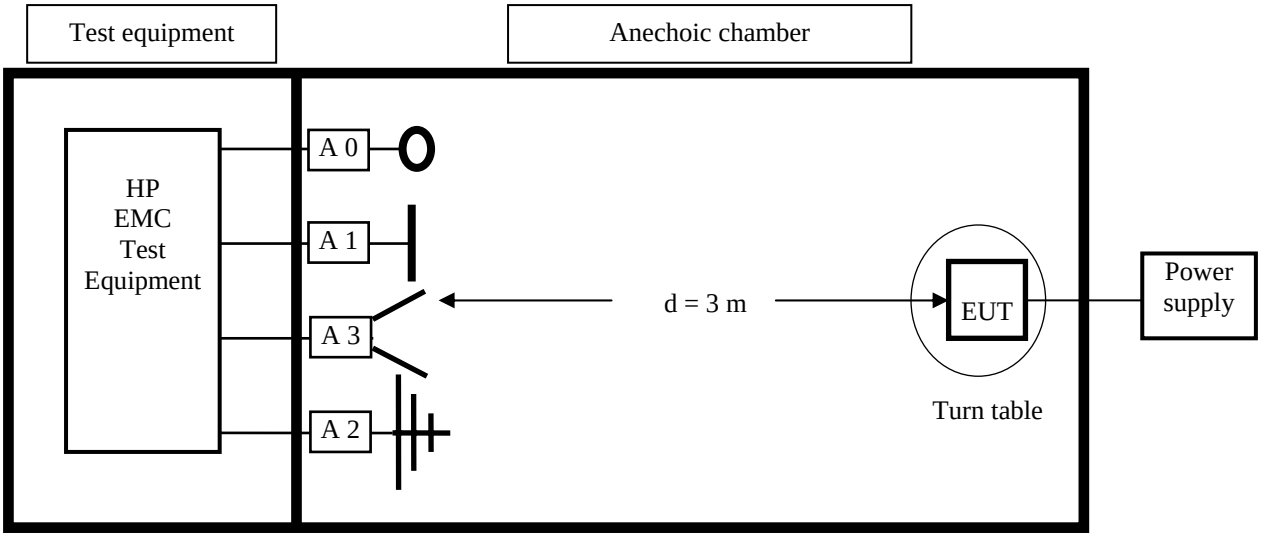
Test equipment	Manufacturer	Type	CETECOM reference	cal. / verf. date
Spectrum Analyser	HP	HP 8565E	300001665	15.05.2003
Spectrum Analyser	Tektronix	TEK 2782	300001401	09.04.2003
Power supply	HP	6032A	300002115	04.06.2003
SGH 40 ... 60 GHz	Thomson	COR 33_50	300001812	not required
Mixer 40 ... 60 GHz	HP	11970U	300000781b	07.11.2002
SGH 50 ... 75 GHz	Thomson	COR 50_75	300000789k	not required
Mixer 50 ... 75 GHz	HP	11970V	300000871o	07.11.2002
SGH 75 ... 110 GHz	Thomson	COR 75_110	300000789m	not required
Mixer 75 ... 110 GHz	HP	11970W	300000871v	07.11.2002
SGH 110 ... 175 GHz	Flann	2924_20	300001210a	not required
Mixer 110 ... 175 GHz	Tektronix	WM 780 D	B010186	07.11.2002
SGH 175 ... 325 GHz	Flann	3024_25	300001210c	not required
Mixer 175 ... 325 GHz	Tektronix	WM 780 J	B010241	07.11.2002

Measurement uncertainties

Test parameter	Measurement uncertainty
Power supply	±0.1 VDC
Temperature	±0.2 °C
Frequency	±0.01 ppm
eirp	±1.4 dB (up to 50 GHz)
eirp	±3.0 dB (above 50 GHz)

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.	cal. / verf. date
Spectrum analyser	HP	HP 85660B	2478A05306	07.10.2002
Analyser display	HP	HP 85662A	2816A16541	07.10.2002
Quasi peak adapter	HP	HP 85650A	2811A01131	07.10.2002
RF-preselector	HP	HP 85685A	2833A00768	07.10.2002
Loop Antenna A 0	R&S	HFH 2–Z2	881 058/42	not required
Biconical antenna A 1	Emco	3104	3758	not required
Log.-per.-antenna A 2	Emco	3146	2304	not required
Double ridge horn ant. A 3	Emco	3115	3007	not required
Relay switch	R&S	RSU	375 339/002	not required
High pass filter	FSY Microwave	HM 985955	001	01.05.2003
Amplifier	Tron-Tech	P42-GA29	B2302	10.05.2003
Power supply	HP	HP 6038A	2848A07027	04.06.2002
RF-cable	HP	5061-5359	P36303	15.05.2003

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

2.5.2 Remarks on methods of measurements

The Radar heads are exchangeable. They are positioned in a non-conductive fixture and can be rotated and tilted in all angles.

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 C63.2-1996 clause 15 and ANSI C63.4-2003 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test set–ups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received.

The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths (RBW) over various frequency ranges are set according to requirement ANSI C63-4-2003 clause 4.2.

1. Measurements of the EIRP and power density (PD) at fundamental frequency

The measurements are carried out according to FCC guideline "Millimetre Wave Test Procedure" with a spectrum analyser (SA), harmonic mixer with appropriate frequency range and a rectangular standard gain horn antenna (SGH) with matching wave guide dimensions. The conversion loss of the external mixer is taken into account in the SA power level reading automatically.

The radiated power measurements are performed with resolution bandwidth filter (RBW) of 1.0 MHz and a video filter of 1 MHz. This filter setting is sufficiently broad enough to receive the peak envelope power (PEP) of the EUT. Tests are also performed with RBW 2.0 and Video bandwidth filter (VBW) 3.0 MHz. The received EIRP does not change when RBW and VBW are set to higher values.

The distance for fundamental power measurement generally is 3.0 m. The SA level scale shows the dimension dBm. With a SGH and a measured antenna aperture area the power density can be calculated from the equation:

Power density	=	EIRP	/	Antenna aperture area	[mW/cm ^{2}]
pd	=	eirp	–	a	[dB(mW/cm ^{2})]

2. Measurements of frequency stability

In order to measure the frequency stability of the EUT under normal and extreme test conditions, it is necessary to use a smaller RBW filter (here 100 kHz or 300 kHz) so that the spectral lines of the modulated signal are displayed correctly in frequency domain. This setting allows to read the occupied bandwidth and the peak frequency deviation value directly.

Frequency measurements are performed under normal test conditions (normal power supply voltage and normal temperature).

Then the test is repeated with extreme test conditions. For extreme test conditions the EUT is placed in a climatic chamber where the front door is made of stable polystyrene. The EUT can radiate through the front door without any additional path losses. The climatic chamber together with the EUT is cooled down to -20 ºC for 1 hour. Then frequency and power density measurements are carried out with power supply set to minimum and maximum values.

The climatic chamber together with the EUT is warmed up at a rate of + 1ºC/minute. During warming-up time the frequency stability and the EIRP is monitored constantly. After 2 hours the temperature stability at 55 ºC is reached. Then frequency and power density measurements are carried out with minimum and maximum power supply.

3. Measurements of field strength and power density at spurious frequencies

Spurious frequencies are produced by transmitter and receiver when the EUT is active (vehicle is moving). When the EUT is in Not-in-motion-mode, the emissions of the TX has to be reduced more than 25 dB. According to FCC requirements 15.209 and 15.253, spurious emissions have to be investigated as maximum field strength values in the frequency range from 9 kHz to 40 GHz, and as maximum power density in the frequency range > 40 GHz up to 220 GHz. Where possible, the measurement distance shall be 3 m.

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 field strength measurements in the frequency range 30 MHz to 4 GHz are carried out in a shielded semi-anechoic test chamber. The measurement distance is 3 m.

In the frequency range 4 GHz to 40 GHz, spurious field strength 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.

In the frequency range 33 GHz to 325 GHz, spurious frequencies are measured as power densities. For further remarks see section 1.). The EUT is operating with FSK-modulation. The RBW and VBW are set to such a value that spurious power levels are clearly readable above the fundamental noise level of spectrum analyzer.

4. Measurements of maximum safe level for radiated power density

According to FCC § 1.1307, 1.1310, 2.1091, and 2.1093 and also according to ETSI/EN 301 091 measurements are carried out in order to evaluate the impact of human exposure to RF radiation. For this test the EUT is in normal operation mode.

The measurements are applicable only for far field conditions. The near field area extends to a distance of R (meters) and can be calculated from the following equation:

$$R < 2 * L^2 / \lambda$$

with R = distance in meters, L = largest dimension of either receiving or transmitting horn antenna (L = 0.02 m), and λ = wavelength in meters. In case of 76 GHz (λ = 0.0039 m), the far field starts at R > 0.205 m.

The peak power density is measured in 3 m distance as 1.6 µW/cm ^{2} (-27.96 dBmW/cm ^{2}).

Peak Power (EIRP) $EIRP = PD * 4\pi * R^2$

EIRP = 1.81 W

As the sample works with FSK modulation there is no difference between peak and average value of the output power.

Limit of maximum ERP for frequencies above 1.5 GHz is 3 W. See FCC § 2.1091 (EIRP = 4.91 Watt)

RF Exposure for mobile conditions at R = 20 cm distance from EUT

$PD = EIRP / (4\pi * R^2)$

$PD = 0.36 mW/cm^2$

Limit of maximum permissible exposure (MPE) for uncontrolled environment:1.0 mW/cm². See FCC § 1.1310.

2.5.3 Test results in details

Equipment under test (EUT) : **AC 20**
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS **SECTION 15.253**

FUNDAMENTAL FREQUENCY **Section 15.253 b (2)**

76.000 GHz to 77.000 GHz

Operation : Vehicle in motion
Antenna assembly: Fixed integral antennas

TEST CONDITIONS T = 23.0 ° C	TRANSMITTER POWER DENSITY		
EUT operating: TX on and RX on	Frequency f [GHz]	Power Density PD [µW/cm ^{2}]	See plot on page
U DC = 10.0 V	76.398 270	1.334	-
U DC = 11.0 V	76.398 280	1.334	-
U DC = 12.0 V	76.398 285	1.334	26
U DC = 13.0 V	76.398 300	1.334	-
U DC = 14.0 V	76.398 310	1.334	-
U DC = 15.0 V	76.398 315	1.334	-
U DC = 16.0 V	76.398 320	1.334	-

REFERENCE OF TEST EQUIPMENT USED : see test set-up on page 10

LIMITS: **Section 15.253 b (2)**

Frequency range [GHz] vehicle in motion	Measurement distance [m]	Power density pd [dBmW/cm^2]	Power Density PD [µW/cm ^{2}]
76.0 to 77.0	3.0	-12.2	60

Verdict :	Power Density limit is kept

Equipment under test (EUT) : **AC 20**
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS **SECTION 15.253**

FUNDAMENTAL FREQUENCY **Section 15.253 b (2)**

76.000 GHz to 77.000 GHz

Operation : Vehicle in motion

Antenna assembly: Fixed integral antennas

TEST CONDITIONS T = - 20.0 ° C	TRANSMITTER POWER DENSITY		
EUT operating: TX on and RX on	Frequency f [GHz]	Power Density PD [µW/cm ^{2}]	See plot on page
U DC = 10.0 V	76.397 530	1.161	-
U DC = 11.0 V	76.397 540	-	-
U DC = 12.0 V	76.397 545	1.365	-
U DC = 13.0 V	76.397 550	-	-
U DC = 14.0 V	76.397 560	-	-
U DC = 15.0 V	76.397 560	-	-
U DC = 16.0 V	76.397 565	1.640	27

REFERENCE OF TEST EQUIPMENT USED : see test set-up on page 10

LIMITS: **Section 15.253 b (2)**

Frequency range [GHz] vehicle in motion	Measurement distance [m]	Power density pd [dBmW/cm^2]	Power Density PD [µW/cm ^{2}]
76.0 to 77.0	3.0	-12.2	60

Verdict :	Power Density limit is kept

Equipment under test (EUT) : **AC 20**
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS **SECTION 15.253**

FUNDAMENTAL FREQUENCY **Section 15.253 b (2)**

76.000 GHz to 77.000 GHz

Operation : Vehicle in motion

Antenna assembly: Fixed integral antennas

TEST CONDITIONS T = + 55.0 ° C	TRANSMITTER POWER DENSITY		
EUT operating: TX on and RX on	Frequency f [GHz]	Power Density PD [µW/cm ^{2}]	See plot on page
U DC = 10.0 V	76.399 810	0.989	28
U DC = 11.0 V	76.399 810	-	-
U DC = 12.0 V	76.399 800	1.035	-
U DC = 13.0 V	76.399 790	-	-
U DC = 14.0 V	76.399 780	-	-
U DC = 15.0 V	76.399 775	-	-
U DC = 16.0 V	76.399 770	1.110	-

REFERENCE OF TEST EQUIPMENT USED : see test set-up on page 10

LIMITS: **Section 15.253 b (2)**

Frequency range [GHz] vehicle in motion	Measurement distance [m]	Power density pd [dBmW/cm^2]	Power Density PD [µW/cm ^{2}]
76.0 to 77.0	3.0	-12.2	60

Verdict :	Power Density limit is kept

Equipment under test (EUT) : **AC 20**
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS **SECTION 15.253**

Frequency over temperature

TEST CONDITIONS T = -20° TO +55°C 12V DC	TRANSMITTER POWER DENSITY AND FREQUENCY		
EUT operating:	Frequency f [GHz]	Power Density PD [µW/cm ^{2}]	
T = -20°	76.397 545	1.365	
T = -10°	76.397 712	1.358	
T = 0°	76.397 916	1.342	
T = +10°	76.398 355	1.338	
T = +20°	76.398 667	1.334	
T = +30°	76.398 812	1.297	
T = +40°	76 399 134	1.116	
T = +50°	76 399 532	1.083	
T = +55°	76 399 800	1.035	

EUT : **AC 20**
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS **SECTION 15.253**

SPURIOUS FREQUENCIES **Section 15.253 c (1)**
In the frequency range 9 kHz to 6 GHz

Operation : Vehicle in motion
Antenna assembly: Fixed integral antennas

TEST CONDITIONS	TRANSMITTER SPURIOUS FIELD STRENGTH			
Frequency range [MHz]	Spurious frequencies [MHz]	S A e [dBµV/m]	E [µV/m]	See plot on page
0.009 – 30.000 (h + v) horizontal and vertical plane	0.110	40.3	103.51	29
30.000 – 4.0 GHz (vert.)	Noise	< limit	< limit	30
30.000 – 4.0 GHz (hor.)	Noise	< limit	< limit	31
4.0 – 6.0 GHz (h + v)	Noise	46.94	223	32

REFERENCE OF TEST EQUIPMENT USED : see test set-up on pages 9, 10 and 11

LIMITS: **SECTION 15.253 / 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 MHz – 40.0 GHz	3	54.0	500

Verdict :	Field strength limits are kept

EUT : **AC 20**
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS **SECTION 15.253**

SPURIOUS FREQUENCIES **Section 15.253 c (1)**
In the frequency range 6 GHz to 40 GHz

Operation : Vehicle in motion
Antenna assembly: Integral patch antenna

TEST CONDITIONS		TRANSMITTER SPURIOUS FIELD STRENGTH			
Frequency range [GHz]		Spurious frequencies [GHz]	S A e [dBµV/m]	E [µV/m]	See plot on page
6.0 – 12.0	(h + v)	Noise	47.44	235	33
12.0 – 18.0	(h + v)	Noise	51.44	373	34
18.0 – 26.0	(h + v)	Noise	54.42	469	35
26.0 – 40.0	(h + v)	Noise	52.12	403	36 / 37

REFERENCE OF TEST EQUIPMENT USED : see test set-up on page 9, 10 and 11

LIMITS: **SECTION 15.253 / 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 MHz – 40.0 GHz	3	54.0	500

Verdict :	Field strength limits are kept

EUT : **AC 20**
Ambient temperature : 23 °C
Relative humidity : 55 %

TRANSMITTER PARAMETERS **SECTION 15.253**

SPURIOUS FREQUENCIES **Section 15.253 c (2) + (3)**
In the frequency range 33 GHz to 325 GHz

Operation : Vehicle in motion
Antenna assembly: Fixed integral antenna

TEST CONDITIONS	TRANSMITTER SPURIOUS POWER DENSITY			
Frequency range [GHz]	Spurious frequencies [GHz]	S A pd [dBm/cm^2]	PD [pW/cm^2]	See plot on page
40.0 – 60.0 (h + v)	Noise	-74.44	35.97	38
50.0 – 75.0 (h + v)	Noise	-67.18	108.4	39
75.0 – 110 (h + v)	Noise	-68.40	100.9	40
75.0 – 76.0 (h + v)	Noise	-64.60	100.9	41
76.0 – 77.0 (h + v)	Noise	-64.60	122.5	42
110.0 - 170.0 (h + v)	Noise	-64.19	< 300	43
152.795 (h + v)	2. Harmonic	-53.74	< 100	44
170.0 - 200.0 (h + v)	Noise	-71.63	68.7	45
200.0 - 240.0 (h + v)	Noise	-76.16	24.2	46

REFERENCE OF TEST EQUIPMENT USED : see test set-up on page 9, 10 and 11

LIMITS: **SECTION 15.253 / 15.205 / 15.209**

Frequency range (MHz)	Measurement distance [m]	pd [dBmW/cm^2]	Power density PD [pW/cm^2]
40.0 GHz - 200 GHz	3.0	-62.2	600
200 GHz - 231 GHz	3.0	-60.0	1000

Verdict :	Power density limits are kept

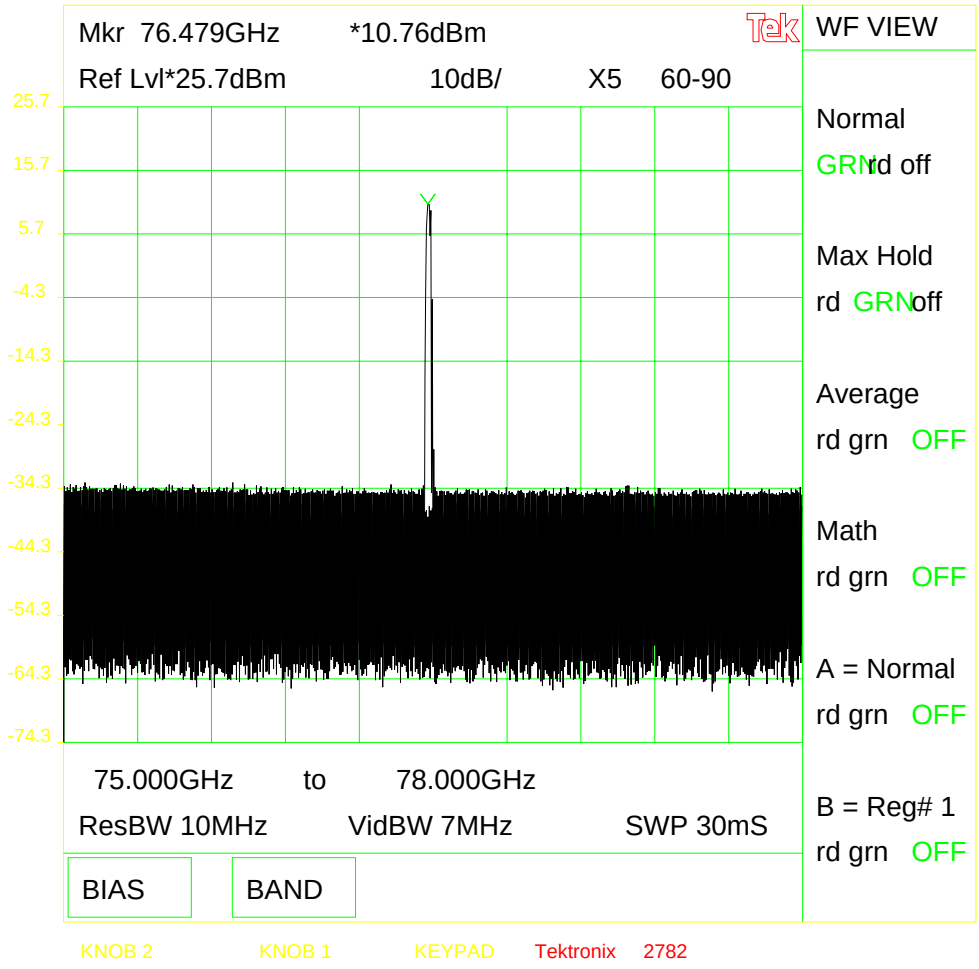
EUT : **AC 20**
Ambient temperature : 23 °C
Relative humidity : 58 %

2.5.4 NOT-IN-MOTION MODE Section 15.253 (b) (1)

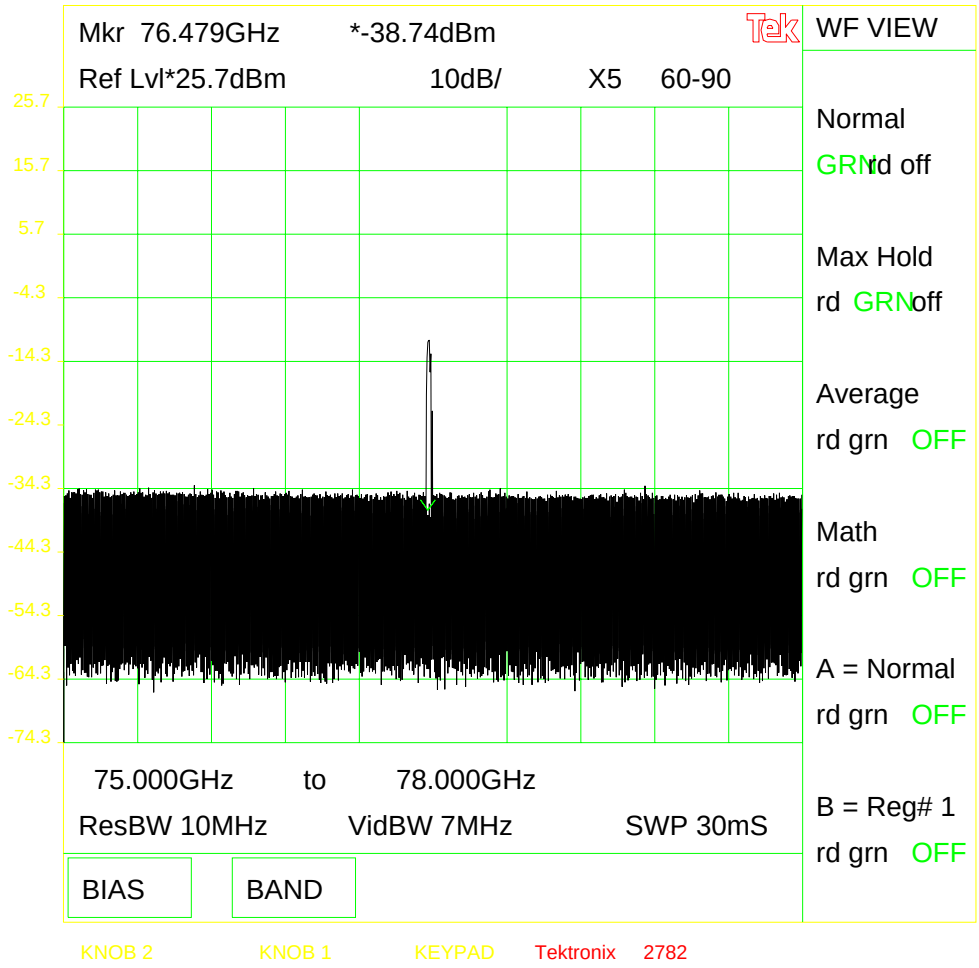
To show compliance with the requirements of Part 15.253 (b) (1) – Not-In-Motion mode, we tested a build in radar system in our lab

Description of the test:
We placed the antenna 25 cm in front of the radar equipment build in a car.
When the engine starts, the system transmits for 5 seconds and then the radar module changes to Not-In-Motion mode
The following plots show first the transmitted power and second the Not-In-Motion mode

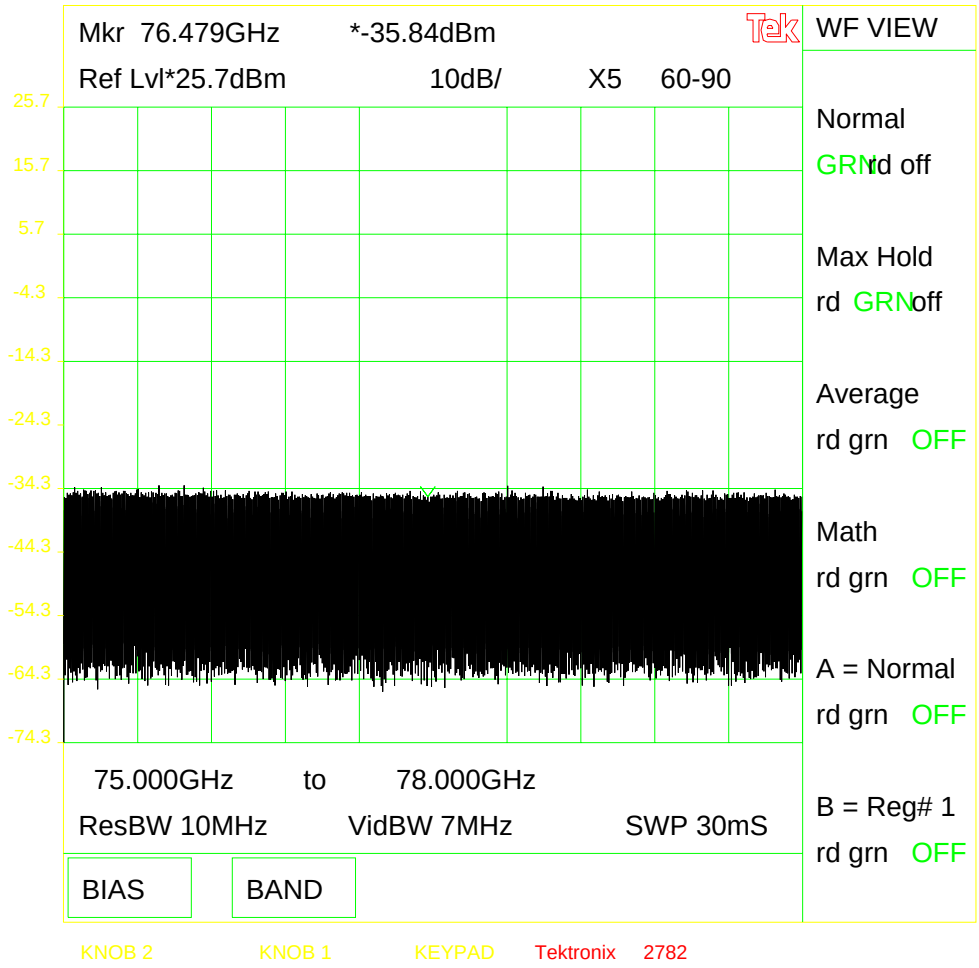
Plot 1: Transmitted Power / Antenna Vertical



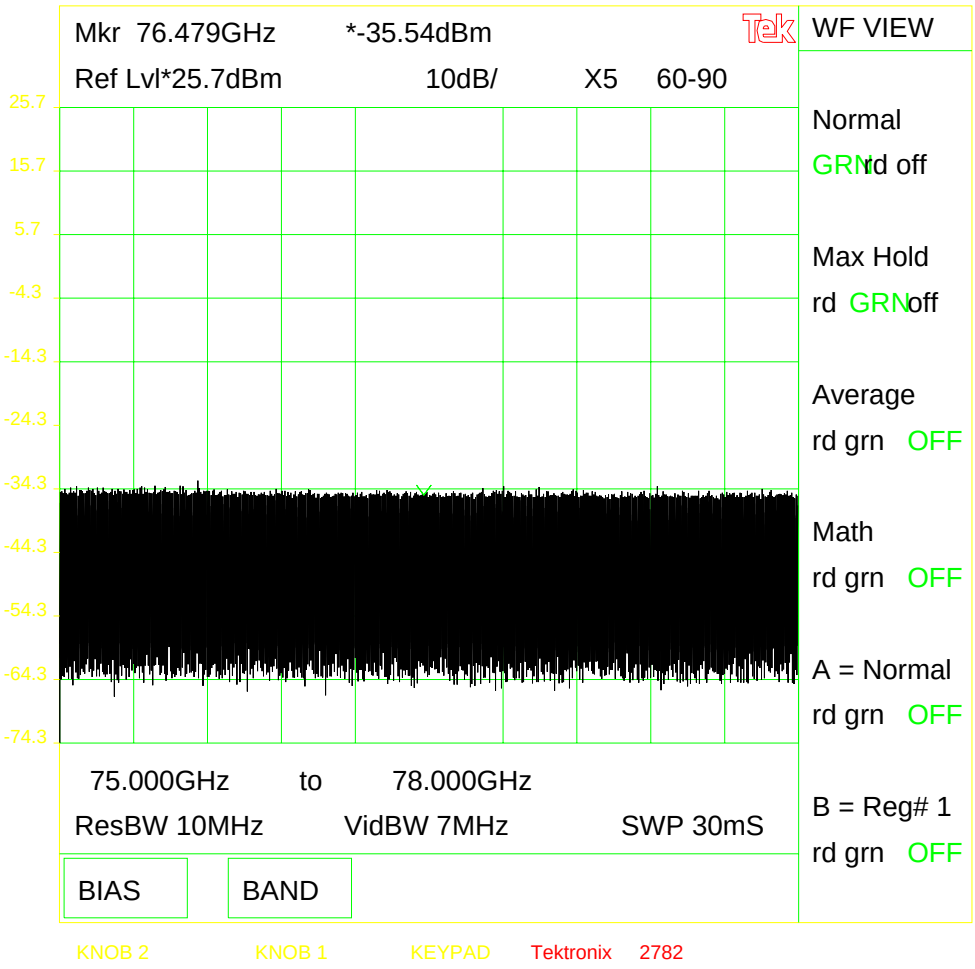
Plot 2: Transmitted Power / Antenna Horizontal



Plot 3: NOT IN MOTIOIN MODE / Antenna Horizontal



Plot 4: NOT IN MOTIOIN MODE / Antenna Vertical



The measured difference between in-motion and not-in-motion is > 45 dB.
So the sample fulfils the requirements.

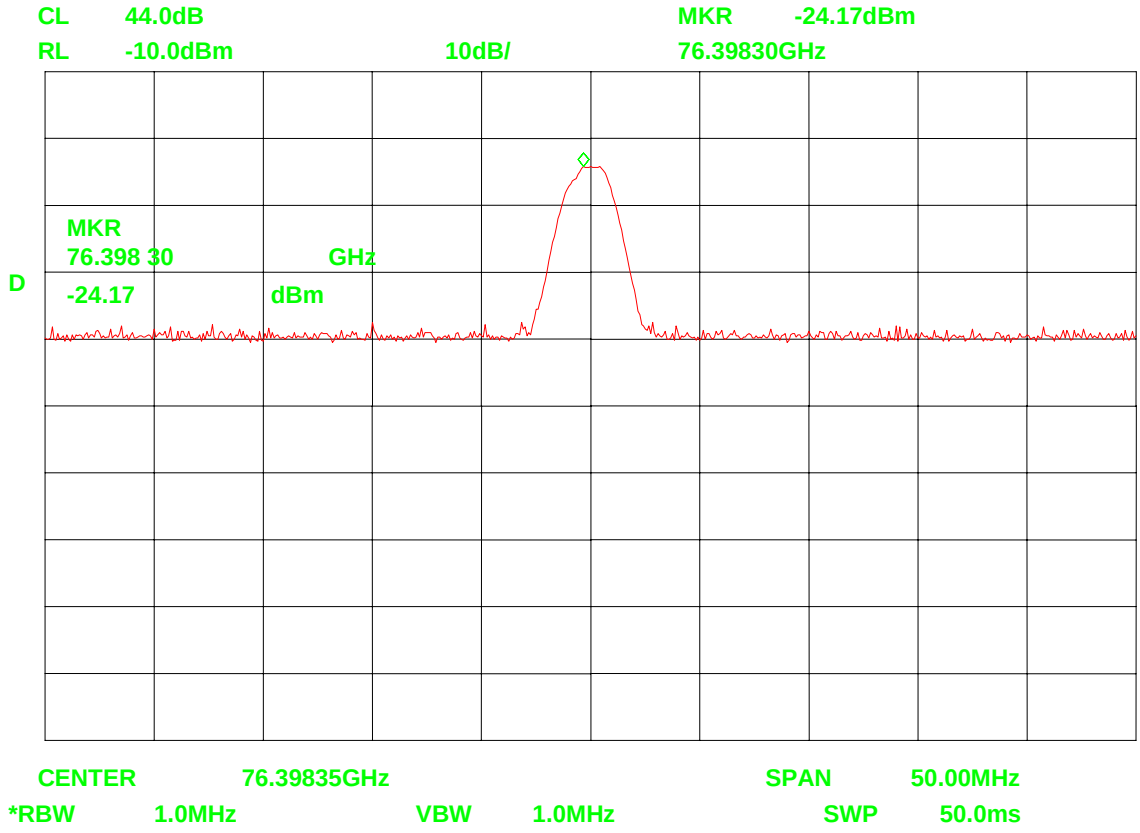
LIMITS: **SECTION 15.253 (B) (1)**

Frequency range [GHz]	Measurement distance [m]	In-motion [dBm]	Not-in-motion [dBm]	Delta [dB]
76.0 – 77.0	3.0	-12	-37	25

Verdict :	pass

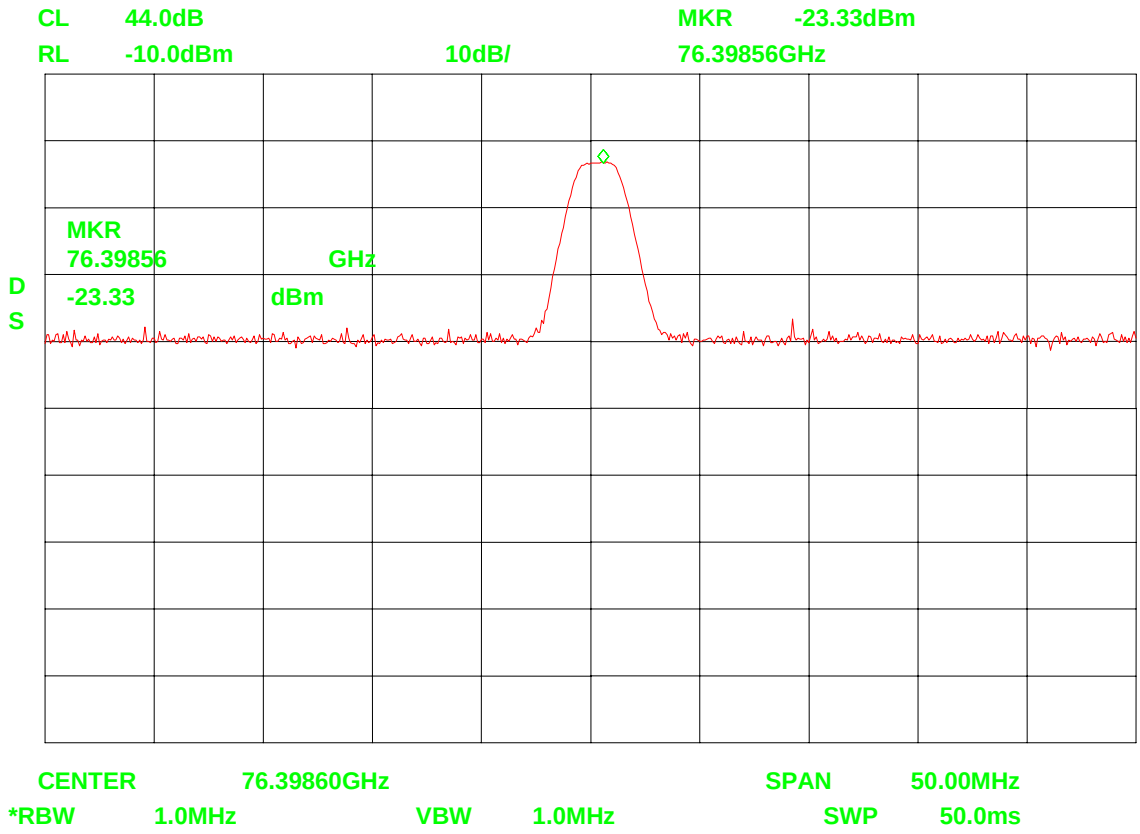
3 Plots, graphs and data sheets

Plot 1 (23 C)



Measurement distance	d	=	3.0 m		
Calculation **: Power density**		=	EIRP	/	Antenna aperture area
	pd	=	-24.2 dBm	-	4.55 dB(cm^2)
	pd	=	-28.75 dB(mW/cm^2)		
	PD	=	1.334 $\mu W/cm^2$		

Plot 2 **(- 20 C)**



Measurement distance d = 3.0 m

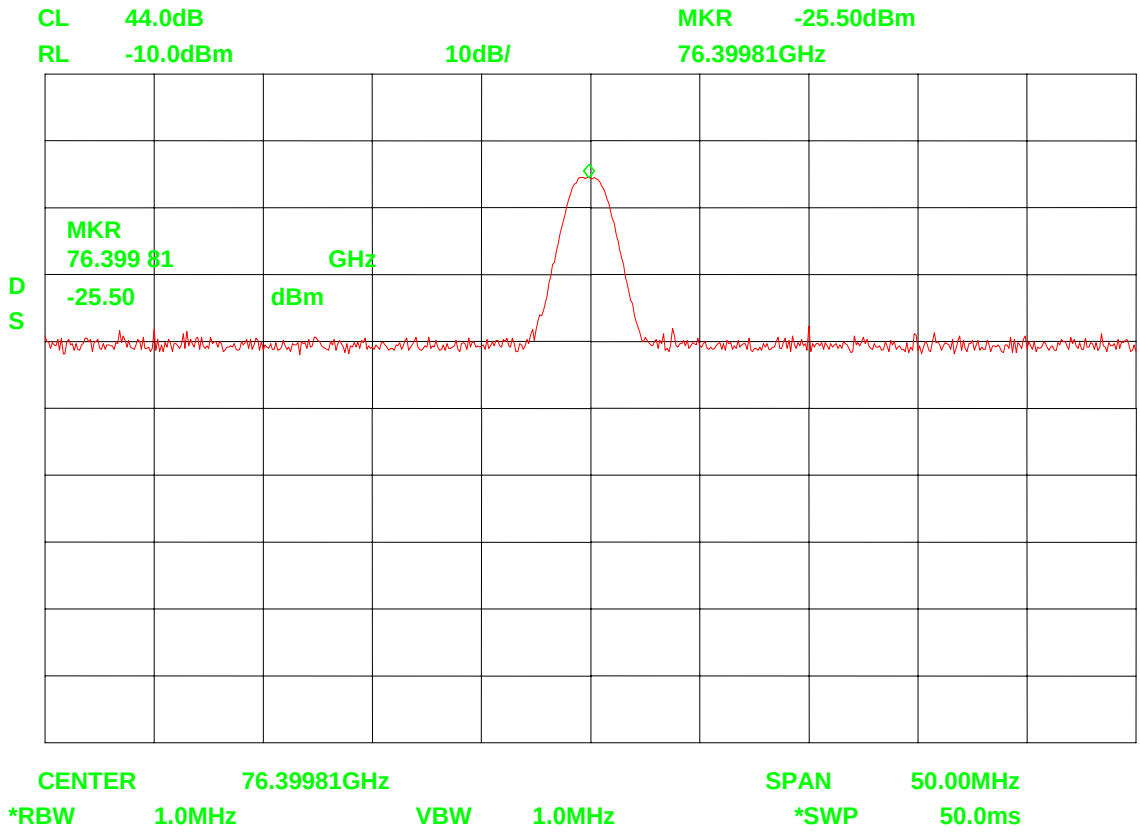
Calculation **: Power density** = EIRP / Antenna aperture area

pd = -23.30 dBm - 4.55 dB(cm^2)

pd = -27.95 dB(mW/cm^2)

PD = 1.643 $\mu W/cm^2$

Plot 3 (+ 55 C)



Measurement distance d = 3.0 m

Calculation **: Power density** = EIRP / Antenna aperture area

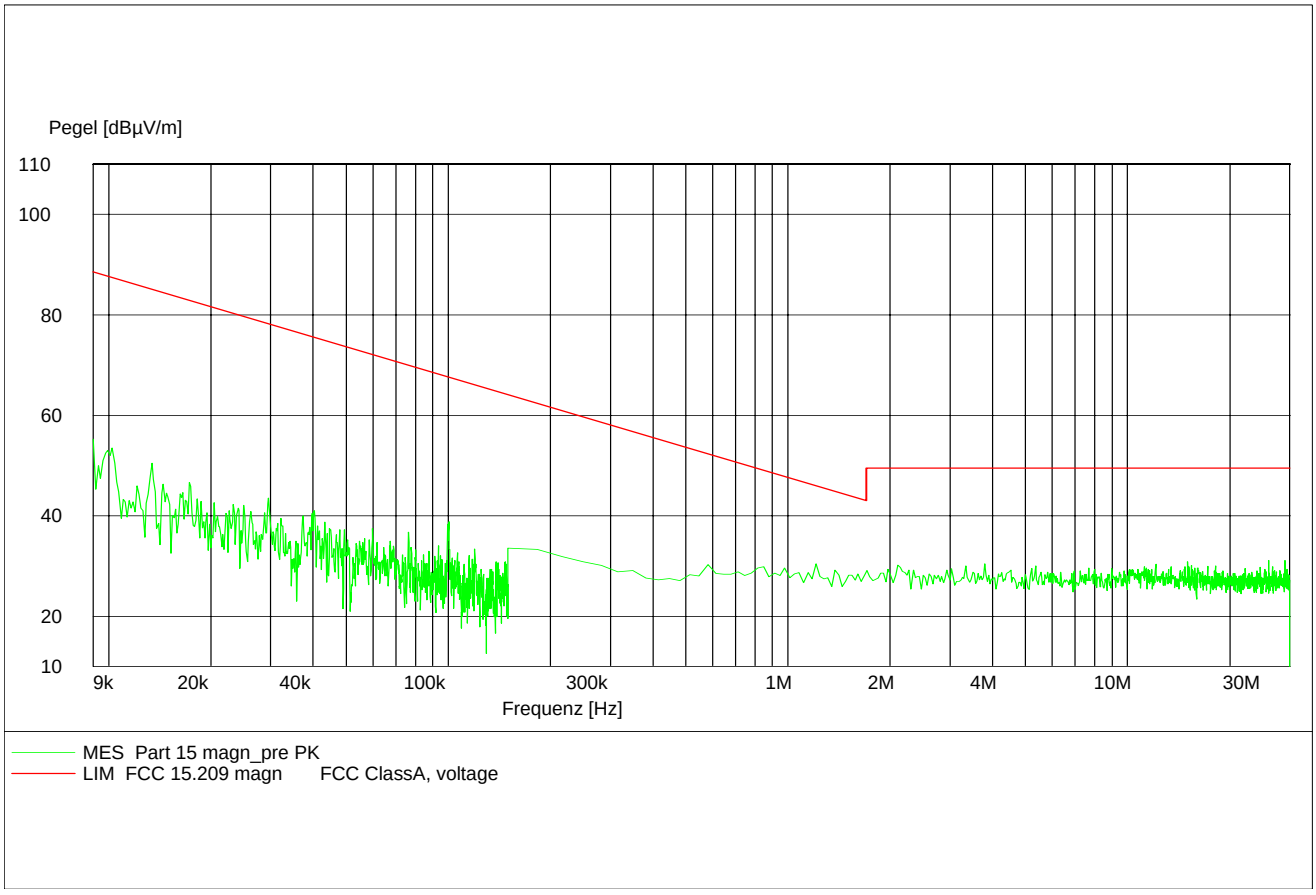
pd = -25.50 dBm - 4.55 dB(cm^2)

pd = -30.05 dB(mW/cm^2)

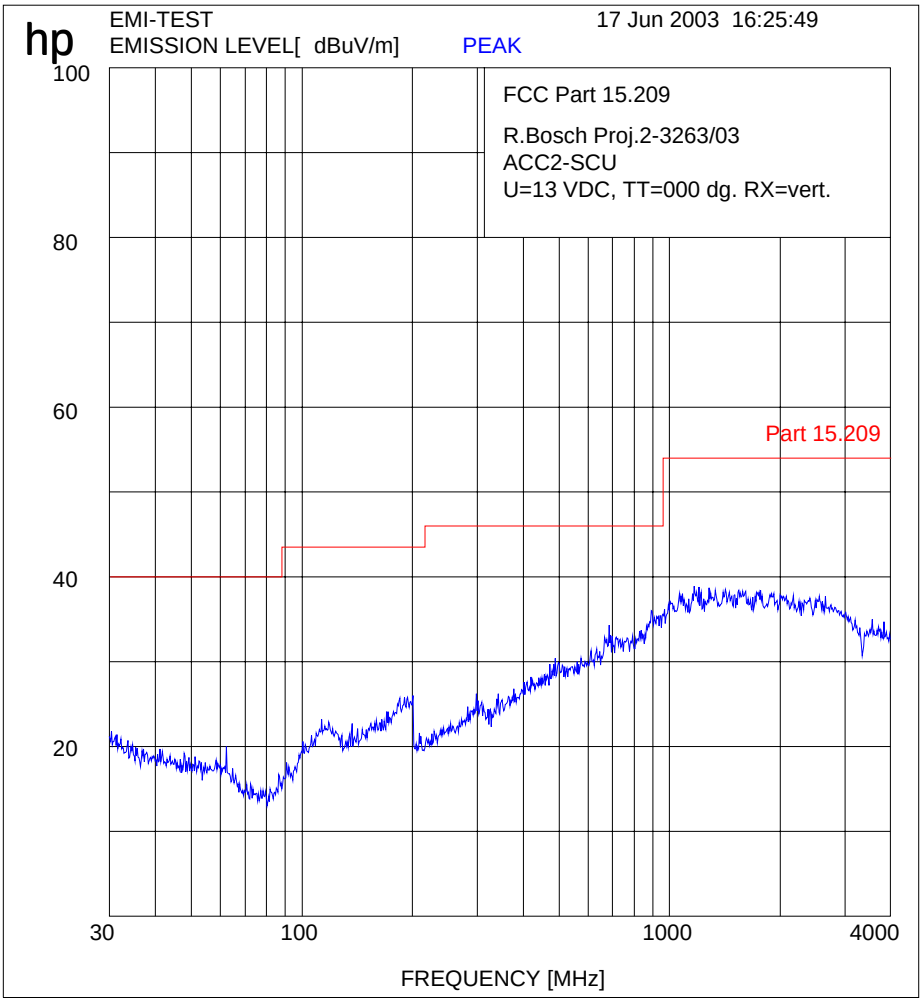
PD = 0.989 $\mu W/cm^2$

Plot 5

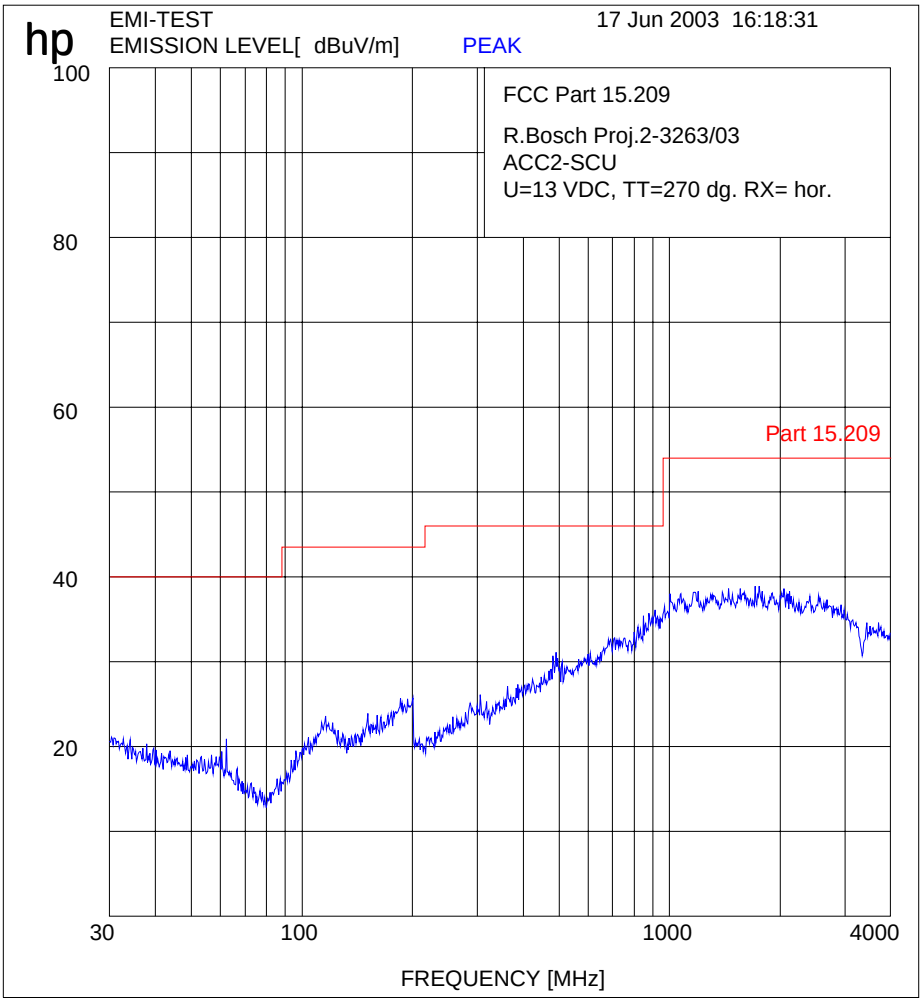
EUT:	Field disturbance sensor ACC2
Manufacturer:	Bosch GmbH
RX-Antenna:	R & S HFH Z2
Operating conditions:	TX on and RX on, vertical plane and horizontal plane; trace max. hold
Power supply:	U = 13.2 V DC
Test specification:	FCC 15.209



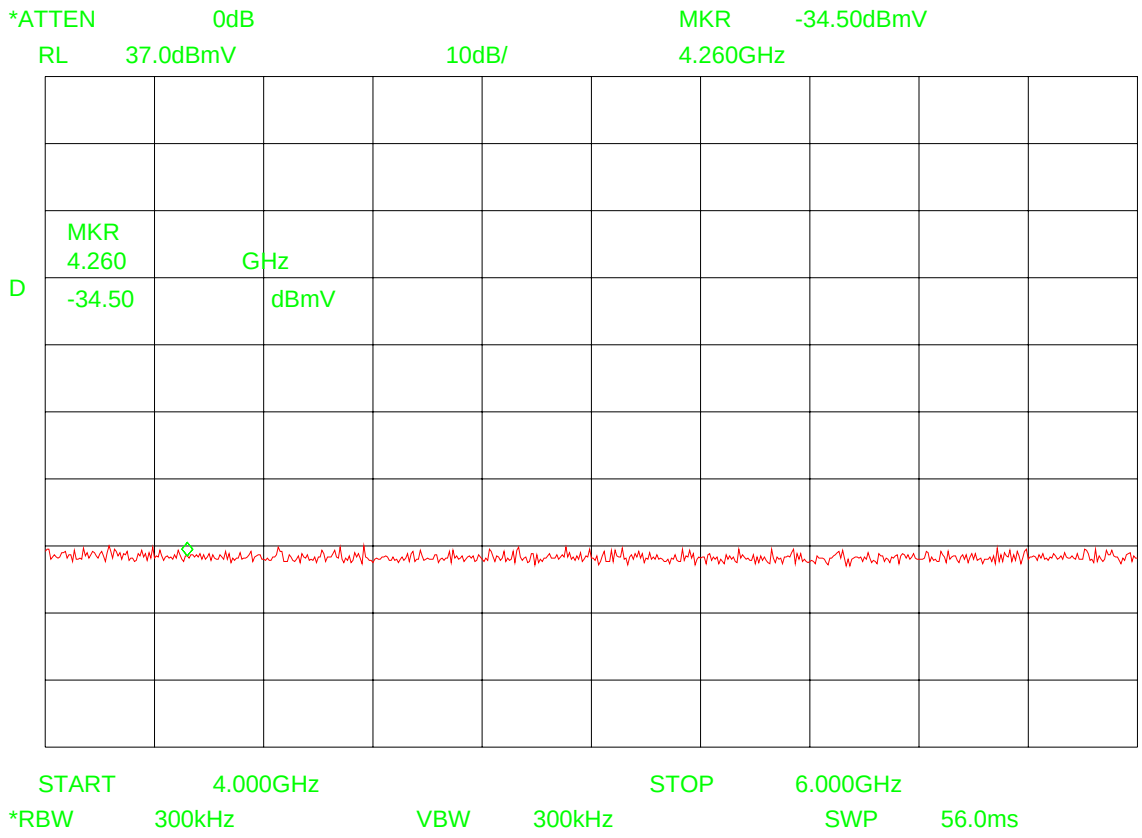
Plot 6


hp
EMI-TEST
17 Jun 2003 16:25:49
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15.209
R.Bosch Proj.2-3263/03
ACC2-SCU
U=13 VDC, TT=000 dg. RX=vert.
Part 15.209
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

Plot 7


hp
EMI-TEST
17 Jun 2003 16:18:31
EMISSION LEVEL[dBuV/m]
PEAK
FCC Part 15.209
R.Bosch Proj.2-3263/03
ACC2-SCU
U=13 VDC, TT=270 dg. RX= hor.
Part 15.209
100
80
60
40
20
30
100
1000
4000
FREQUENCY [MHz]

Plot 8



Measurement distance d = 0.5 m

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

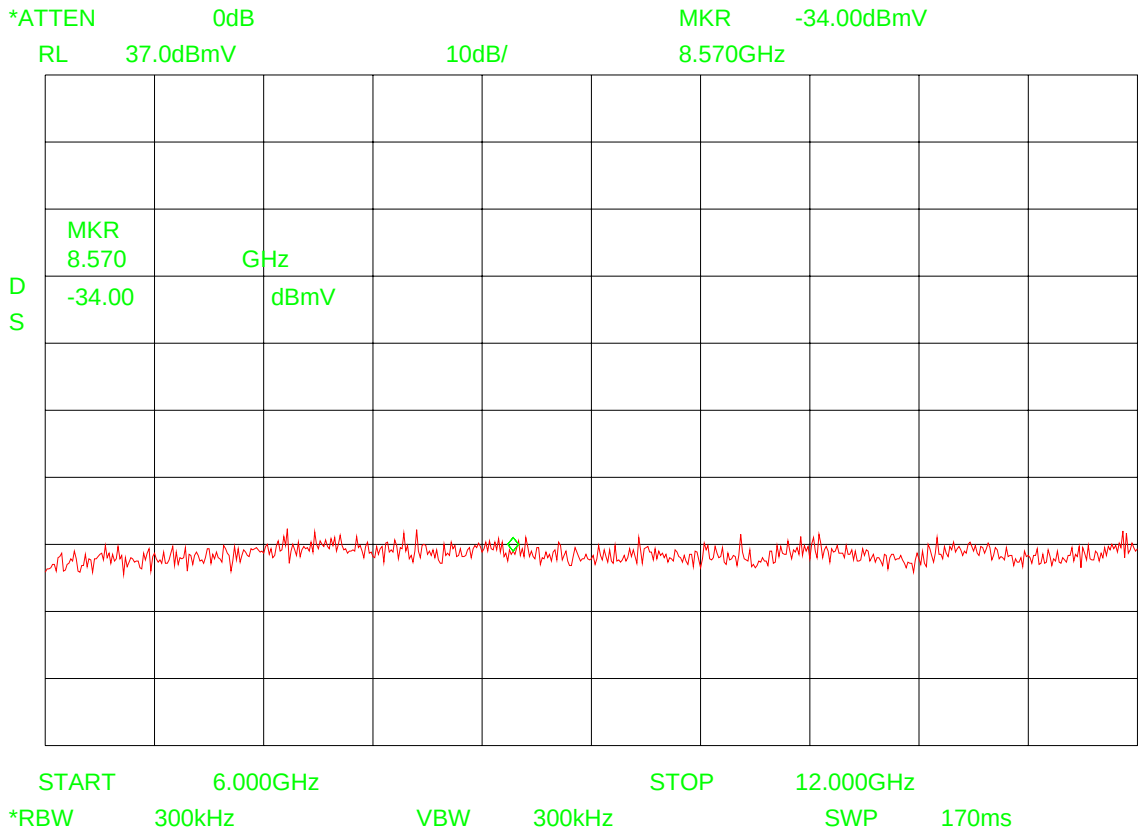
e = -34.50 dBmV + 35.2 dB(1/m) + (- 15.56 dB) + 1.8 dB

e = -13.06 dB(mV/m)

E = 0.223 mV/m

E = 223 µV/m

Plot 9



Measurement distance d = 0.5 m

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

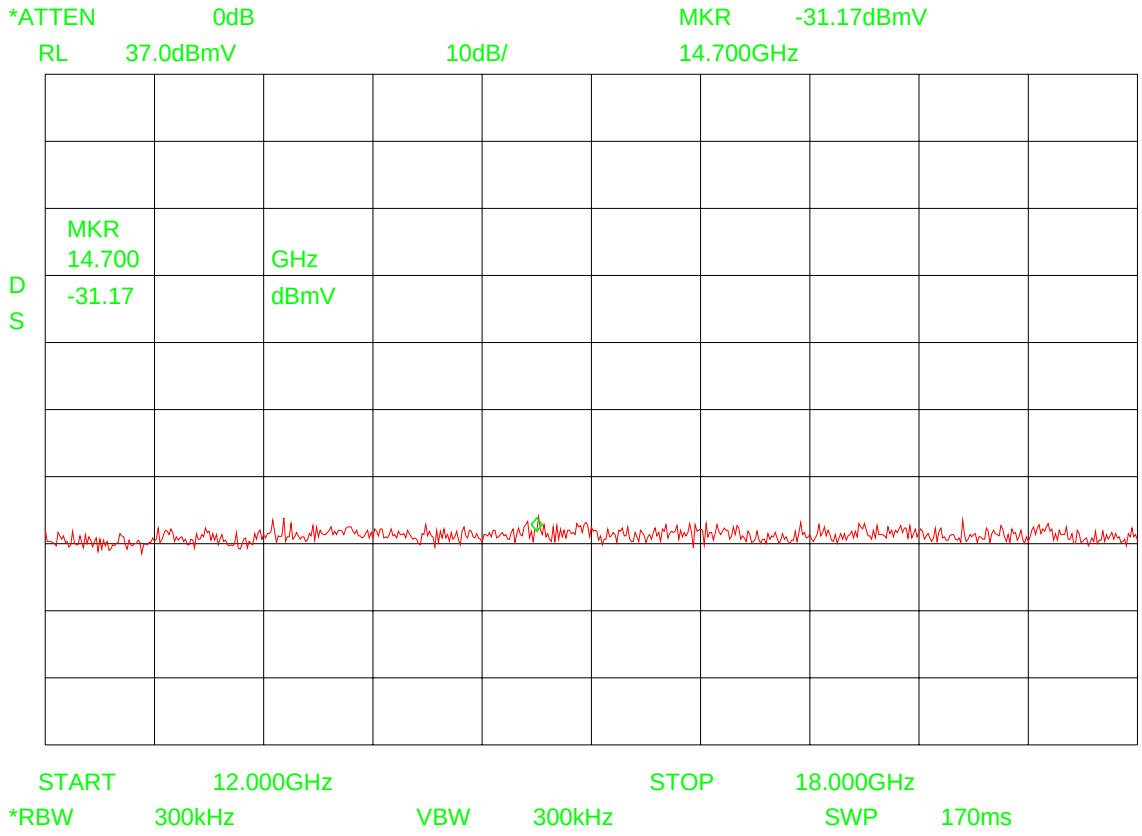
e = -34.00 dBmV + 35.2 dB(1/m) + (- 15.56 dB) + 1.8 dB

e = -12.56 dB(mV/m)

E = 0.235 mV/m

E = 235 µV/m

Plot 10



Measurement distance d = 0.5 m

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

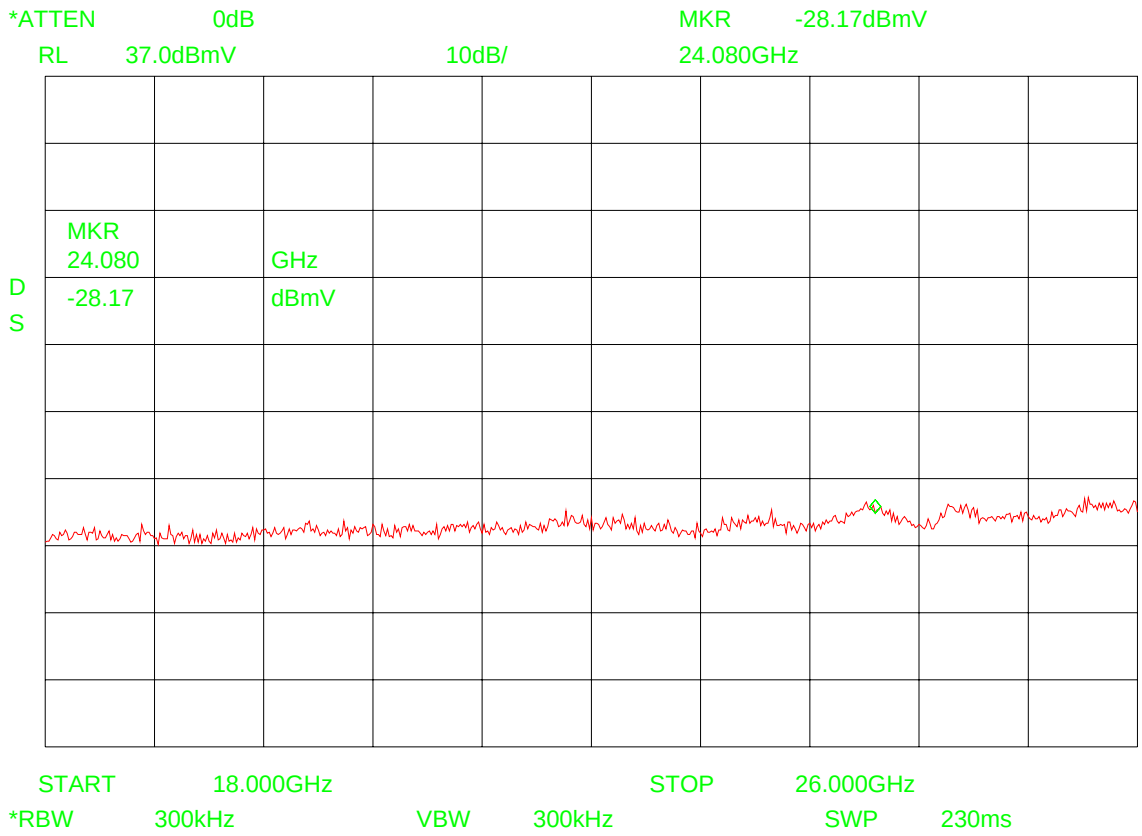
e = -31.20 dBmV + 36.2 dB(1/m) + (- 15.56 dB) + 2.0 dB

e = -8.56 dB(mV/m)

E = 0.373 mV/m

E = 373 µV/m

Plot 11



Measurement distance d = 0.25 m

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

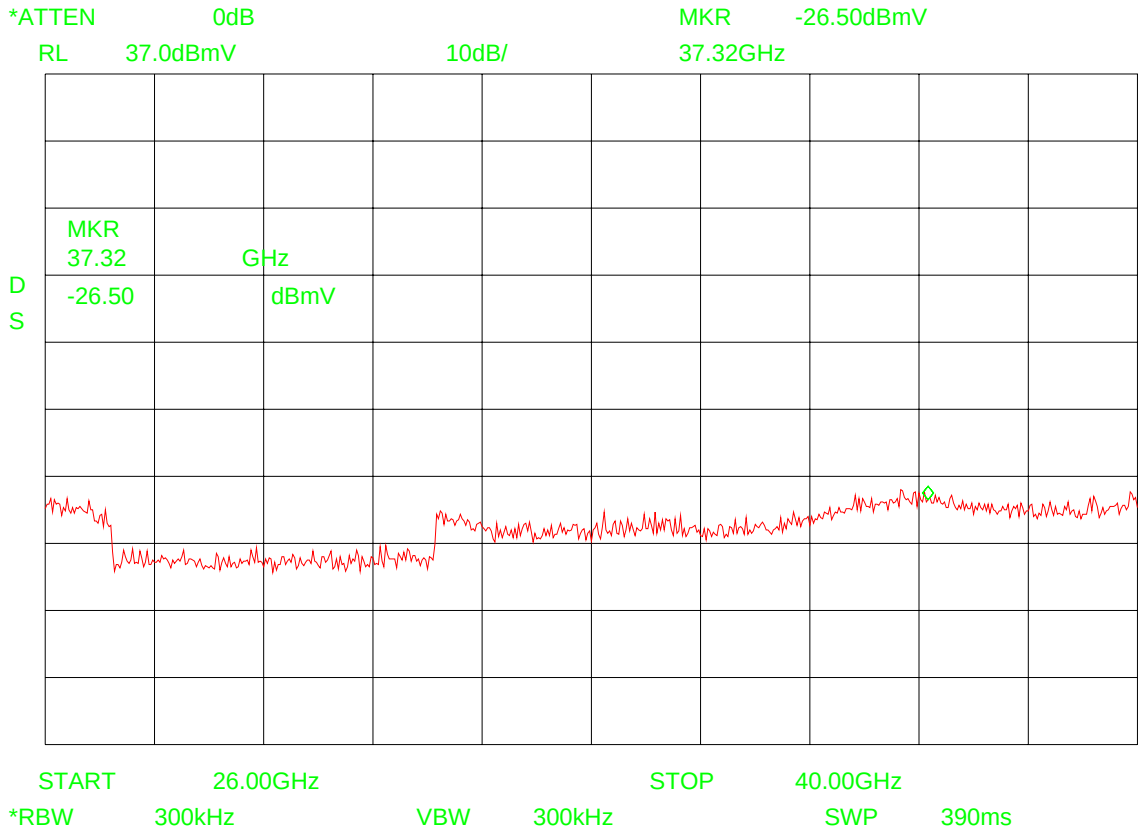
e = -28.20 dBmV + 40.4 dB(1/m) + (- 21.58 dB) + 2.8 dB

e = -5.58 dB(mV/m)

E = 0.469 mV/m

E = 469 µV/m

Plot 12



Measurement distance d = 0.25 m

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

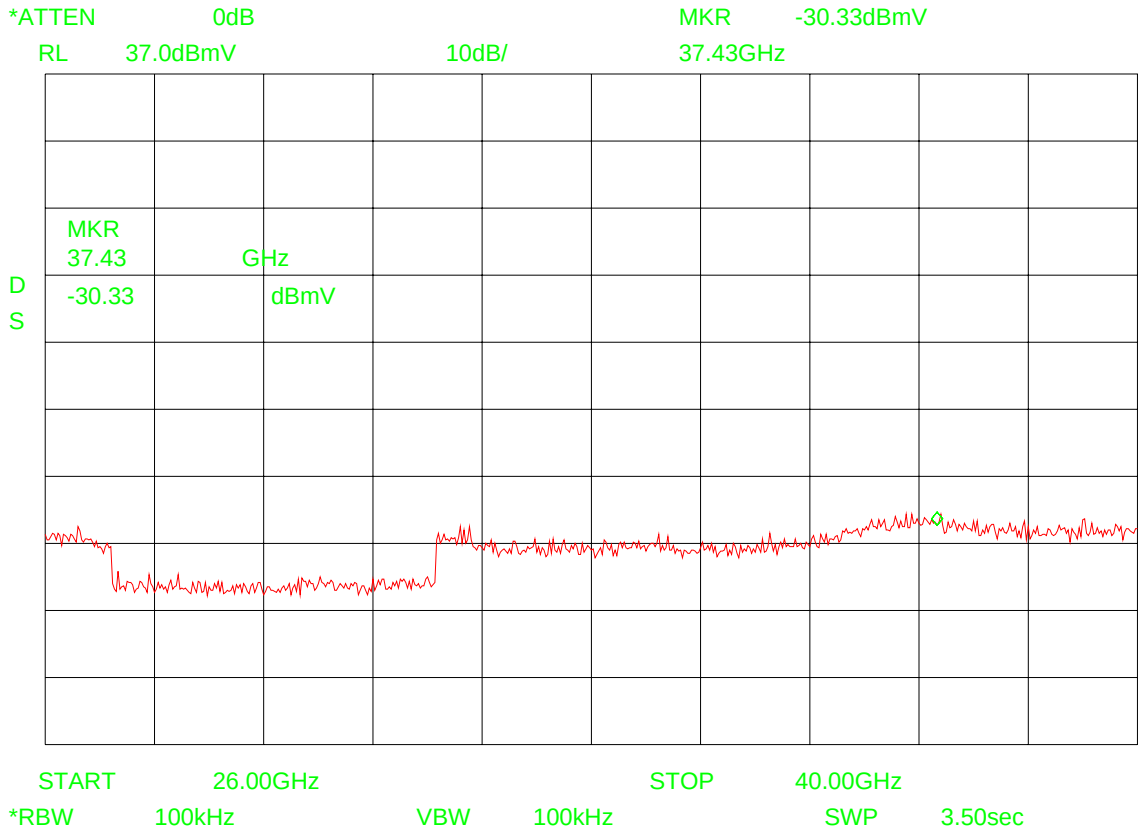
e = -26.5 dBmV + 41.0 dB(1/m) + (- 21.58 dB) + 3.0 dB

e = -4.08 dB(mV/m)

E = 0.625 mV/m

E = 625 µV/m

Plot 13



Measurement distance d = 0.25 m

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

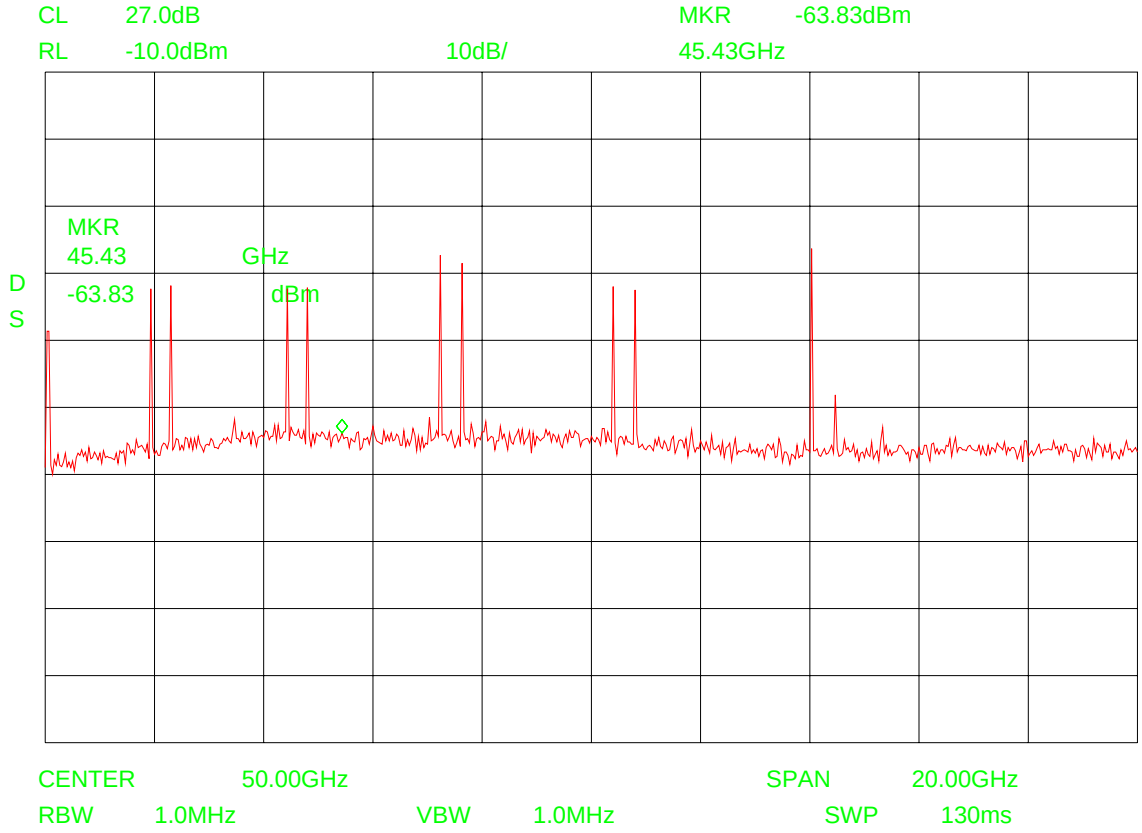
e = -30.33 dBmV + 41.0 dB(1/m) + (- 21.58 dB) + 3.0 dB

e = -7.88 dB(mV/m)

E = 0.403 mV/m

E = 403 µV/m

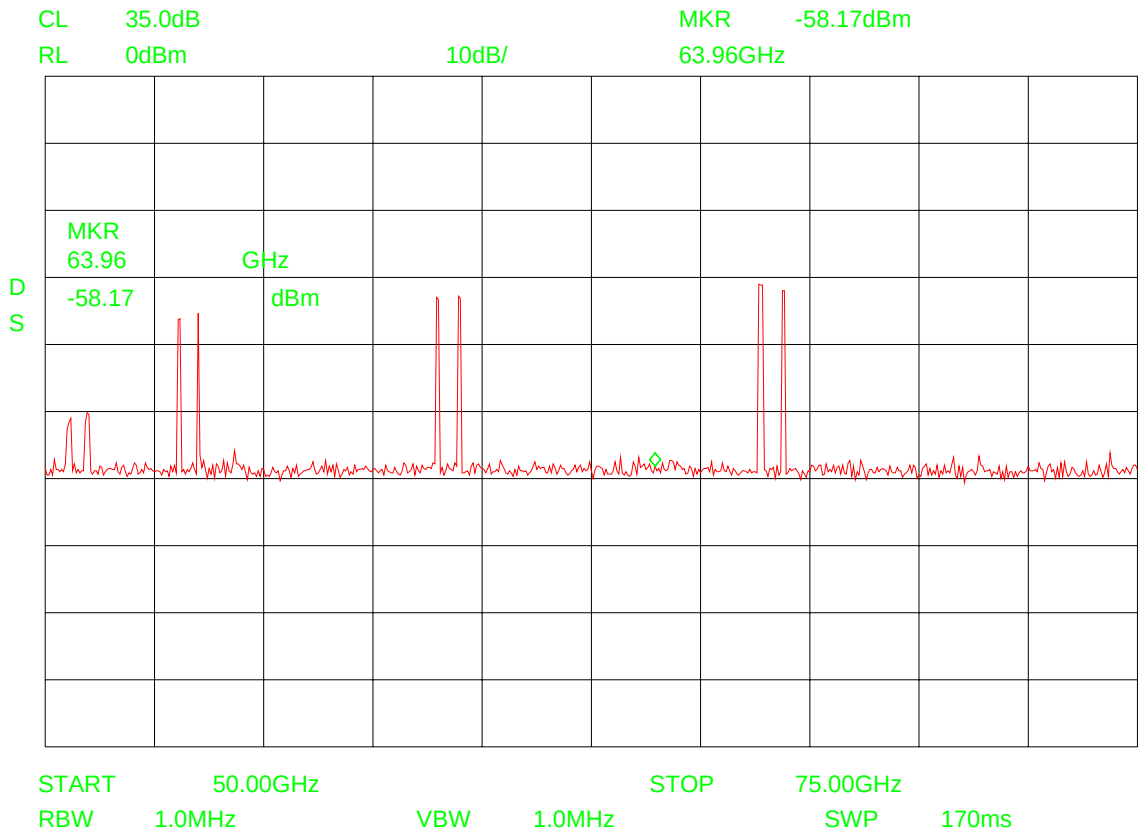
Plot 14



Measurement distance	d	=	3.0 m		
Calculation **: Power density**		=	EIRP (Noise)	/	Ant. aperture area
	pd	=	-63.80 dBm	-	10.64 dB(cm^2)
	pd	=	-74.44 dB(mW/cm^2)		
	PD	=	35.974 pW/cm^2		

Remark: Spurious frequencies e.g. 40.03 ; 41.97 ; 42.30 GHz .... are produced by the external mixer. They are image frequency responses, and can be identified by calling up signal identifier program.

Plot 15



Measurement distance d = 3.0 m

Calculation **: Power density** = EIRP (Noise) / Ant. aperture area

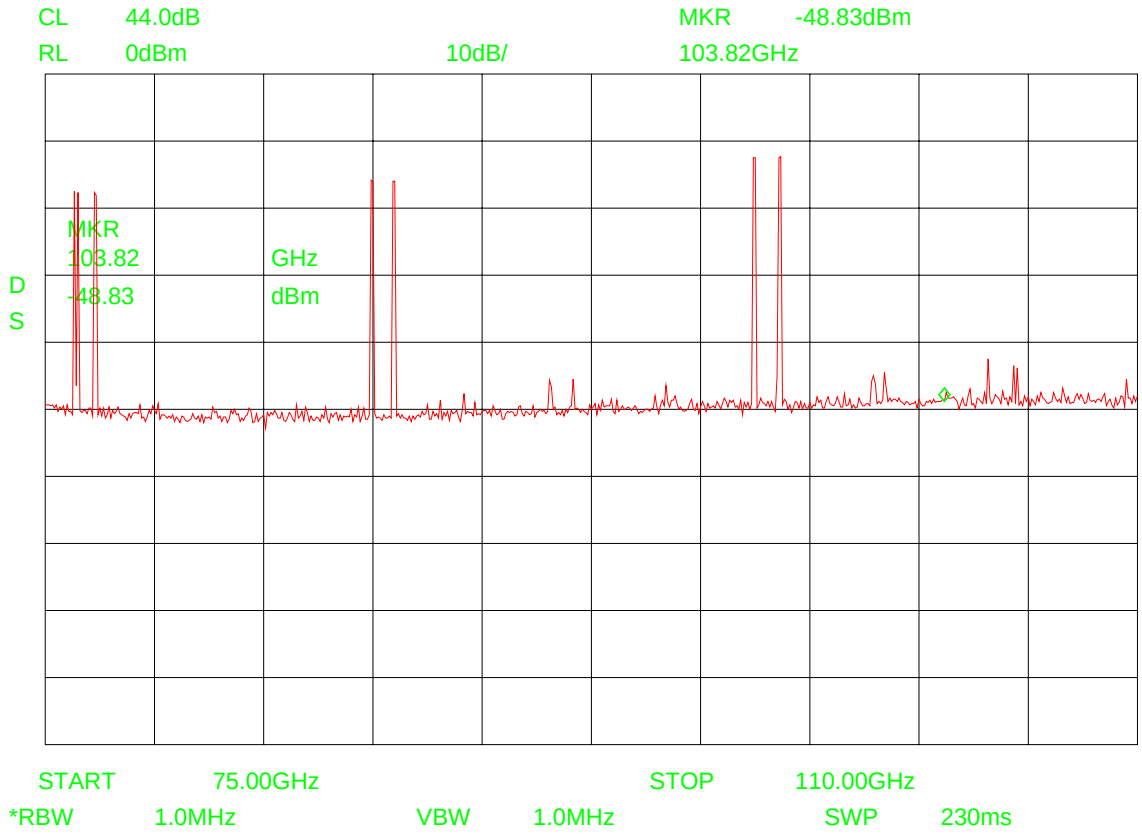
pd = -58.20 dBm - 8.98 dB(cm^2)

pd = -67.18 dB(mW/cm^2)

PD = 100.0 pW/cm^2

Remark: Spurious frequencies e.g. 50.54; 52.68; 53.05 GHz .... are produced by the external mixer. They are image frequency responses, and can be identified by calling up signal identifier program.

Plot 16



Measurement distance d = 0.5 m

Calculation **: Power density** = EIRP (Noise) / Ant. aperture area x dist. corr.

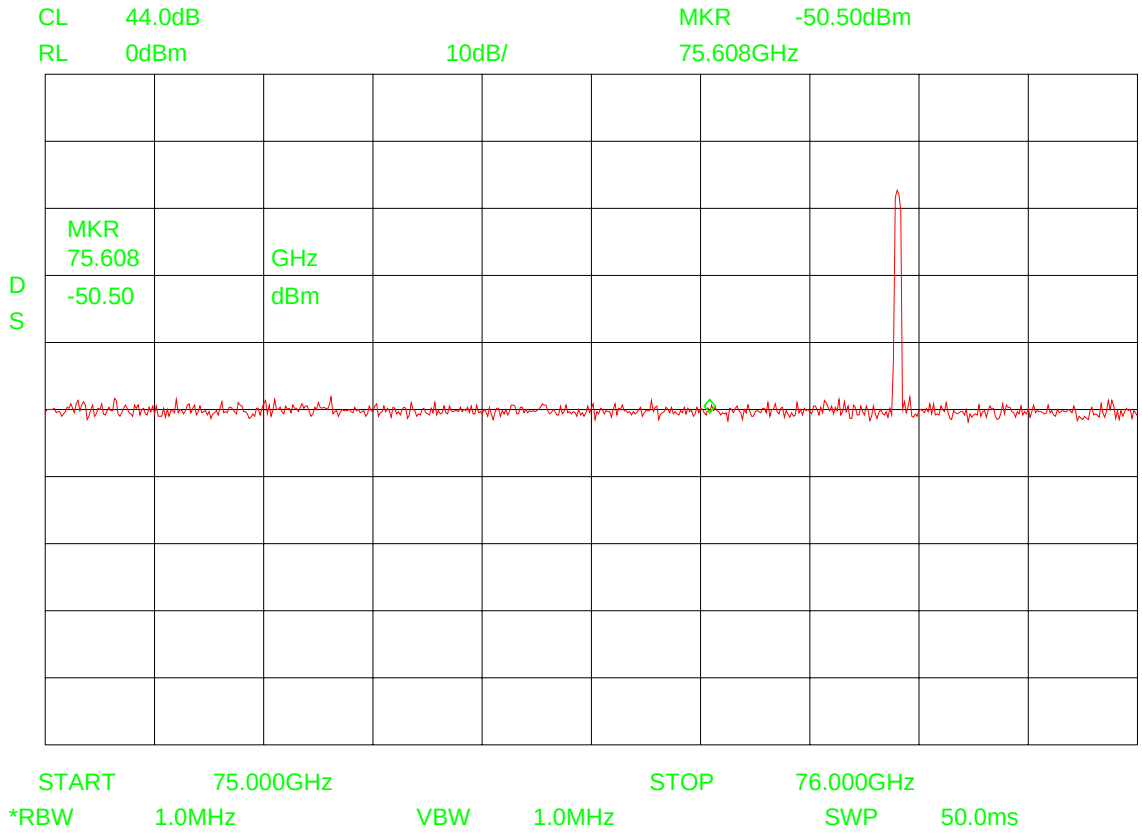
pd = -48.3 dBm - 4.55 dB(cm^2) + (-15.56 dB)

pd = -68.41 dB(mW/cm^2)

PD = 100 pW/cm^2

Remark: Spurious frequencies e.g. 85.85 GHz ; 86.22 GHz ; 97.755 GHz .....are produced by the external mixer. They are image frequency responses, and can be identified by calling up signal identifier program.

Plot 17



Measurement distance d = 1.0 m

Calculation **: Power density** = EIRP (Noise) / Ant. aperture area x dist. corr.

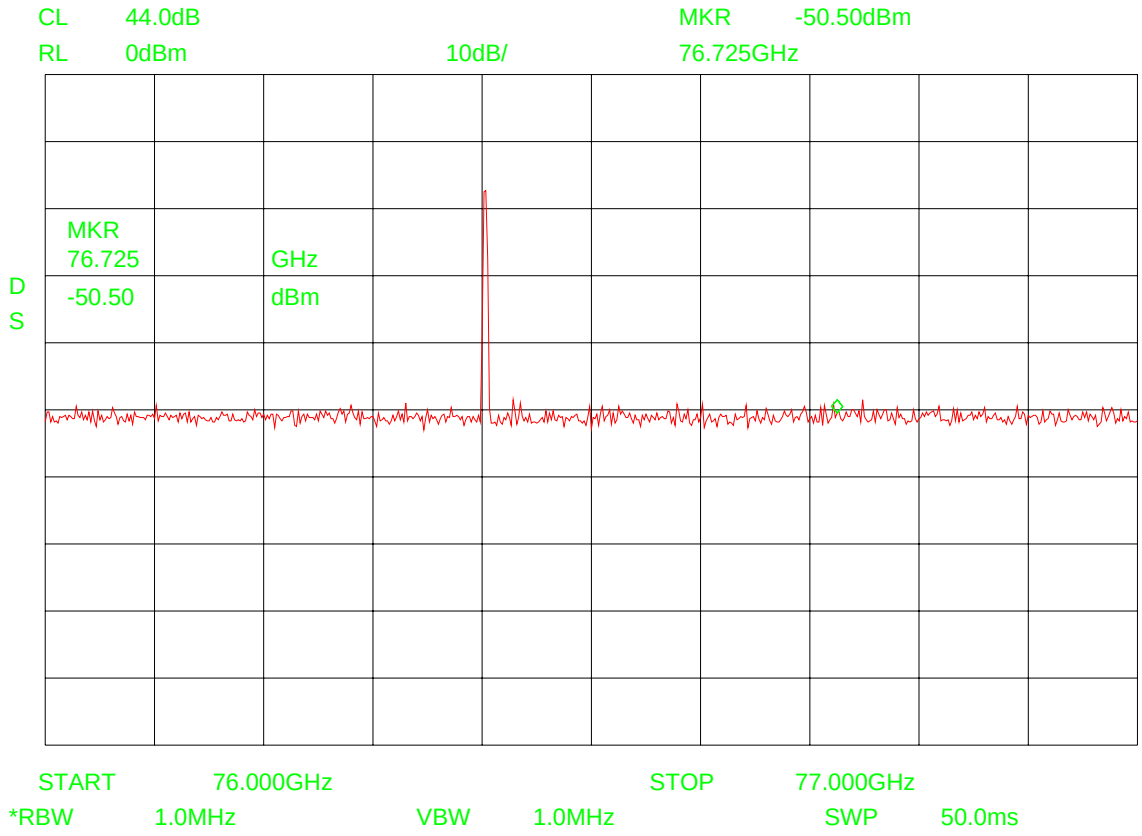
pd = -50.50 dBm - 4.55 dB(cm^2) + (-9.54 dB)

pd = -64.59 dB(mW/cm^2)

PD = 300 pW/cm^2

Remark: The spurious frequency . 75.922 GHz is produced by the external mixer.
This is image frequency responses, and can be identified by calling up signal identifier program.

Plot 18



Measurement distance d = 1.0 m

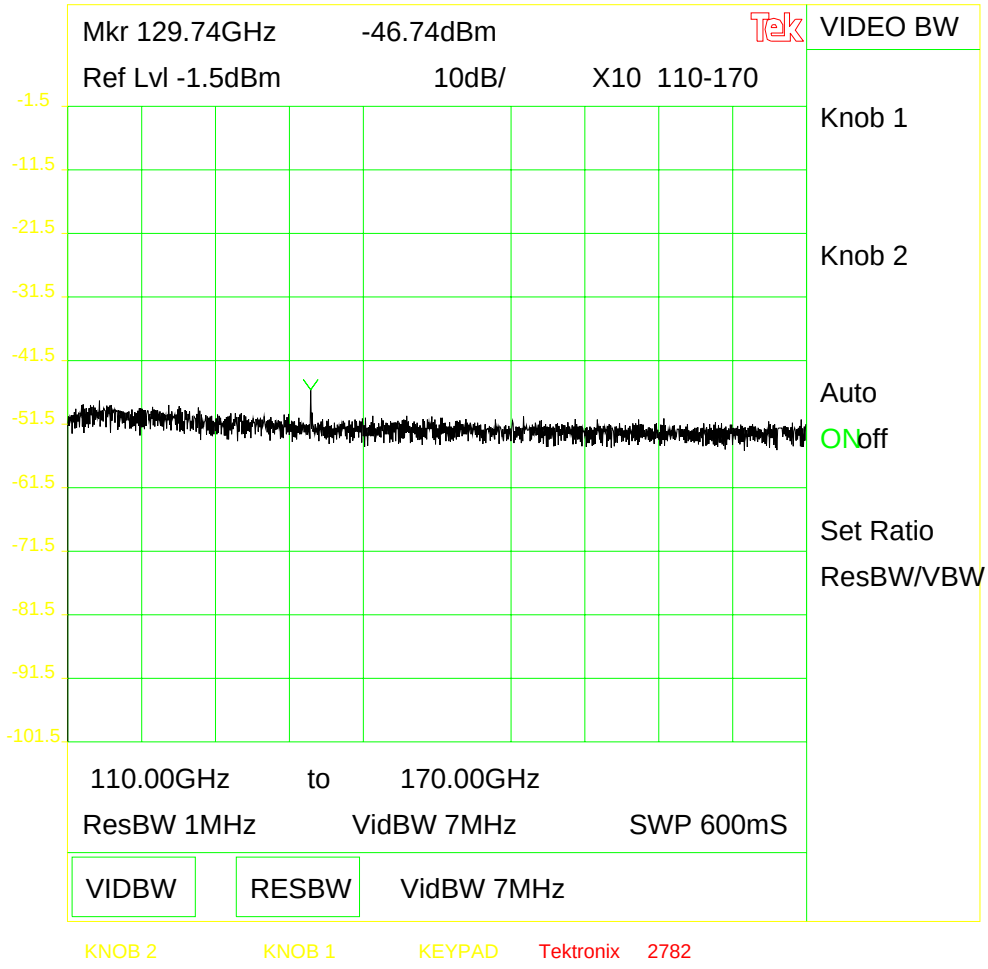
Calculation **: Power density** = EIRP (Noise) / Ant. aperture area x dist. corr.

pd = -50.50 dBm - 4.55 dB(cm^2) + (-9.54 dB)

pd = -64.59 dB(mW/cm^2)

PD = 300 pW/cm^2

Plot 19



Measurement distance d = 0.5 m

Calculation **: Power density** = EIRP (Noise) / Ant. aperture area x dist. corr.

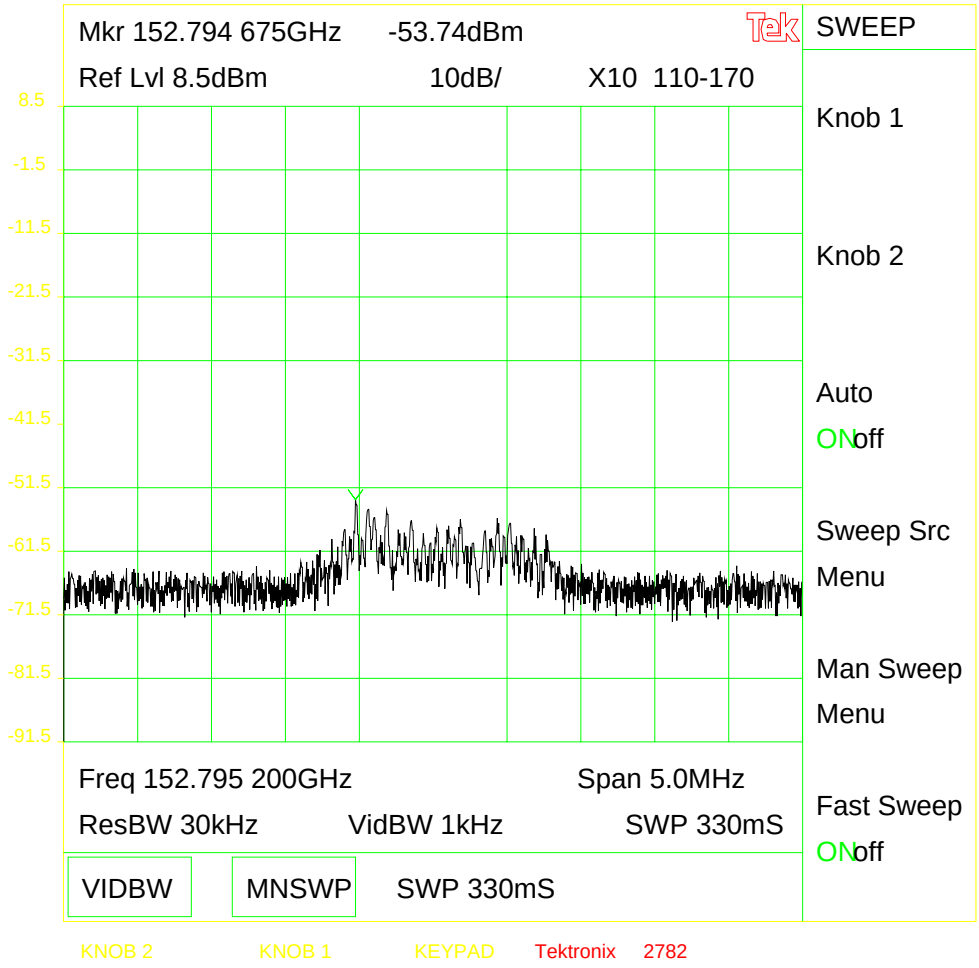
pd = -48.50 dBm - 0.13 dB(cm^2) + (-15.56 dB)

pd = -64.19 dB(mW/cm^2)

PD = < 300 pW/cm^2

Remark: the spurious frequency 129.740GHz is produced by the external mixer.
This is a image frequency responses, and can be identified by calling up signal identifier program.

Plot 20



Remark: this is the first harmonic of the fundamental frequency. The distance is < 1 cm

Measurement distance d = 0.01 m

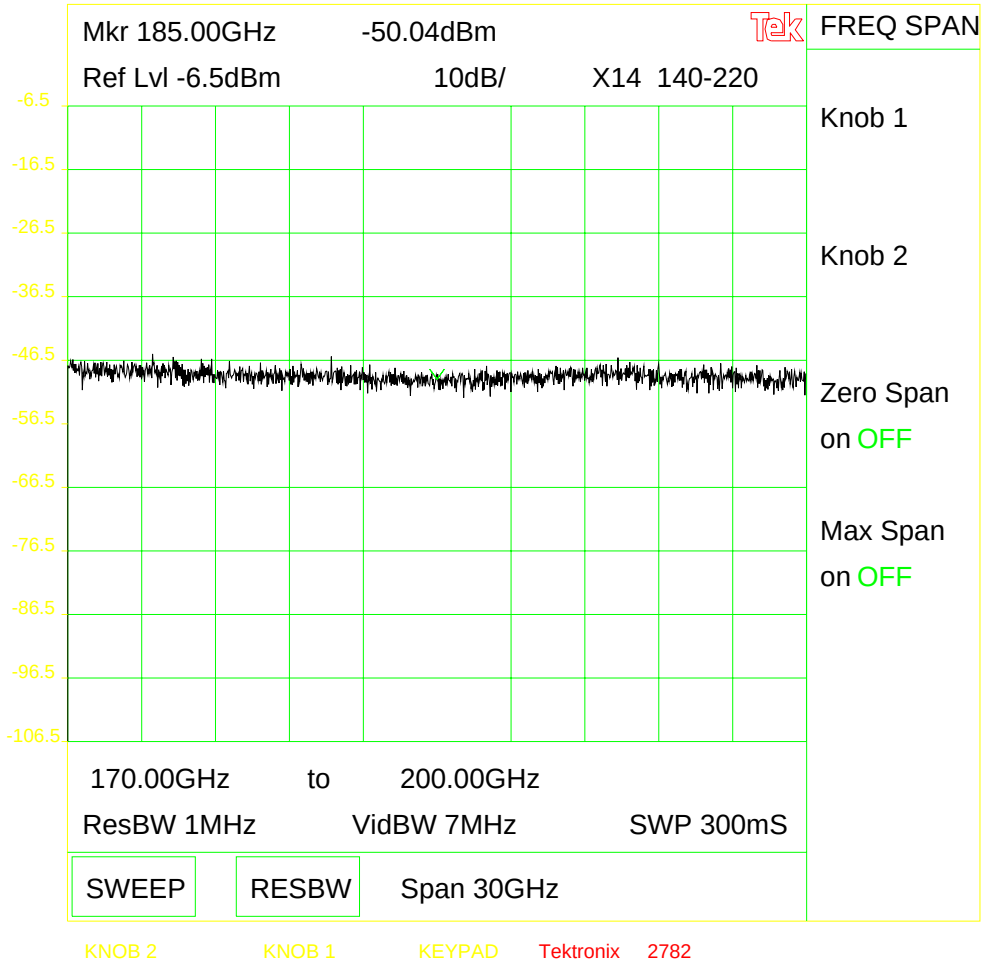
Calculation **: Power density** = EIRP (Noise) / Ant. aperture area x dist. corr.

pd = -53.74 dBm - 0.01 dB(cm^2) + (> -40.0 dB)

pd = -90.0 dB(mW/cm^2)

PD = < 1.0 pW/cm^2

Plot 21



Measurement distance d = 0.25 m

Calculation **: Power density** = EIRP (Noise) / Ant. aperture area x dist. corr.

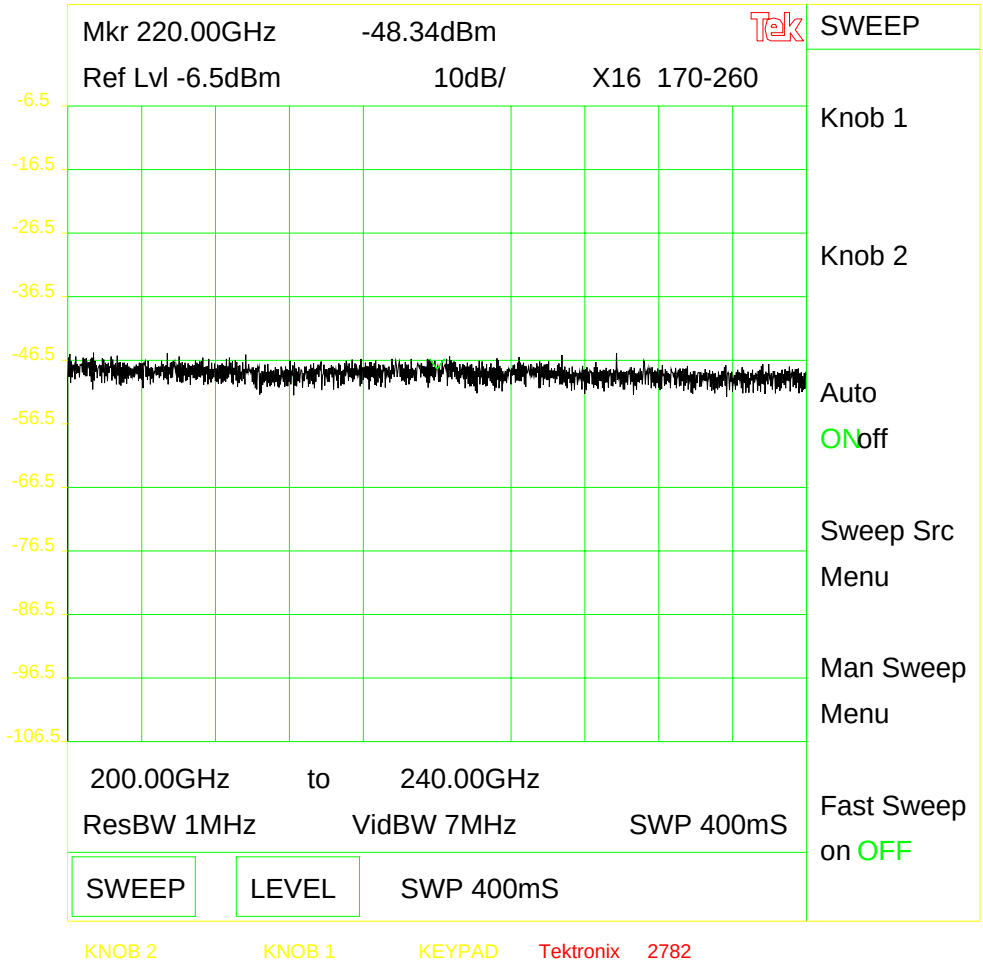
pd = -50.04 dBm - 0.01 dB(cm^2) + (-21.58 dB)

pd = -71.63 dB(mW/cm^2)

PD = 68.7 pW/cm^2

Remark: all spurious frequencies are produced by the external mixer.
They are image frequency responses, and can be identified by calling up signal identifier program.

Plot 22



Measurement distance d = 0.125 m

Calculation **: Power density** = EIRP (Noise) / Ant. aperture area x dist. corr.

pd = -48.34 dBm - -0.22 dB(cm^2) + (-27.60 dB)

pd = -76.16 dB(mW/cm^2)

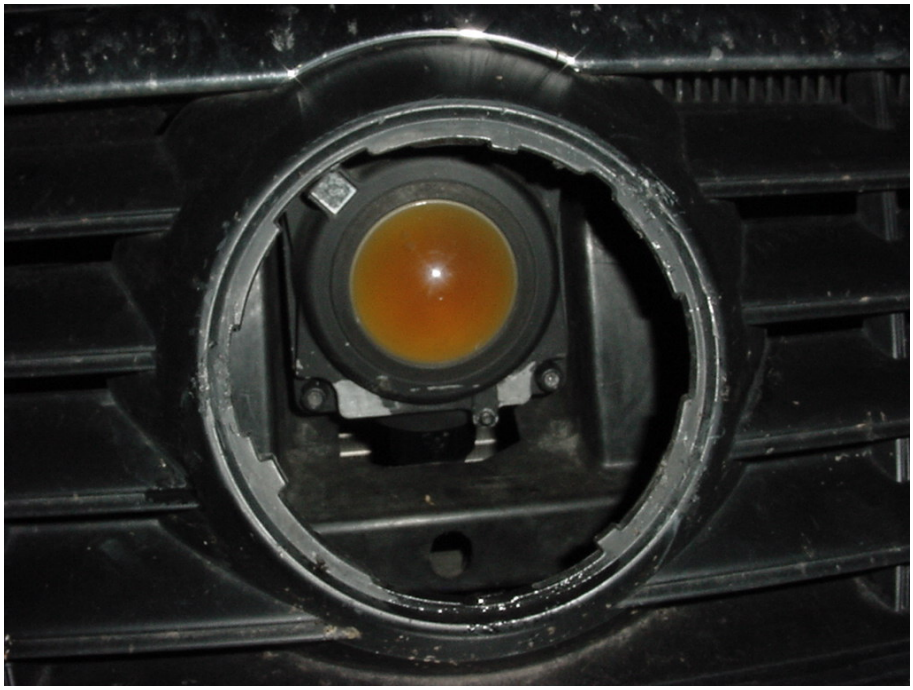
PD = 24.2 pW/cm^2

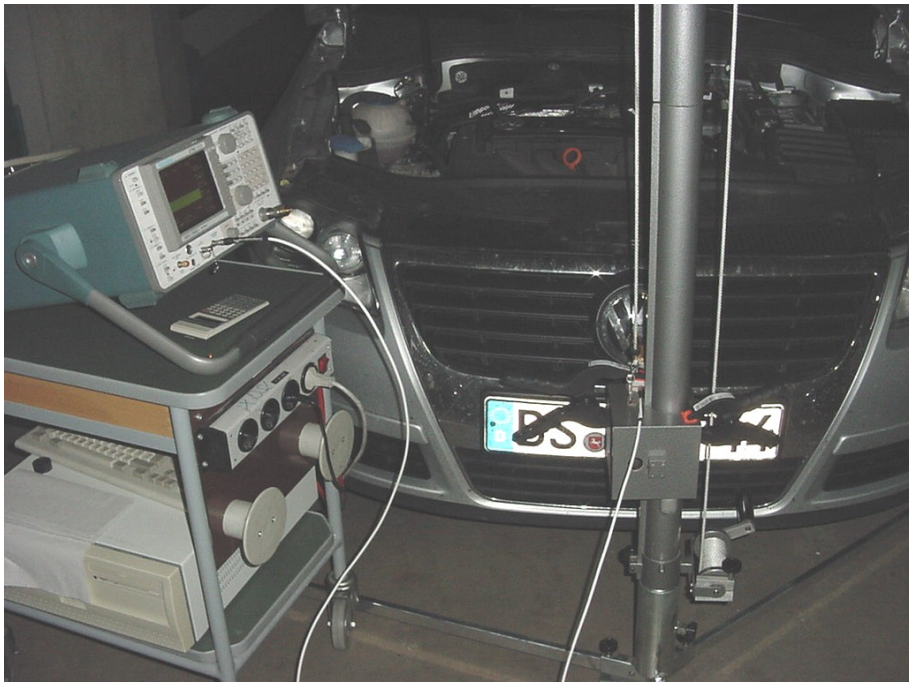
Remark: all spurious frequencies are produced by the external mixer.
They are image frequency responses, and can be identified by calling up signal identifier program.

4 Photographs

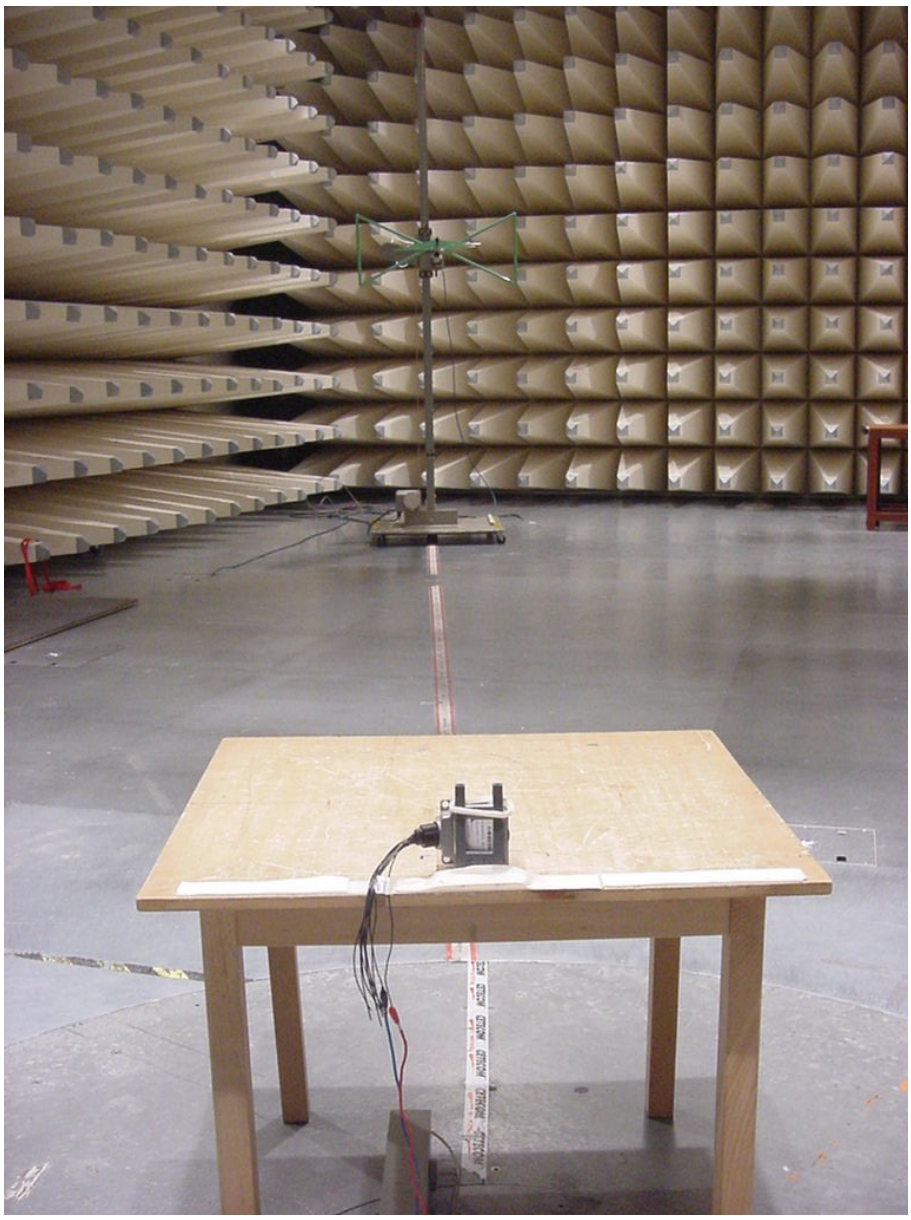
4.1 Photographs of the test set-up

Not in Motion Mode

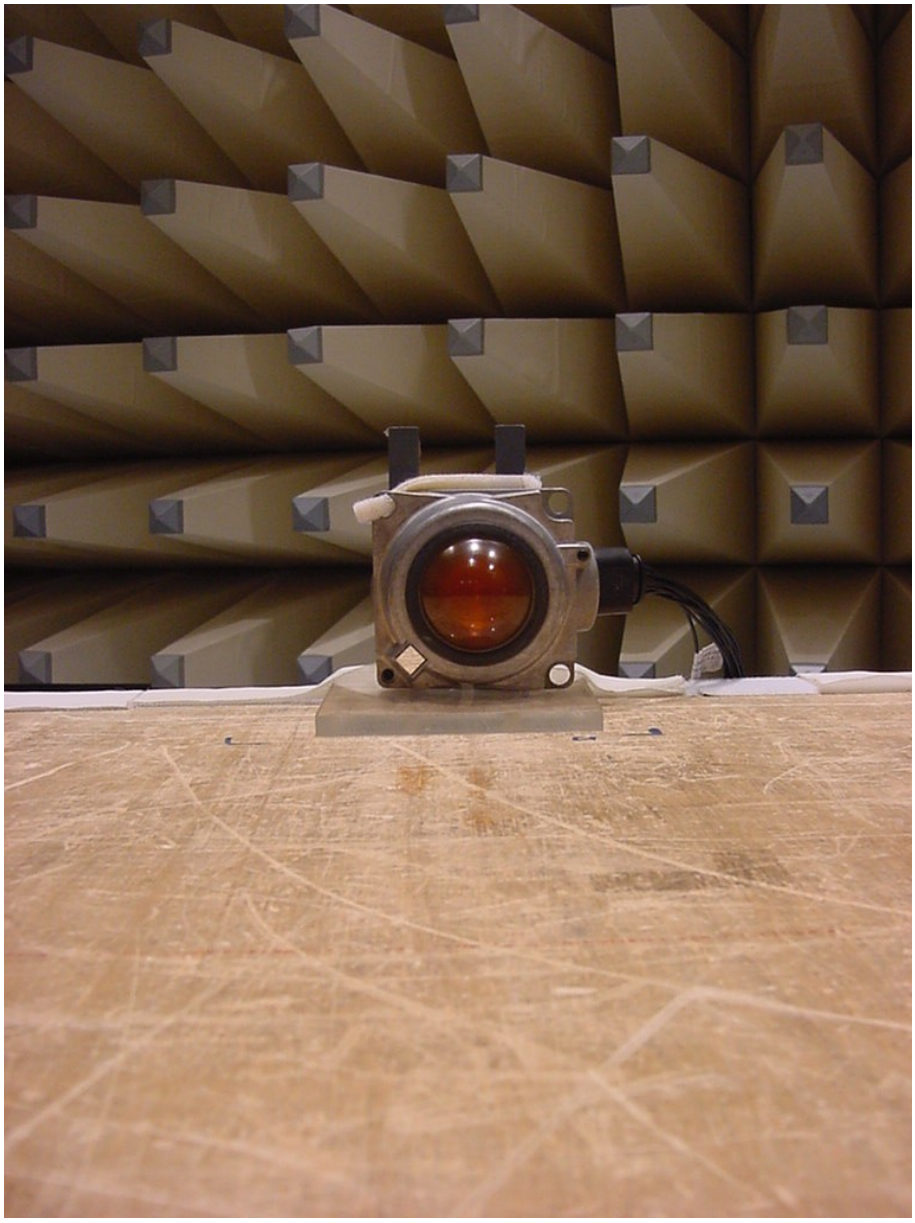




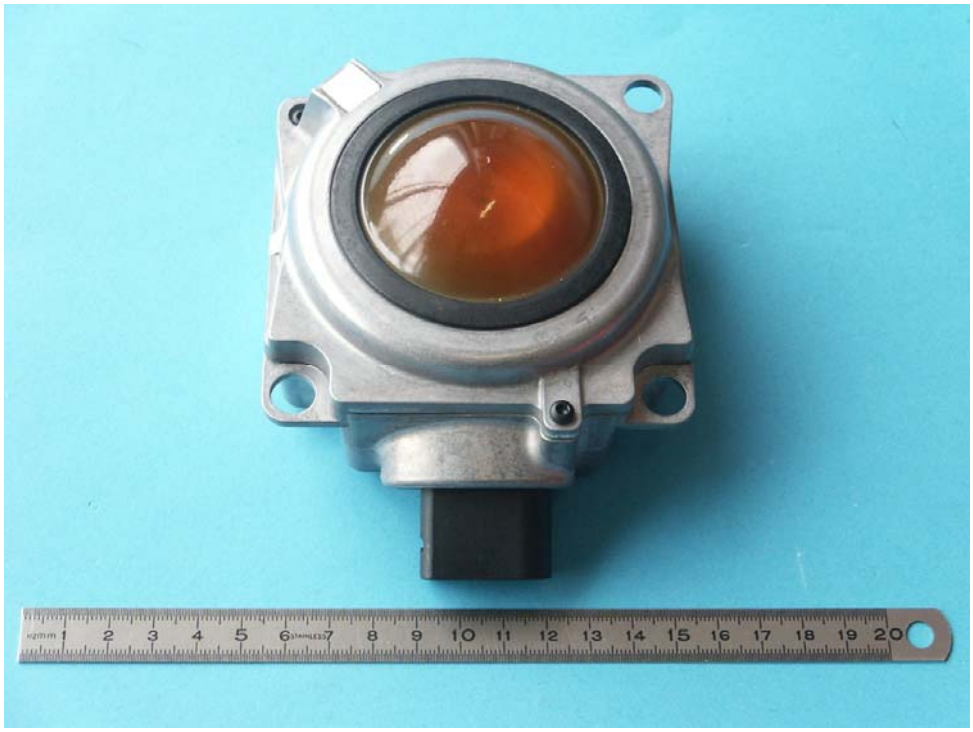
Radiated Emission



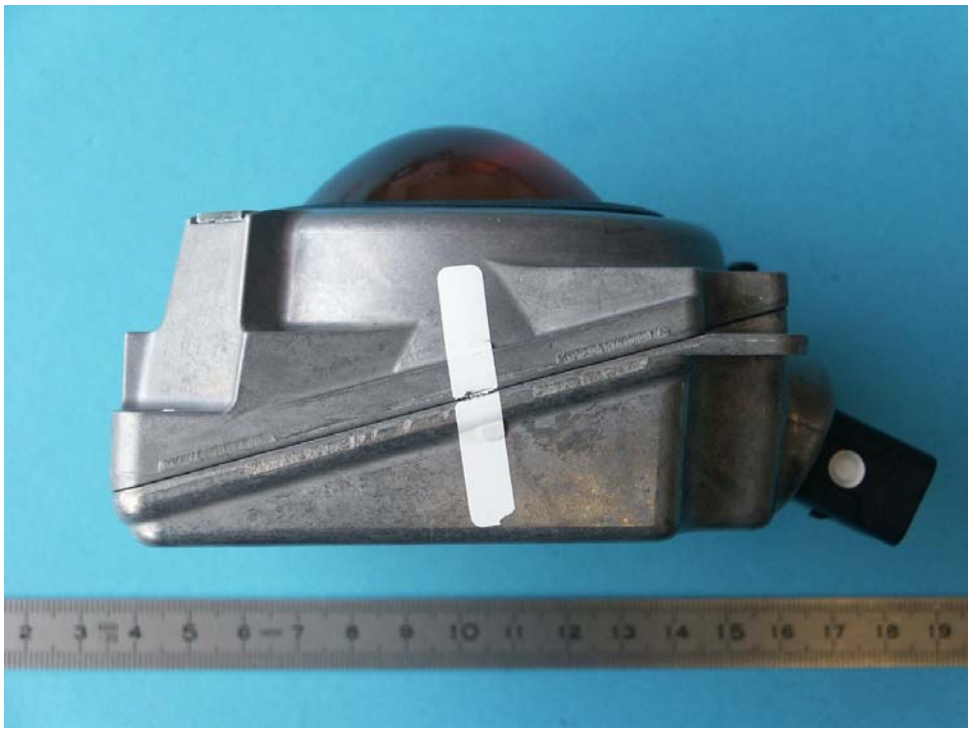
Radiated Emission

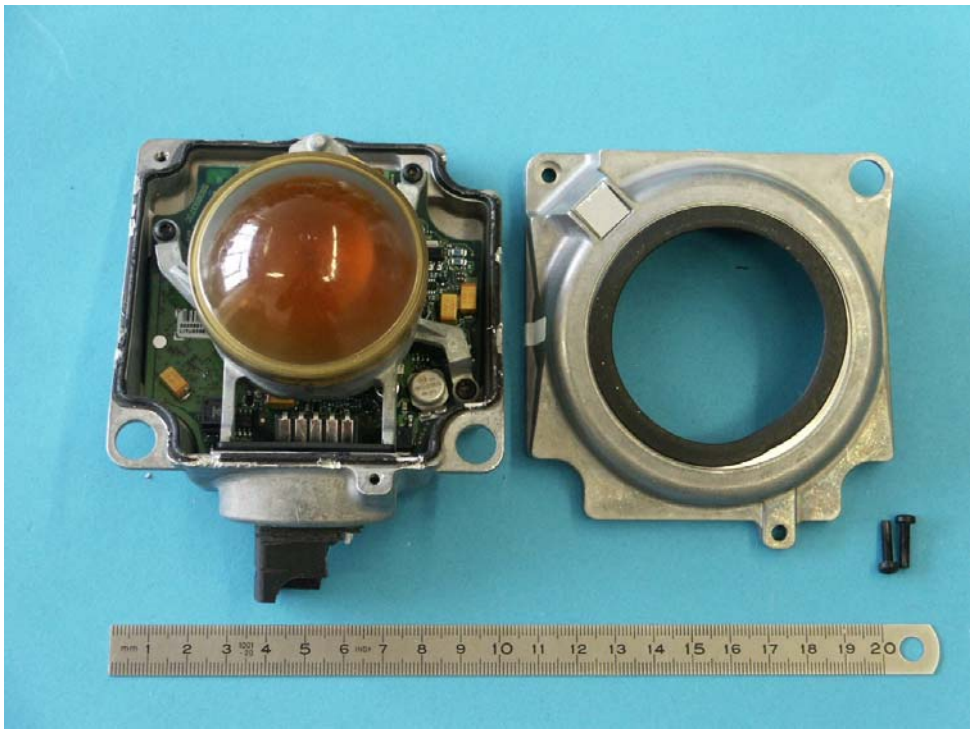


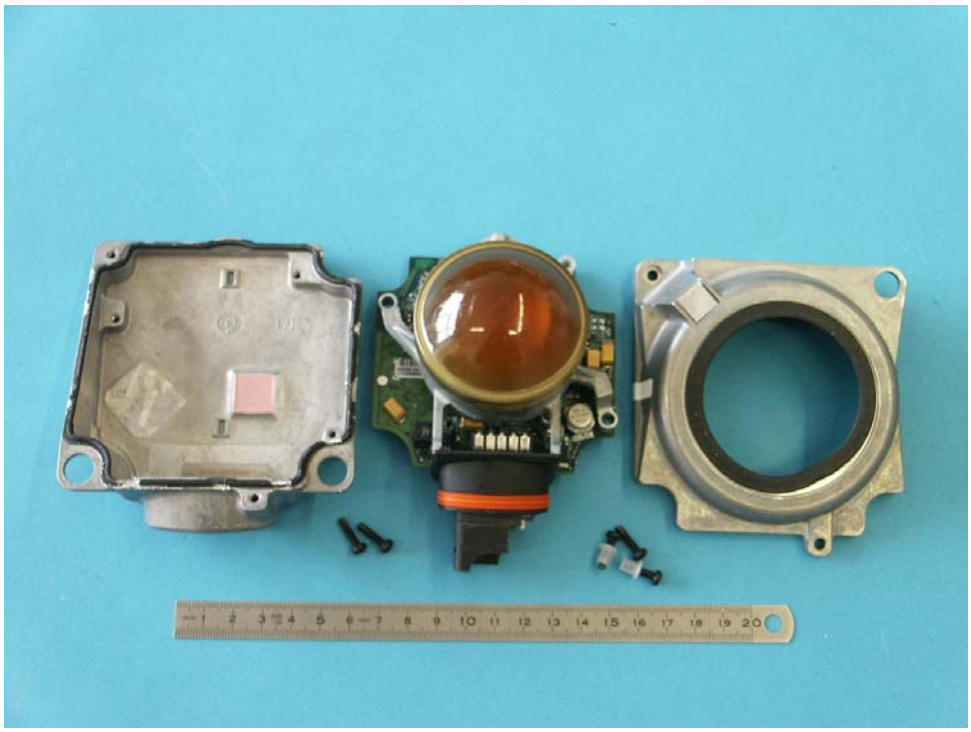
4.2 Photographs of the EUT



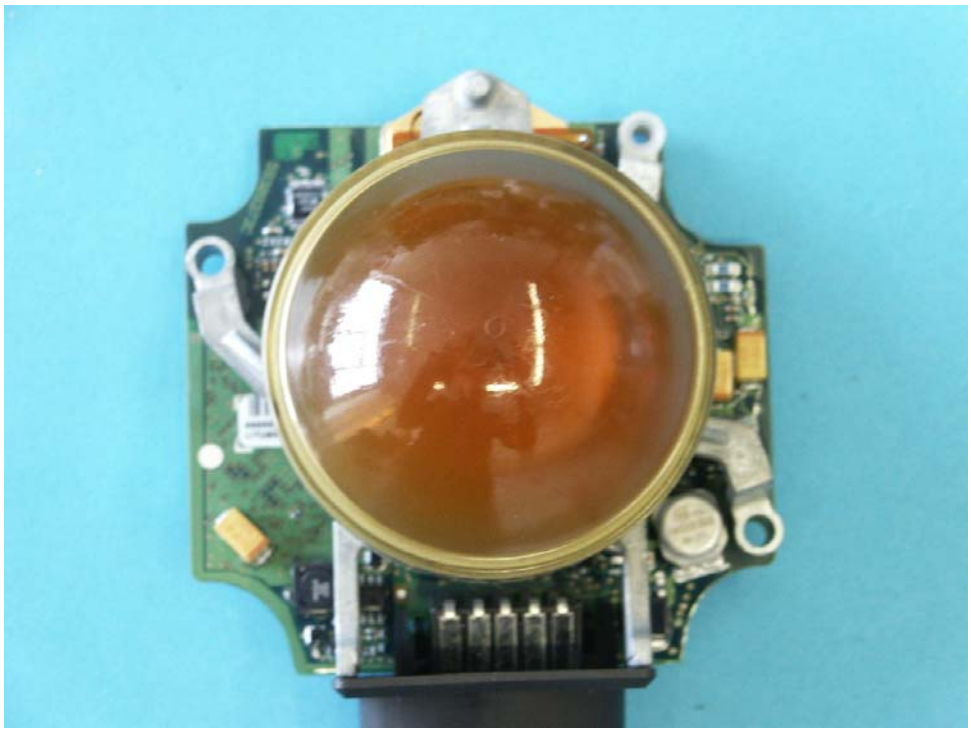

VW
AC20
LC2_FR
3C0 907 567 B
P/5/07/05
SN B0507000424 Sw0103 Hw030
CETECOM
CETECOM ICT Services

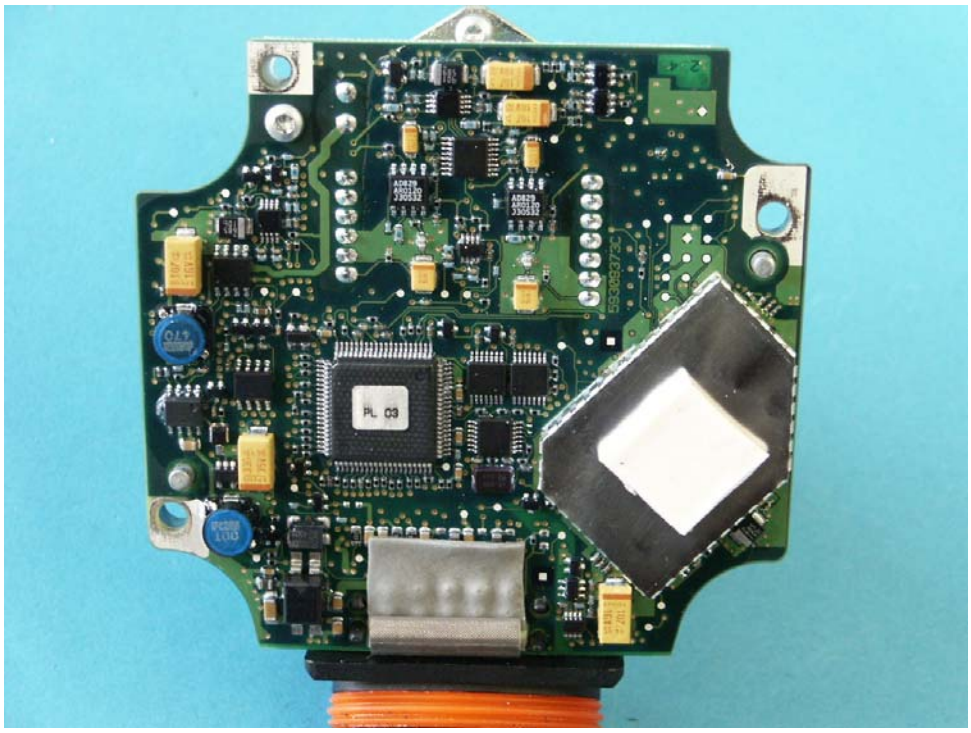







VW
3C0 907 567 B
LCI_FR
P/5/07/05
SN B0507000424 Sw0103 Hw030
TRW
Autocruise




PL 03